FINAL

REMEDIAL INVESTIGATION REPORT
FOR
FORMER CAMP WELLFLEET FUDS – MMRP REMEDIAL INVESTIGATION THROUGH DECISION DOCUMENT

WELLFLEET, MASSACHUSETTS

CONTRACT NO.: W912DR-15-D-0015, DELIVERY ORDER 0002

Prepared for:

US Army Corps of Engineers®

BUILDING STRONG®

April 2019

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Former Camp Wellfleet FUDS Remedial Investigation Through Decision Document

Wellfleet, Massachusetts

Prepared for:

U.S. Army Corps of Engineers

Contract: W912DR-15-D-0015
Delivery Order 0002

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08/18/2018

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COMPLETION OF SENIOR TECHNICAL REVIEW

This document has been produced within the framework of the ERT, Inc. (ERT) quality management system. As such, a senior technical review has been conducted. This included review of all elements addressed within the document, proposed or utilized technologies and alternatives and their applications with respect to project objectives and framework of U.S. Army Corps of Engineers regulatory constraints under the current project, within which this work has been completed.

08/17/2018

Ronald J. Marnicio, PhD., PE — Date
Senior Technical Reviewer

COMPLETION OF INDEPENDENT TECHNICAL REVIEW

This document has been produced within the framework of ERT's quality management system. As such, an independent technical review, appropriate to the level of risk and complexity inherent in the project, has been conducted. This included a review of assumptions; alternatives evaluated; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the project objectives. Comments and concerns resulting from review of the document have been addressed and corrected as necessary.

08/17/2018

Lynn E. Arabia, CHMM — Date
Independent Technical Reviewer

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TABLE OF CONTENTS

List of Appendices

List of Tables

ACRONYMS AND ABBREVIATIONS

ADR	Automated Data Review
AOI	Area of Interest
ARAR	Applicable or Relevant and Appropriate Requirements
Army	U.S. Army
ASP	Ammunition Supply Point
bgs	Below Ground Surface
BTV	Background Threshold Value
CCNS	Cape Cod National Seashore
CENAB	USACE Baltimore District
CENAE	USACE New England District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Constituent of Concern
COPC	Chemicals of Potential Concern
COPEC	Chemicals of Potential Ecological Concern
CSM	Conceptual Site Model
Cu	Copper
DD	Decision Document
DERP	Defense Environmental Restoration Program
DGM	Digital Geophysical Mapping
DMM	Discarded Military Munitions
DNT	2,4-dinitrotoluene
DoD	Department of Defense
DOT	Department of Transportation
DQA	Data Quality Assessment
DQI	Data Quality Indicator
DQO	Data Quality Objectives
Eco-SSL	USEPA Ecological Soil Screening Level
EE/CA	Engineering Evaluation/Cost Analysis
EOD	Explosive Ordnance Disposal
ERT	Earth Resources Technology, Inc.
FS	Feasibility Study
ft	Feet
FUDS	Formerly Used Defense Sites
FUDSChem	FUDS Chemistry Database
g	Gram
GPS	Global Positioning System
HHRA	Human Health Risk Assessment
HI	Hazard Index
HTRW	Hazardous, Toxic and Radioactive Waste
IS	Incremental Sampling
ISM	Incremental Sampling Methodology
ITR	Independent Technical Reviewer
ITRC	Interstate Technology Regulatory Council

J	Estimated value
K	Estimated value, result may be biased high
kg	Kilogram
lbs	Pounds
LCS	Laboratory Control Sample
LOD	Limit of Detection
LOQ	Limit of Quantification
LUC	Land Use Control
m	Meter
MA	Massachusetts
MassDEP	Massachusetts Department of Environmental Protection
MC	Munitions Constituent
MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
MD	Munition Debris
MEC	Munitions and Explosives of Concern
mg	Milligram
mL	Milliliter
mm	Millimeter
MMCL	Massachusetts Maximum Contaminant Levels
MMRP	Military Munitions Response Program
Mn	Manganese
MPPEH	Material Potentially Presenting an Explosive Hazard
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
MS	Matrix Spike
MSD	Matrix Spike Duplicate
msl	Mean Sea Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NHESP	Natural Heritage & Endangered Species Program
ND	Not Detected
NFA	No Further Action
Ni	Nickel
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NS	None specified
NTCRA	Non-time Critical Removal Action
OE	Ordnance and Explosives
ORNL	Oak Ridge National Laboratory
ORSG	Office of Research and Standards Guideline
Pb	Lead
PDT	Project Delivery Team
PP	Proposed Plan
PSL	Project Screening Level
PWS	Performance Work Statement
QAPP	Quality Assurance Project Plan
QC	Quality Control

RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RDX	Cyclotrimethylenetrinitramine
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
RSL	Regional Screening Level
RTK GPS	Real Time Kinematic GPS
RTS	Robotic Total Station
SU	Sampling Unit
Sb	Antimony
SL	Screening Level
SLERA	Screening Level Ecological Risk Assessment
SOP	Standard Operating Procedure
STR	Senior Technical Reviewer
TAL	Target Analyte List
TBD	To Be Determined
TBC	To Be Considered
TNT	Trinitrotoluene
UCL	Upper Confidence Limit
UFP-QAPP	Uniform Federal Policy Quality Assurance Project Plan
µg	Microgram
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UXO	Unexploded Ordnance
VOCs	Volatile Organic Compounds
VSP	Visual Sampling Plan
Zapata	Zapata, Inc.
Zn	Zinc
%R	Percent Recovery

GLOSSARY OF TERMS

Defense Site – All locations that are or were owned by, leased to, or otherwise possessed or used by the Department of Defense (DoD). The term does not include any operational range, operating storage or manufacturing facility, or facility that is used or was permitted for the treatment or disposal of military munitions.

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 (UXO), 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 United States Code (U.S.C.) 2710(e)(2)).

Explosive Hazard – A condition where danger exists because explosives are present that may react (e.g., detonate, deflagrate) in a mishap with potential unacceptable effects (e.g., death, injury, damage) to people, property, operational capability, or the environment.

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.

Incremental Sampling Methodology (ISM) – ISM is a structured composite sampling and processing protocol that reduces data variability and provides a reasonably unbiased estimate of mean contaminant concentrations in a volume of soil targeted for sampling. ISM provides representative samples of specific soil volumes defined as decision units (DUs) by collecting numerous increments of soil that are combined, processed, and subsampled according to specific protocols.

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; range-related debris); or material potentially containing a high enough concentration of explosives such that the materia1 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.

Munitions and Explosives of Concern (MEC) – This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks means (A) UXO, as defined in 10 U.S.C. 101(e)(5); (B) DMM, as defined in 10 U.S.C. 2710(e)(2); or (C) munitions constituents (MC) (e.g., trinitrotoluene [TNT], cyclotrimethylenetrinitramine [RDX]), as defined in 10 U.S.C. 2710(e)(3), present in high enough concentrations to pose an explosive hazard.

Munitions Constituents (MC) – Any materials originating from UXO, DMM, or other military munitions, including explosive and nonexplosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. (10 U.S.C. 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.

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. An MRA is composed 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).

Sampling Unit (SU) – An SU is a volume of soil from which increments are collected to determine an estimate of the mean concentration for that volume.

Unexploded Ordnance (UXO) – Military munitions that (A) have been primed, fuzed, 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)).

UXO-Qualified Personnel – Personnel who have performed successfully in military EOD positions or are qualified to perform in the following Department of Labor, Service Contract Act, Directory of Occupations, contractor positions: UXO Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist, or Senior UXO Supervisor.

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EXECUTIVE SUMMARY

INTRODUCTION AND SCOPE

ERT, Inc. (ERT) performed a Remedial Investigation (RI) for the Former Camp Wellfleet Formerly Used Defense Site (FUDS) near Wellfleet, Massachusetts, under U.S. Army Corps of Engineers (USACE) Baltimore District (CENAB) contract W912DR-15-D-0015, Delivery Order 0002. The RI identifies and assesses potential risks associated with munitions and explosives of concern (MEC) and/or munitions constituents (MC).

This RI Report describes in detail the procedures, methods, organization, and resources that ERT used to achieve the project objectives described in the Performance Work Statement (PWS) dated 11 March 2016, and the Final Work Plan (USACE, 2018). The overall purpose of this RI was to determine whether futher response actions are necessary under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Military Munitions Response Program (MMRP) processes. The objectives of the RI were to:

- Determine if MEC risks were present, and if so, define acceptable and unacceptable risk from MEC hazards;
- Determine if MC were present in concentrations greater than the Project Screening Levels (PSLs), by collecting soil and groundwater samples;
- Where sampling indicated MC concentrations greater than the PSLs, conduct a Human Health Risk Assessment (HHRA) and Screening-Level Ecological Risk Assessment (SLERA) to determine the potential MC risks at the Former Camp Wellfleet; and
- Using the MEC and MC data, determine if further actions are necessary to reduce explosive hazards and human health and ecological risks to acceptable levels.

The scope of the project includes the conduct or preparation of the following work elements required to achieve the project objectives:

- Project Management Plan, Schedule, and Technical Project Planning meetings;
- RI Work Plan and Uniform Federal Policy - Quality Assurance Project Plan (UFP-QAPP);
- RI Field Work;
- RI Report, Feasibility Study (FS), Proposed Plan (PP), Decision Document (DD); and
- Administrative Record/Information Repository.

PROPERTY DESCRIPTION AND HISTORICAL INFORMATION

The Former Camp Wellfleet is in the Town of Wellfleet, Barnstable County, MA, approximately one mile east of South Wellfleet, MA on the Cape Cod peninsula. The Former Camp Wellfleet consists of a total of 1,738 acres - of which approximately 1,688 acres are located in the Cape Cod National Seashore (CCNS) and 49.2 acres in the Town of Wellfleet.

Camp Wellfleet was used by the U.S. Army and U.S. Navy for training purposes. The property was leased beginning in 1942 for an anti-aircraft artillery training base, with an artillery firing line located along the beach cliff. From January 1945 through the end of World War II, the U.S. Navy used the base as a mobile radar training school supporting Navy night fighter and Dove missile training. The Camp also was used for training by National Guard troops and Active Army Reserve anti-aircraft artillery training units.

The property was declared as excess and officially closed on 30 June 1961. The Department of the Interior then acquired the land through a Declaration of Taking in August 1961 to establish and develop the CCNS (currently owned by the National Park Service (NPS)). The Town of Wellfleet owns and manages approximately 49.2 acres.

INVESTIGATION AREAS FOR THE RI

The RI investigation for the Former Camp Wellfleet was designed based on the previous investigations conducted, including the Archive Search Report (ASR) and Engineering Evaluation/Cost Analysis (EE/CA). The ASR and EE/CA investigations identified 'Areas' that were defined as areas that were determined to have MEC, have a potential for MEC, or have no potential for MEC.

Additional research, including a CENAB provided U.S. Army Topographic Engineering Center aerial photographic and groundscar analysis, helped to further identify the investigation areas, and consequently, Areas of Interest (AOIs) were developed as the primary basis of investigation for this RI. The AOI configurations considered the original ASR and EE/CA Areas, the aerial groundscar analysis, and the results of subsequent removal actions. Review of common past activities allowed for combining some of the areas, or the screening out of Areas where there was no evidence of MEC or munitions debris (MD), resulting in six (6) AOIs (five land-based and one ocean range fan) that form the basis of the RI. Table ES-1 summarizes the AOIs and the EE/CA Areas used to develop them.

Table ES-1. RI Areas of Interest

AOI	EE/CA Areas	Conceptual Site Model	Acreage
AOI-01	Area E, as reduced	Burial/Disposal Pits, Possible Landfill	33.1
AOI-02	Area A as expanded	Artillery Firing Points	275.0
AOI-03	Areas D and L and the acreage between them	Ammunition Supply Points and Ground Scars	120.2
AOI-04	Areas C, F, and J	Bomb Targets and Small Burial Area	141.8
AOI-05	Area B, as expanded	Rocket Range and Small Arms Range	56.10
AOI-06	Area I	Range Fan of Artillery Targets in Ocean	167,856

INVESTIGATION ACTIVITIES

MEC

The five (5) land-based AOIs represent areas that had MEC or have the potential for MEC. Data from previous investigations and removal actions were evaluated and a Data Quality Objective (DQO) for MEC was developed to determine if there was sufficient data to characterize nature and extent. It was determined that there were sufficient MEC data to make nature and extent evaluations using only the existing data. For the ocean range fan AOI, MEC presence was assumed and therefore no further field investigation during this RI was required.

MC

The previous investigations were focused on MEC with limited analytical sampling for MC, and it was unknown if an MC release had occurred at the site. Therefore, ERT conducted soil and groundwater sampling at the Former Camp Wellfleet to determine if an MC release had occurred.

As the five (5) land-based AOIs represent locations where MC would be expected, soil samples were collected from them in areas judgmentally considered to pose the greatest likelihood to have MC contamination present. AOI-06 is the ocean portion of the artillery range fans that is addressed by the current 3Rs (Recognize, Retreat, Report) educational program in effect at the site based on the EE/CA recommendations. No MC sampling was conducted for AOI-06.

The RI sampling program included:

- 17 incremental sampling (IS) surface soil samples (0-6 inches below ground surface);
- 3 IS subsurface soil samples (0.5-3 feet bgs);
- 8 discrete subsurface samples in the AOI-01 burial pit area (8-10 ft bgs);
- 7 paired IS surface and subsurface background soil samples (0-6 inches bgs and 0.5-3 ft bgs, respectively); and
- one groundwater sample from the NPS CNSS drinking water supply well.

All samples were submitted for laboratory analysis of select metals (antimony, copper, lead, manganese, nickel, and zinc) and select explosives (RDX, TNT, nitroglycerin, 2,4-dinitrotoluene, 2,6-dinitrotoluene, tetryl, and nitroguanidine). These analytes were chosen for their relationship to the MEC historically associated with the AOIs. The analytical data obtained during the RI were deemed valid and usable for project decision making.

RI FINDINGS

<u>MEC</u>

MEC risk was evaluated using the current USACE risk assessment methodology to define risk posed by MEC hazards using the data collected from prior MEC investigation activities at the Former Camp Wellfleet. *Decision Logic to Assess Risks Associated with Explosive Hazards, and to Develop Remedial Action Objectives for Munitions Response Sites* (USACE, 2017c), involves the use of four matrices to define acceptable and unacceptable risk from MEC hazards based on the likelihood of an encounter, the severity of incident, and the sensitivity of interaction based on expected land use activities. MEC risk was evaluated for each AOI. The findings for the Former Camp Wellfleet AOIs are summarized in Table ES-2.

Table ES-2: Summary of Risk Assessment Matrix Analysis

Area	Matrix 1: Likelihood of Encounter	Matrix 2: Severity of Incident	Matrix 3: Likelihood of Detonation	Matrix 4: Acceptable and Unacceptable Site Conditions
AOI-01	Seldom (No MEC, Often Access)	D - (Improbable Severity, Seldom Likelihood)	3 - (Not Sensitive, Modest Likelihood)	**Acceptable**
AOI-02	Likely (Confirmed MEC, Regular Access)	A - (Catastrophic Severity, Likely Likelihood)	2 - (Moderate Sensitivity, Modest Likelihood)	**Unacceptable**

Table ES-2: Summary of Risk Assessment Matrix Analysis				
Area	**Matrix 1: Likelihood of Encounter**	**Matrix 2: Severity of Incident**	**Matrix 3: Likelihood of Detonation**	**Matrix 4: Acceptable and Unacceptable Site Conditions**
AOI-03	Seldom (MEC, Often Access)	C - (Modest Severity, Seldom Likelihood)	2 - (Moderate Sensitivity, Modest Likelihood)	**Acceptable**
AOI-04	Seldom (No MEC, Often Access)	D - (Improbable Severity, Seldom Likelihood)	3 - (Not Sensitive, Modest Likelihood)	**Acceptable**
AOI-05	Likely (MD Indicative of MEC, Regular Access)	A - (Catastrophic Severity, Likely Likelihood)	2 - (Moderate Sensitivity, Modest Likelihood)	**Unacceptable**
AOI-06	Seldom (MEC Suspected, Regular Access)	B - (Catastrophic Severity, Seldom Likelihood)	2 - (Moderate Sensitivity, Modest Likelihood)	**Unacceptable**

The Munitions Response Site Prioritization Protocol (MRSPP) is a methodology for prioritizing sites known or suspected to contain MEC or MC for response actions, assigning a relative priority based on various safety and environmental factors (i.e., 1 is the highest priority ranking, 8 is the lowest). The MRSPP scores for the AOIs are summarized in Table ES-3.

Table ES-3: Summary of MRSPP Ratings				
Area	**EHE Rating/Priority**	**CHE Rating/Priority**	**HHE Rating/Priority**	**Priority Ranking**
AOI-01	NLR	NKSH	NKSH	**NLR**
AOI-02	A-2	NKSH	NKSH	**2**
AOI-03	NLR	NKSH	NKSH	**NLR**
AOI-04	NLR	NKSH	NKSH	**NLR**
AOI-05	C-4	NKSH	NKSH	**4**
AOI-06	C-4	NKSH	NKSH	**4**

EHE – Explosive Hazard Evaluation
CHE – Chemical Warfare Materiel Hazard Evaluation
HHE – Health Hazard Evaluation
NKSH – No Known or Suspected Hazard
NLR – No Longer Required

MC

No site soil sampling results were greater than their PSLs or USEPA Ecological Soil Screening Level (Eco-SSLs). Based on these results, no release of MC metals or explosives that would present a risk to human health or the environment has occurred.

In addition, no site groundwater sampling results were greater than their PSLs, and all site soil sampling results were less than the impact to groundwater screening levels. Based on these results, no release of MC metals or explosives that would present a risk to human health has occurred.

CONCLUSIONS AND RECOMMENDATIONS

MEC

The MEC risk matrix analyses indicate AOIs that pose Acceptable MEC risk and AOIs posing Unacceptable MEC risk. Baseline conditions that are assessed to be Acceptable do not warrant further action with regard to MEC, and it is recommended that a ‘No Further Action’ (NFA) PP and DD be prepared to address those AOIs posing acceptable MEC risk (AOI-01, AOI-03, and AOI-04).

However, Unacceptable baseline site conditions warrant action and should proceed to the next phase of the CERCLA response process, and it is therefore recommended that an FS be conducted to address those AOIs determined to pose unacceptable explosive risks (AOI-02, AOI-05, and AOI-06). A PP and DD will also be prepared, following the FS, to address those AOIs.

MC

No site soil or groundwater sampling results were greater than their PSLs or Eco-SSLs. All site soil sampling results were less than the impact to groundwater screening levels. Based on these results, no release of MC metals or explosives that would present a risk to human health or the environment has occurred, and therefore, no additional soil or groundwater sampling for MC metals or explosives is warranted.

Because no reported results for soil or groundwater sampling were greater than their PSLs, there are no MC releases to soil or groundwater which present a risk to human health and/or the environment. Therefore no further action is recommended for MC at the Former Camp Wellfleet.

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1.0 INTRODUCTION

ERT, Inc. (ERT) performed a Remedial Investigation (RI) and the subsequent activities and analyses associated with the process that will result in a Decision Document (DD) for the Camp Wellfleet Formerly Used Defense Site (FUDS) near Wellfleet, Massachusetts, under U.S. Army Corps of Engineers (USACE) Baltimore District (CENAB) contract W912DR-15-D-0015, Delivery Order 0002. Services completed to date include development of a Work Plan, Community Relations Plan (CRP), field investigations, and RI Report. If the RI demonstrates potential risks to receptors at the Former Camp Wellfleet, a Feasibility Study (FS) will be conducted to identify and evaluate potential remedial alternatives that are suitable for addressing any unacceptable site-specific risks associated with munitions and explosives of concern (MEC) and/or munitions constituents (MC). A Proposed Plan (PP) and DD will also be prepared in accordance with the CERCLA process.

The Department of Defense (DoD) established the Military Munitions Response Program (MMRP) under the Defense Environmental Restoration Program (DERP) to address MEC, which includes unexploded ordnance (UXO) and discarded military munitions (DMM), and MC located on current and former military installations. ERT performed the work in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) [42 USC 9601 et seq.], the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR 300), and applicable DoD policies in managing and executing the FUDS program (ER 200-3-1). Activities involving work in areas potentially containing MEC hazards were conducted in full compliance with USACE, Department of the Army, including Engineering Manual (EM) 385-1-1, and DoD safety regulations. No MEC and/or material potentially presenting an explosive hazard (MPPEH) were encountered during this RI.

This RI Report describes in detail the procedures, methods, organization, and resources that ERT used to achieve the project objectives described in the Performance Work Statement (PWS) dated 11 March 2016, and the Final Work Plan (USACE, 2018).

1.1 Purpose and Scope

The overall purpose of this RI was to determine whether futher response actions are necessary under the CERCLA and MMRP processes. The objectives of the RI were to:

- Determine site-specific background metals concentrations;
- Determine if munitions-related MC contamination exists within surface and subsurface soil at the Former Camp Wellfleet at concentrations greater than U.S. Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) for residential soil, S-1 & GW-1 Massachusetts Contingency Plan (MCP) table 2, 310 CMR 40.0975(6)(a) levels, USEPA Ecological Soil Screening Levels (Eco-SSLs, https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents, last accessed 25 September 2018), and background metals concentrations;
- If the initial sampling indicates the presence of MC greater than RSLs, S-1 & GW-1 Massachusetts Contingency Plan (MCP) table 2, 310 CMR 40.0975(6)(a) levels, Eco-SSLS, and background concentrations, then conduct additional sampling to determine the extent of MC contamination.
- At the request of the National Park Service (NPS) Cape Cod National Seashore (CCNS), collect one groundwater sample from Supply Well B;

- Refine the CSM, as necessary;
- If the initial sampling indicates the presence of MC greater than RSLs and background concentrations, using MC data, conduct a Human Health Risk Assessment (HHRA) and Screening-Level Ecological Risk Assessment (SLERA) to determine the potential MC risks at the Former Camp Wellfleet;
- Determine whether risks due to explosive hazards are present;
- Using MEC and MC data, determine if further actions are necessary to reduce risks to acceptable levels; and
- Support completion of the CERCLA process through DD.

Previous investigations at the Former Camp Wellfleet were focused on MEC with limited analytical sampling. Therefore, it was unknown if an MC release has occurred at the site. ERT conducted sampling at the Former Camp Wellfleet to determine if an MC release has occurred.

The scope of the project includes the conduct or preparation of the following tasks or work elements required to achieve the project objectives:

- Project Management Plan (PMP) and Schedule;
- Technical Project Planning;
- RI Work Plan and Uniform Federal Policy - Quality Assurance Project Plan (UFP-QAPP);
- RI Field Work;
- RI Report;
- Feasibility Study Report, if needed;
- Proposed Plan;
- Decision Document; and
- Administrative Record (AR)/Information Repository.

1.2 Property Description

The Former Camp Wellfleet consists of a total of 1,738 acres - of which approximately 1,688 acres are located in the Cape Cod National Seashore and 49.2 acres in the Town of Wellfleet, Barnstable County, MA on the Cape Cod peninsula. The U.S. Army and U.S. Navy used Camp Wellfleet for training purposes. The property was leased beginning in 1942. Camp Wellfleet was declared as excess and officially closed on 30 June 1961.

The Former Camp Wellfleet is in the Town of Wellfleet, Barnstable County, MA, approximately one mile east of South Wellfleet, MA (Figure 1-note, all figures are presented in Appendix A) on the Cape Cod peninsula. The site is accessible from U.S. Route 6, which is located just west of the site.

1.3 Former Camp Wellfleet Historical Information

Camp Wellfleet was previously used by the U.S. Army and U.S. Navy for training purposes. The approximately 1,738-acre property was leased beginning in 1942 for an anti-aircraft artillery training base, with an artillery firing line located along the beach cliff. The site was used as such by the U.S. Army until June 1944, when it temporarily closed. From January 1945 through the end of World War II, the U.S. Navy used the base as a mobile radar training school supporting Navy night fighter training based in Quonset Point, Rhode Island, and for Dove missile training. The Camp also was used for training by National Guard troops and Active Army Reserve anti-aircraft artillery training units. Camp Wellfleet was declared as excess and officially closed on 30 June 1961.

The Department of the Interior acquired the land through a Declaration of Taking in August 1961 to establish and develop the CCNS. The majority of the Former Camp Wellfleet site is currently owned by the NPS. The Town of Wellfleet owns and manages approximately 49.2 acres.

1.4 Previous Former Camp Wellfleet Investigations

Historical investigations have been performed at the site to characterize the extent of MEC. Investigation activities were performed between 1961 and 1962, and the discovery of ordnance items at various locations required the execution of risk reduction actions between 1961 and 1998. In 1991, an Inventory Project Report/Preliminary Assessment was completed, and the Camp was determined to be eligible under the FUDS program for hazardous, toxic, and radioactive waste and MMRP evaluations. Munitions used at the Former Camp Wellfleet, based on previous investigations, include MK 65 "Dove" practice bombs, 60-millimeter (mm) projectiles, 90mm projectiles, 105mm projectiles, .30 and .50 caliber ammunition, grenades, and rifle smoke grenades. MEC items including a 76mm anti-aircraft artillery round have been identified at the site to date.

1.4.1 Archives Search Report Conclusions and Recommendations for the Former Camp Wellfleet, USACE Rock Island District

An Archives Search Report (ASR) was compiled in 1994. Areas A, B, and C of the site were identified and categorized as containing MEC while Areas D, E, and F were categorized as potentially containing MEC, and Areas G and H as not containing MEC (USACE, 1994). See Figure 2 for the locations of these Areas.

1.4.2 Camp Wellfleet, Historical Environmental Aerial Photographic Analysis, U.S Army Topographic Engineering Center (TEC) Operations Division

An analysis of historical aerial photos and other documents was completed by the TEC in 1998. The TEC georeferenced air photographs beginning with one dated 1943 (shortly after the first structures at Camp Wellfleet were built), including many from the years Camp Wellfleet was active, and ending with a 1994 photo. The analysis included stereoscopic delineation of ground scars, excavations, new structures, and other features such as bombing targets, gun emplacements, and ammunition supply points. The TEC report was a primary source of information in the development of the Engineering Evaluation and Cost analysis (EE/CA) work plan, particularly the placement of geophysical grids.

1.4.3 Final Former Camp Wellfleet Engineering Evaluation and Cost Analysis, Foster Wheeler Environmental Corporation

Based on the conclusions of the ASR, an EE/CA investigation was recommended. Further characterization performed in support of the EE/CA resulted in the identification of additional Areas I through N. Figure 2 shows these areas overlying the TEC aerial photos. Nine hundred fifty-nine (959) anomalies were investigated during the EE/CA, within geophysical grids, as shown in Figure 2. Identified inert munitions-related items that were found included four 1,000-pound Dove missiles, and one 250-pound practice bomb. The EE/CA Action Memorandum, signed in April 2001, approved the recommended removal actions, which included Clearance to Depth for Areas A and B and Institutional Controls (ICs) without Access Restrictions for the remaining areas (USACE North Atlantic Division New England District [CENAE], 2013).

1.4.4 Helicopter Geophysical Survey at Former Camp Wellfleet, Oak Ridge National Laboratory

Oak Ridge National Laboratory (ORNL) conducted a helicopter geophysical survey of all of Camp Wellfleet in March 2002. The purpose of the survey was to detect and map unexploded ordnance (UXO) and concentrations of metallic waste or debris that could contribute to environmental degradation or otherwise pose a safety hazard. The total survey coverage was 1,738 acres. The *Arrowhead* eight-sensor magnetometry system was used, but due to vegetation, the sensor height above ground was a limiting factor in the usefulness of the data, in that typical UXO would not be detected when the sensor was 5 or more meters above ground. However, 345 single point anomalies (SPAs) were identified in the report and most were investigated intrusively. This resulted in removal actions in several focused areas of the Former Camp Wellfleet (e.g. SPA 250, 264, 266, 279, and 329).

1.4.5 Final – Revision 1 Site Specific Final Report, Ordnance and Explosives Removal Action, Former Camp Wellfleet, and Final Site Specific Final Investigation Report - Addendum, OE Removal Action, Former Camp Wellfleet, Zapata Engineering

Ordnance and Explosives (OE) removal activities were conducted from approximately 2003 through 2005. These activities included investigations of SPAs in 2003 and 2004, investigation grids in 2004, and removal action areas in 2005. SPA locations were based on selected anomalies identified by the ORNL airborne geophysical survey. Some grids were installed to further investigate SPAs and others were installed in other areas. Removal actions resulted in the excavation of over 1,600 anomalies and removal of over 3,400 pounds of MD and 5,109 pounds of metal scrap. 136 projectile flashtubes were excavated from SPA 329 and were identified at that time as UXO. A geophysical grid was installed at SPA 279, a suspected Open Burn/Open Detonation (OB/OD) area. A series of pits were installed at anomalies by an excavator and 1,040 pounds of MD was removed from one of the pits. A removal action was conducted in EE/CA Area B to the east of the large parking lot, where abundant MD (mostly rocket parts) was removed. Additionally, calcium hydride cannisters were found in one of the SPAs and one of the investigation grids.

A limited number of soil samples were collected at grid 279. These samples were analyzed for metals (i.e., arsenic, barium, cadmium, chromium, lead, mercury, nickel, selenium, and silver), explosives compounds, and extractable petroleum hydrocarbons (EPH). The reported results for all soil samples were less than screening levels for the metals, explosives, and EPH.

1.4.6 Summary of Previous Investigations

The following summary provides a more complete understanding of the findings of the various previous activities at the former Camp Wellfleet.

The TEC investigation of historical aerial photography summarized changes in the land use at the installation over time and identified the locations of ground scars and other features of interest. These features, which are shown in the aerial photo background of Figure 2, form the basis of Areas A through N, investigated during the EE/CA. The geophysical grids placed throughout Areas A through N are shown on Figure 2. One MEC item (rifle smoke grenade) was discovered in Area L, and various types of MD were found in many other areas.

The EE/CA Action Memorandum recommended focused removal actions which were conducted from 2003 through 2005. Prior to implementing the Action Memorandum recommendations, the aerial magnetic helicopter survey was conducted by ORNL in 2002, and it functioned to further support areas for removal. The ORNL effort identified SPAs (as shown in Figure 2), which were intrusively investigated as part of the removal actions. MD was found in several SPAs. More investigation grids were completed in 2004, mostly along the old artillery firing line, and more MD was discovered. These grids are also identified on Figure 2. Removal actions continued into 2005, focusing on grid 279, SPA 329, and the area to the east of the parking lot where abundant MD was removed.

1.5 Initial Summary of Risk from MEC and MC

Results of previous investigations at the Former Camp Wellfleet indicate that MEC had been found at the site. Table 1-1 presents a general summary of MEC and MD items identified during previous investigations, but munitions-related findings specific to the areas of investigation for this RI are described in Section 3.1.2.

With regard to more recent findings, the 2013 Five-Year Review Report (USACE, 2013) states that since May 2008, munitions-related findings include:

In July 2008 NPS contacted the State bomb squad after a marine marker, an intact 0.50 caliber shell, and an empty 0.50 caliber shell casing were found coming out of the dune face. This location is shown on Figure 2. These were considered to be MD.

In April 2009 approximately thirty 0.50 caliber shells were found coming from the dunes; however, while noted as generally being associated with Marconi Beach, no coordinate information was reported.

In July 2014, a 14-inch projectile was found and news reports indicated that the State bomb squad noted that it was a live item (considered to be MEC). While noted as generally being associated with Marconi Beach, specific details for this item are anecdotal based on news reports of the incident; no coordinate information was provided and size and type of the item was not confirmed.

The previous investigations/removals were focused across several different EE/CA Areas, and it was necessary to determine whether sufficient MEC data had been obtained to characterize MEC nature and extent for this RI. Section 1.6 describes the approach to organizing the various areas to make this determination, and Section 3.1 provides the detail for the conclusion that sufficient MEC field investigation had been conducted to determine the nature and extent characterizations of MEC at the site.

Based on this conclusion, additional MEC field investigations were not required during this RI. However, it was not known if any risks associated with MC were present at the Former Camp Wellfleet. Therefore, the RI field investigation was designed to determine if any releases of MC have occurred at the Former Camp Wellfleet, and if so, whether any MC risks exist.

Table 1-1. MEC and MD Items Found at the Former Camp Wellfleet
MEC
76mm anti-aircraft artillery Rifle Smoke Grenade
14-inch projectile*
MD
M28A1 Flash Tubes from 106mm cartridges (initially considered MEC but later determined to be MD)
250-pound practice bomb
60mm projectiles
Ammunition clips
Dove missile (practice)
Fuze shipping debris
Grenade (fragments, fuzes, spoons)
Metal fragments/burned metal debris
Rocket head/motor
Warhead fragments
Small Arms ammunition, 0.30 ball, 0.30 caliber, 0.50 cal
* - *Specific information for this item is anecdotal based on news reports of the incident. Location, size, and type has not been confirmed.* *NOTE: As described in more detail in Table 3-2 and Section 3.1.4, for the ocean artillery range fan, the presence of 3.5" rockets, and 90mm and 105mm high explosives (HE) MEC items is assumed based on historical evidence of munitions use where anti-aircraft and rocket firing was conducted for approximately 20 years.*

1.6 Areas of Investigation for the RI

The RI investigation approach for the Former Camp Wellfleet was based primarily on the ASR and EE/CA identified 'Areas', as described in Sections 1.4.1 and 1.4.2. The ASR and EE/CA investigations defined areas that were determined to have MEC, have a potential for MEC, or no potential for MEC.

However, additional research, including the TEC aerial photo and groundscar analysis, helped to further identify the investigation areas for this RI. Consequently, the Project Delivery Team (PDT) developed Areas of Interest (AOIs) as the primary basis of investigation for the RI. The AOI term is used to be consistent with terminology used in the USACE FUDS Handbook on Delineation and Munitions Response Site Prioritization Protocol (MRSPP) Implementation.

The AOI configurations consider the original ASR and EE/CA Areas, the results of subsequent removal actions, the aerial groundscar analysis, and the FUDS Management Information System (FUDSMIS) project acreage for Camp Wellfleet. Additionally, review of Conceptual Site Model (CSM) elements and common past activities allowed for combining some of the Areas, or the screening out of Areas where there was no evidence of MEC/MD, resulting in the six (6) AOIs that form the basis of the RI. The AOIs, overlying the original 'Areas', are shown in Figure 3. Section 3.1 provides more detail on the development of the AOIs as the basis for this investigation, and how the original EE/CA Areas became the current AOIs.

The sixth AOI (AOI-06) is the ocean portion of the artillery range fan that is addressed by the current 3Rs (Recognize, Retreat, Report) educational program in effect at the site. The 3Rs educational program is part of the institutional controls recommended in the EE/CA. AOI-06 is shown as an inset in Figure 3.

By definition, the five (5) land-based AOIs are areas that have MEC or have the potential for MEC. As such, with regard to the MC investigation component, these AOIs also represent locations judgmentally considered to pose the greatest likelihood to have MC contamination present. No MC sampling was conducted for AOI-06 as there were no specific MEC items to target and MC sampling in an ocean range is not typical or practical; however, it was evaluated for MEC risk for this RI.

1.7 Report Organization

This report is organized in general accordance with the suggested RI report table of contents presented in the USEPA Guidance for Conducting RI/FS (USEPA, 1988) and the Army MMRP RI/FS Guidance (USACE, 2009).

Sections 1.0 and 2.0 present the introduction, history, and site description. Section 3.0 presents the investigation approach and Section 4.0 presents the assessment of MC data quality. Section 5.0 presents the RI results and Section 6.0 the conclusions and recommendations for the Former Camp Wellfleet. All figures are presented in Appendix A. Other appendices present MEC Data Quality Objectives (DQOs), the Incremental Sampling Technical Memorandum, Analytical Data, MEC Risk Matrix tables, MRSPP scoring, a Photographic Log, and Field Documentation.

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2.0 SITE DESCRIPTION AND ENVIRONMENTAL SETTING

A site layout map is presented in Figure 2. The environmental setting for the Former Camp Wellfleet comprises beaches and dunes on the eastern side, heathlands and grasslands, and forested areas on the central portion and western side.

2.1 Overall Site Description

Cape Cod lies within the New England physiographic province, Seaboard Lowlands Section (USGS, 1999). Cape Cod was built primarily during the Ice Age (Pleistocene Epoch) by the advance and then retreat of the ice sheets that covered New England. The retreating glaciers deposited rock debris, called drift, which overlies the older bedrock. Drift consists of very fine to very coarse rock debris. This is a glaciofluvial depositional environment, with drift deposits near the Former Camp Wellfleet consisting mostly of glacial outwash materials, primarily sand and gravel. The drift thickness on Cape Cod ranges from 100 to more than 1,000 feet. Cape Cod undergoes changes due to marine erosion and deposition with approximately 7 meters of loss per year along the Atlantic Ocean and approximately 10 meters of new land created by beach and dune deposits (USGS, 2013).

2.1.1 Surface Features

The highest elevation within the uplands region of the Former Camp Wellfleet is approximately 100 feet above mean sea level on NAVD88 (USGS, 2016). The land surface is characterized by rolling hills and bluffs along the eastern side of the site (Figure 4).

2.1.2 Surface Water Hydrology

The Atlantic Ocean borders the Former Camp Wellfleet to the east. Blackfish Creek is north of Area E. There are a small unnamed lake and an unnamed stream south of Area L, and two small streams (Silver Spring Brook and Hatches Creek) near Area M. There are riverine or freshwater emergent wetlands along the stream south of Area L, a freshwater forested/shrub wetland east of Area E, and estuarine and marine wetland along the coast of the Atlantic Ocean within the Former Camp Wellfleet (USFWS, https://www.fws.gov/wetlands/arcgis/rest/services/Wetlands/MapServer last accessed 2 November 2016). Surface water features are shown in Figure 4.

2.1.3 Meteorology

The Former Camp Wellfleet is located within Cape Cod with weather consisting of four distinct seasons. The Atlantic Ocean influences the climate of Cape Cod with cold ocean temperatures delaying the onset of spring and warmer ocean temperatures delaying the onset of fall. The average temperatures in the summer and winter are in the mid-60s [Fahrenheit (°F)] and mid-40s °F, respectively. July is the warmest month of the year with an average high temperature of 78°F; January is the coldest month with an average low temperature of 39°F. Daily temperature variations between night and day average approximately 15°F.

The annual average precipitation is 43.36 inches. Precipitation is evenly distributed throughout the year. The wettest month of the year is March with an average precipitation of 4.49 inches and the driest month of the year is July with an average precipitation of 2.8 inches.

2.1.4 Geology

The sediments of Cape Cod were deposited at or near the terminus of the Laurentide ice sheet, which formed the surficial geology of Cape Cod. It consists of sandy terminal moraines and an assortment of thick sandy till, ice-contact outwash, and glacial-lake deposits underlain by Paleozoic crystalline bedrock. Glacial deposits range in thickness from 100 feet along Cape Cod Canal to approximately 1,000 feet at the northern end of the peninsula (USGS, 1999).

2.1.5 Soils and Sediments

Soils in the Former Camp Wellfleet primarily consist of Carver Coarse Sand (very deep, excessively drained coarse sandy soils formed in glaciofluvial deposits) on the western side and rolling Hooksan Sand (very deep, excessively drained sandy soils formed from eolian sands derived from sandy marine deposits) on the eastern side. These soils generally exhibit moderate to high permeability (USDA, 1993). Figure 5 shows the soil types within the site.

Sediments underlying the Former Camp Wellfleet primarily consist of undifferentiated outwash and local ice-contact characterized by coarse sand and gravel with some clay, silt, cobbles, and boulders. Beach and dune deposits are evident along the Atlantic coastal areas of the Former Camp Wellfleet (USGS, 1995).

2.1.6 Hydrogeology

The Former Camp Wellfleet is underlain by the Nauset fresh water lens, which is bounded laterally and below by saltwater. The Nauset is one of four lenses that constitute the Lower Cape Cod aquifer. Surface water discharge areas separate the lenses. The Lower Cape Cod aquifer provides drinking water for the communities of Wellfleet, Eastham, Truro, and Provincetown, and for the NPS CCNS facilities throughout the Cape Cod National Seashore.

Groundwater discharge from the Lower Cape Code aquifer provides the primary source of water for the wetlands, kettle ponds, and streams throughout Lower Cape Cod. Groundwater elevation is approximately 8 ft above the local sea level (USGS, 2005) within the Former Camp Wellfleet. Groundwater in the Nauset lens flows radially toward the Atlantic Ocean (east and south), Cape Cod Bay (west), and Black Fish Creek (north) (USGS, 2005). Groundwater within the site flows east toward the Atlantic Ocean.

Precipitation recharges groundwater. Due to the high permeability of the soils, an estimated 45% of the annual precipitation becomes groundwater recharge (USGS, 1995).

2.1.7 Demography and Land Use

The Former Camp Wellfleet beach area is currently used for recreational sunbathing, surfing, fishing, hiking, and sightseeing. The remaining areas are currently used for recreational hiking, hunting, picnicking, and mushroom picking. The National Seashore Headquarters is located on the Former Camp Wellfleet within in the former cantonment area. Land use at the site is projected to remain recreational.

2.1.8 Ecology

The Former Camp Wellfleet is located within the CCNS National Park and is within the Town of Wellfleet. The coast, wetlands, and woodland areas contain a variety of ecosystems. The Former Camp Wellfleet is within Natural Heritage & Endangered Species Program (NHESP) Estimated Habitats of Rare Wildlife and NHESP Priority Habitats of Rare Species (Figure 4).

The field sampling program required coordination with resource agencies, including the U.S. Fish and Wildlife Service and the MA Natural Heritage & Endangered Species Program. USACE sent coordination letters to these agencies as part of the Work Plan coordination activities.

Depending on the season, there are 25 Federally-listed species known to occur at the Cape Cod National Seashore, of which three have the potential to occur in our investigation area (Northern-long Eared Bat, Red Knot, and Piping Plover). In addition, there are 32 rare or endangered species protected under the Massachusetts Endangered Species Act that are known to occur at the National Seashore.

Sixteen plant communities are within the boundary of the Former Camp Wellfleet, as shown in Figure 6. Information on plant communities is from Vegetation Classification and Mapping at Cape Cod National Seashore, Massachusetts (USDOI NPS, 2010). The NHESP classifies two areas within Former Camp Wellfleet as natural communities of biodiversity conservation interest, the Sandplain Heathlands and Coastal Atlantic White Cedar Swamp (Figure 4). RI sampling was conducted within the Coastal Pitch Pine/Scrub Oak Barren, Lower New England Red Maple-Blackgum Swamp, North Atlantic Upper Ocean Beach, Outwash Shrub Oak Barrens, Pitch Pine – Heath Barrens, Pitch Pine Dune Woodland, Pitch Pine-Oak Forest, and Sandplain Heathland plant communities.

2.1.9 Cultural and Archaeological Resources

The Camp Wellfleet FUDS includes the Marconi site, which is a historical and cultural resource. The field team coordinated with NPS CCNS and MA State Historic Preservation Officer to ensure that sampling locations did not impact known cultural or archaeological sites. USACE sent a coordination letter to the MA State Historic Preservation Officer as part of the Work Plan coordination activities.

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3.0 INVESTIGATION APPROACH

The goal of the RI field investigation activities was to determine the nature and extent of MEC and MC contamination at the Former Camp Wellfleet, potentially caused by prior military operations, and to recommend whether further actions are warranted. This section discusses the investigation that was conducted to make these determinations for MEC and MC, respectively.

As described in Section 1.6, five land-based AOIs were developed from areas determined by previous investigations (ASR, EE/CA) to have had MEC or have the potential for MEC. These AOIs would consequently represent locations where MC might also be expected, and therefore, they form the primary basis of investigation for MEC and MC for this RI.

A more detailed summary of the development of each AOI is provided in the discussions below.

3.1 MEC Data Needs

Data were needed to assess the nature and extent of MEC contamination at the Former Camp Wellfleet. In order to demonstrate that there were sufficient data, those areas of previous military activities were developed into focused AOIs. Then a MEC CSM and MEC Data Quality Objectives (DQOs) were developed based on the descriptions of past activities conducted within these AOIs. Using the existing previous Former Camp Wellfleet investigation findings, each AOI was then tested to determine whether the DQOs were met.

3.1.1 Geophysical Data Usability Assessment

It was first necessary to assess the usability of the data from previous investigations to determine the geophysical coverage and the statistical confidence of MEC density determinations to apply to each focused AOI. The type and quality of the data from each of the key prior investigations/removal actions, as described in Section 1.4, are discussed below.

In general, while these investigations pre-dated the more current Geophysical System Verification process, either a test strip or Geophysical Proveout (GPO) was used in each of the surveys. For example, for the EE/CA (2000), a 30 m x 30 m test plot was constructed by burying inert and simulated ordnance items. The geophysicists collected G-858 gradiometer data on the test plot initially and then re-ran the collection weekly during the survey. The buried items were detected each time, demonstrating repeatability in the system and usability of the data. Figure 2 shows the grids investigated during the EE/CA. For most of the grids, 100% excavation was conducted, and those data were used for geophysical coverage calculations for this RI. For some grids, however, only a sample of anomalies was excavated. Since the MEC density calculations made to assess data for this RI assume that all anomalies within a grid were excavated, the partial EE/CA grids were not used for geophysical coverage calculations.

For the aerial magnetic helicopter survey of 2002, ORNL also used a test plot. Steel pipes were buried in the ground in a clear area, and the helicopter's sensors were passed over them. The report notes that this was performed daily, demonstrating repeatability and supporting usability of the data. Existing large metallic structures (i.e., buildings) were detected where expected, validating the locational accuracy of the survey. Metallic objects were subsequently found at nearly all single point anomalies (SPAs), supporting the reliability of the data. However, the height of the sensors above the ground, determined primarily by vegetation, limited the ability to detect anything but the largest ordnance items in most cases, so these data were not used for geophysical coverage calculations for this RI.

For the 2003-2004 SPA investigations, although over 300 anomalies were investigated, the coverage associated with each individual one is only a few square feet and they were not used for geophysical coverage calculations for the RI. However, when the associated follow-on grid investigations (2004) were conducted, a full GPO was constructed and a report including test plot design and results of sensor tests was prepared and approved prior to grid data collection. A G-858 magnetometer was used for the GPO and in the grids, with a tight sensor spacing of 18 inches, producing excellent quality usable data, and all these grid data were used for geophysical coverage calculations for this RI.

The 2005 larger scale removal actions (EE/CA Area B and other SPAs) were performed using hand-held analog detectors followed by immediate excavation ("mag & dig"), which is a standard method for a removal action used today. The areas are well defined and the amount of MEC and MD is well documented, and therefore these data were used for geophysical coverage for this RI.Section 5.1.3 provides a MEC data uncertainty discussion.

3.1.2 AOI Development

Table 3-1 summarizes past activities and previous investigation findings used to adjust the EE/CA-defined Areas, combine Areas where appropriate, or screen out Areas with no evidence of MEC/MD, and then make determinations of whether they warranted further review in this RI. The determination of whether further review was required for this RI formed the basis of development of the focused AOIs. Note that the issue of whether additional field investigation was required for the AOIs once they were developed, is addressed in Section 3.1.4 below.

Figure 2 shows Areas A through N.

Table 3-1. Analysis of Historical Investigation Areas

ASR or EE/CA Area	Description	Prior Investigation Findings	Analysis	Further Addressed in this RI?
A	Former Artillery Firing Line—firing points for 90 mm and other anti-aircraft artillery	Small arms debris, 90 mm fuze clips/cans, frag, and calcium hydroxide cannisters. Sea cliff erosion exposes ordnance including 76 mm anti-aircraft round (MEC).	MEC presence established from historical record and investigations. Area was expanded westward to capture aerial features and some ORNL survey areas.	Yes
B	Rocket Range – area also includes a small arms range	3.5-in rocket and 105 mm projectile parts and frag. Removal action completed. Small arms range now parking lot.	MEC presence possible but only MD found. Area was expanded south and westward to capture removal action areas.	Yes
C	Bomb Target Area—large Dove bomb target/impact area in mid 1940s	3 empty Dove bombs, fuze shipping spacers, grenade frag, small arms debris, flash tubes	MEC presence possible but only MD found. Combined with Area F and J based on common past activities.	Yes
D	Ammunition Supply Point—multiple U-shaped revetments possibly used to store ammunition	Fuze shipping spacers, small arms debris	MEC presence possible but only MD found. Combined with Area L, capturing aerial features in the acreage between them.	Yes

Table 3-1. Analysis of Historical Investigation Areas

ASR or EE/CA Area	Description	Prior Investigation Findings	Analysis	Further Addressed in this RI?
E	North Burial Site - Includes area initially considered an Open Burn/Open Detonation	Possible OB/OD area determined to be disposal pits for MD and non-munitions debris	Additional MD presence possible if other disposal pits exist. Footprint reduced to match extent of ground scars.	Yes
F	South Burial Site – described as a known burial area in ASR	One empty Dove bomb, one empty 250 pound bomb found	MEC presence possible but only MD found. Combined with Area C and J based on common past activities.	Yes
G	Cantonment Area – housing and living quarters for personnel	One small arms ammunition clip found	No evidence of MEC based on historical operations and previous investigations	No
H	Remaining Lands – acreage outside of ASR-EE/CA identified areas for investigation	One empty Dove bomb, small frag found	Minor areas of MD deleted from Area H footprint and captured by adjacent areas based on common past activities.	No
I	Off-Shore Ordnance Area – off-shore artillery range fan	Not investigated previously	MEC presence assumed, but current 3Rs program sufficient to address risk	Yes
J	Southern Bomb Target Area - large Dove bomb target/impact area in mid 1940s	Fragments of grenade spoons, frag, small arms debris found	MEC presence possible but only MD found. Combined with Area C and F based on common past activities.	Yes
K	Old 1,000 Range – shown on an installation plan drawing, identified in 1951 aerial photo	No ordnance related debris found	No evidence of MEC based on historical operations and previous investigations	No
L	Ground Scar Area – multiple groundscars identified from 1943 and 1947 aerial photos	One rifle smoke grenade found	MEC presence possible based on single finding. Combined with Area D, capturing aerial features in the acreage between them.	Yes
M	Ground Scar/Impact Crater Area – identified from 1943 and 1947 aerial photos	No ordnance related debris found	No evidence of MEC based on historical operations and previous investigations	No
N	Former Clifton Airfield – four cleared areas identified from a 1961 aerial	No ordnance related debris found	No evidence of MEC based on historical operations and previous investigations	No

Based on the information summarized in **Table 3-1**, the EE/CA-defined areas determined to warrant further investigation in this RI, as adjusted or combined based on CSM elements, were developed into AOIs (**Table 3-2**). The CSM and munition types associated with each AOI (discussed below) is also indicated. Figure 3 shows the AOIs and their relationship to the EE/CA Areas.

Table 3-2. RI Areas of Interest

AOI	Description	CSM	Munition Types	Acreage
AOI-01	Area E, as reduced	Burial/Disposal Pits, Possible Landfill	No MEC. MD included 3.5" practice rockets, expended M2 anti-personnel mines, 407 M48 flashtubes, m7A3 2.36" practice rocket, and part of an inert filled M65 1,000lb "Dove" guided bomb.	33.1
AOI-02	Area A as expanded	Artillery Firing Points	A 76mm anti-aircraft artillery (MEC), and 50 caliber ammunition, fuze cans, shipping clips for 90mm fuzes, 30 caliber ammunition cans, and unknown frag (MD).	275.0
AOI-03	Areas D and L and the acreage between them	Ammunition Supply Points and Ground Scars	Rifle smoke grenade (MEC), and multiple fuze shipping spacers, and some small arms debris (MD).	120.2
AOI-04	Areas C, F, and J	Bomb Targets and Small Burial Area	No MEC. MD included fuze shipping spacers, small arms debris, an empty Dove Missile/1000-pound bomb, an empty 250-pound bomb, 186 M28A1 flash tubes from 106mm projectile cartridge cases, and fragments of grenade spoons.	141.8
AOI-05	Area B, as expanded	Rocket Range and Small Arms Range	HE frag from 3.5-inch rockets and 105mm projectiles (MD indicative of MEC), and miscellaneous MD scrap.	56.10
AOI-06	Area I	Range Fan of Artillery Targets in Ocean	None found. Potential types: 76mm anti-aircraft artillery, 90mm and 105mm projectiles, 3.5" rockets.	167,856

3.1.3 MEC Conceptual Site Model

A CSM is used to communicate and describe the current state of knowledge and assumptions about risks at a project site. The CSM presents the exposure pathway analysis by integrating information on the MEC source, receptors, and receptor/MEC interaction. Figure 7 provides a graphical presentation of the MEC CSM for the Former Camp Wellfleet. Using the CSM elements, the AOIs were developed based on the following:

- EE/CA Area E was reduced in size to match the extent of groundscars representing a suspected sanitary landfill (TEC Report, 1998). Previous investigation suggested this was a possible Open Burn/Open Detonation (OB/OD) Area, but subsequent excavations found only MD with evidence that some items had undergone demolition procedures. This reduced area became AOI-01, where the possibility of additional MD remains.
- The original EE/CA Area A footprint included only the beach, bluff, and a narrow area west of the bluff where the artillery firing points were located. It was developed into AOI-02 by expanding westward to include all the EE/CA investigated grids, aerial features, removal action grids, and many SPAs. The nature and quantity of MD found (90 mm fuze cans and shipping clips) in the area is consistent with the known firing points along the bluffs.

- EE/CA Area D was used as an ammunition supply point with multiple U-shaped revetments. It was combined with Area L, including with the acreage between them, into AOI-03, due to similarity of ground scars of unknown origin within the areas on the 1943 and 1947 air photos.
- EE/CA Areas C and J are centered on large diameter bomb targets observed on aerial photos from the 1940s. Area F was a known burial site according to the ASR (1994). Practice Dove bombs and one empty 250-pound bomb have been found within or adjacent to these areas, including within Area F, confirming the use as bombing targets. These three areas were therefore combined into a single AOI (AOI-04).
- EE/CA Area B was expanded to include the terrestrial portions of a rocket range and small arms range. The small arms range has been completely covered by the large parking lot now present. The southern portion includes a small 5-acre removal action area (Zapata 2006). This expanded area became AOI-05.

3.1.4 MEC Data Quality Objectives

DQOs are qualitative and quantitative statements that specify the quality and level of data required to support the decision-making processes for a project. DQOs for MEC were developed as a basis for determining whether each of the AOIs identified in Table 3-2 above, required additional field investigation during the RI.

A typical MEC DQO is to have sufficient data to state that the density of MEC within the study area is below a threshold with a confidence expressed as a percentage. The basis of the DQO at the Former Camp Wellfleet was to make use of previous/existing geophysical data in order to decide if further field investigation of nature and extent was necessary. Visual Sample Plan (VSP), a statistically-based software published by Pacific Northwest National Laboratory, was used in the analysis of the previous data collected at the Former Camp Wellfleet. The following is a summary of that analysis; a more detailed presentation is contained in Appendix B.

The VSP module used was *Sampling Goals > Remedial Investigation (UXO) > Target of Interest (TOI) Rate Estimation*. Required inputs include the area of valid geophysical coverage, and the number of MEC items found within the geophysical area. The analysis was conducted for each of the five land-based AOIs using both 80% and 95% confidence and both 1.0 TOI/acre and 5.0 TOI/acre thresholds. Results are summarized in Appendix B, Table B-1.

The DQO for determining the need for further fieldwork was determined by the PDT to be:

- *For each AOI, there should be at least 80% confidence that the TOI/acre should be less than 1.0.*

Table B-1 indicates that this DQO was met for AOI-02 through AOI-05, with confidence ranging from 86.5% to 99.9%, i.e., no further field work was required. Due to low geophysical coverage (less than 1 acre), the DQO was not met for AOI-01, but the PDT concurred that no further fieldwork was necessary because it is a burial pit/possible landfill, where MD was found in only one grid, along with a significant amount of non-munition related debris, and it was estimated that, assuming coverage credit for the 3 grids that were not completely excavated (but for which no MEC or MD were found in the excavated portions) the confidence calculation would likely exceed the 80% goal.

As shown in Appendix B, Table B-1, the analysis concluded that sufficient MEC data existed and that no additional field investigation for MEC was required to complete this RI. For AOI-06, the ocean range fan, MEC presence was assumed and therefore no further field investigation for this RI was required.

3.2 Characterization of MEC

The discussions above indicate that sufficient data were available to characterize the nature and extent of MEC at each AOI, without the need for additional field investigation during this RI. Using the existing data from the previous investigations, the methodologies described below were used to make determinations of explosive risk posed by each AOI.

3.2.1 MEC Risk Assessment Matrices

MEC risk was evaluated using the current USACE risk assessment methodology to define risk posed by MEC hazards. The method, provided in the *Decision Logic to Assess Risks Associated with Explosive Hazards, and to Develop Remedial Action Objectives for Munitions Response Sites* (USACE, 2017c), involves the use of four matrices to define acceptable and unacceptable risk from MEC hazards based on the likelihood of an encounter, the severity of incident, and the sensitivity of interaction based on expected land use activities. This method is ultimately used to establish remedial action objectives and to help evaluate potential remedial action alternatives.

Section 5.1.1 provides the detail of the analysis of whether the Former Camp Wellfleet AOIs pose acceptable or unacceptable explosive risk.

3.2.2 Munitions Response Site Prioritization Protocol

DoD developed the Munitions Response Site Prioritization Protocol (MRSPP) as a methodology for prioritizing sites known or suspected to contain MEC or MC for response actions, assigning a relative priority based on various safety and environmental factors. The MRSPP consists of three modules to evaluate the unique characteristics of each hazard type at an MRS: the Explosive Hazard Evaluation module, the Chemical Warfare Materiel Hazard Evaluation module, and the Health Hazard Evaluation module.

Section 5.2 provides the detail of the MRSPP rankings for each Former Camp Wellfleet AOI.

3.3 MC Data Needs

Data were needed to assess the nature and extent of potential MC contamination resulting from past practices at Camp Wellfleet. Environmental sampling was conducted to determine the distribution and concentrations of metals and explosives in surface and subsurface soil. In addition, ERT collected a groundwater sample from one drinking water supply well (Supply Well B) at the request of NPS CCNS personnel. All sample data were screened against the relevant comparison criteria to evaluate potential release of MC to the environment, to achieve the RI objectives.

3.3.1 MC Conceptual Site Model

An MC CSM (Figure 8) was developed in accordance with EM-200-1-12 (USACE, 2012), to illustrate the mechanisms by which MC from past DoD activities at Camp Wellfleet could potentially migrate from affected source media to the point of exposure where contact with receptors may occur.

3.3.1.1 Receptors

Potential receptors to MC in the Former Camp Wellfleet include human populations, animal species, or habitats that may be exposed to site-related MC contamination in environmental media.

Upland habitat types within the Former Camp Wellfleet are shown in Figure 6. Soil sampling was conducted within the Coastal Pitch Pine/Scrub Oak Barren, Lower New England Red Maple-Blackgum Swamp, North Atlantic Upper Ocean Beach, Outwash Shrub Oak Barrens, Pitch Pine – Heath Barrens, Pitch Pine Dune Woodland, Pitch Pine-Oak Forest, and Sandplain Heathland plant communities.

Human receptors are primarily the following:

- Recreational Users
- Site Workers (including CCNS NPS Staff and Road/Utility Workers)
- Construction Workers

Ecological receptors include various birds, mammals, invertebrates, flora, and fauna that occur within the Former Camp Wellfleet. Wildlife species at the CCNS include twelve species of amphibians, 370 species of birds, 59 species of mammals, five species of migratory marine turtles, and 13 species of land-based reptiles (NPS website, https://www.nps.gov/caco).

There are two distinct habitat areas within the site: upland and beach. Both human and natural influences have created the upland habitat. The dominant tree species in the upland habitat include pitch pine (Pinus rigida), black oak (Quercus velutina), and white oak (Quercus alba) with smaller areas of black locust (Robinia pseudoacacia), and red maple (Acer rubrum). Sandplains, areas of glacial outwash, are also part of the uplands habitat and consist of grassland and heathland. The beach habitat consists of areas above and below the tide line. Above the tide line is a transition zone between the marine and terrestrial habitats. Below the tide line, the sand is host to nematodes, copepods, and other invertebrates (NPS website, https://www.nps.gov/caco).

3.3.1.2 Sources, Mechanisms, and Exposure

The source of potential MC at the Former Camp Wellfleet is primarily the result of historical military activities, including the firing of artillery, practice bombing, and small arms. The potential MC across the Former Camp Wellfleet includes select munitions-related metals and explosive compounds. Munitions used at Camp Wellfleet were identified from the prior investigations, as outlined in Section 1.5. The munitions-related metals were selected based on knowledge of the munitions used at Camp Wellfleet, USACE guidance (USACE, 2013), and the MIDAS search results (Final Work Plan (USACE, 2018), Appendix E, Attachment B). The previous military activities may have impacted surface and subsurface soil, which potentially results in MC being released by runoff and erosion. Where access is available and activities are such that exposure is possible, then exposure to receptors by ingestion, inhalation, and dermal contact are potentially complete pathways.

Groundwater is not currently a pathway of concern unless soil sampling results indicate a possible impact to groundwater. Groundwater at the Former Camp Wellfleet is currently used for drinking water, and therefore, at the request of CCNS NPS, ERT collected one groundwater sample from the supply well (Supply Well B).

3.3.2 MC Data Quality Objectives

MC DQOs were developed to support the determination of the nature and extent of MC contamination at the Former Camp Wellfleet and to recommend whether further actions are warranted. The DQOs for the environmental sampling are presented in **Table 3-3** (MC sampling). In addition, laboratory analytical DQOs for environmental sampling were presented in the approved UFP-QAPP, Appendix E to the Work Plan [USACE, 2018]). All DQOs were reviewed and accepted by the PDT prior to the commencement of field activities.

Table 3-3. Soil Sampling DQO – Former Camp Wellfleet

DQO Element	Specific DQO Statement
Project Objective(s) Satisfied	To determine the nature and extent of MC.
Data User Perspective(s)	To obtain representative soil data to determine if an MC release has occurred, and if a release is identified, define nature and extent of MC by additional sampling, and compare results against defined screening levels and background sampling results. If detected soil concentrations exceed both screening levels and background results, conduct an HHRA and SLERA to determine if there are human health and/or ecological risks associated with contamination present in soils due to past DoD activities.
Contaminant or Characteristic of Interest	Based on historical use of the Former Camp Wellfleet and results for MEC and MD items found, analyze the media of interest for the following: • Metals (antimony, copper, lead, manganese, nickel, and zinc) • Explosives (RDX, TNT, nitroglycerin, 2,4-dinitrotoluene, 2,6-dinitrotoluene, tetryl, and nitroguanidine)
Media of Interest	Surface and subsurface soil, groundwater
Required Sampling Locations or Areas	Surface and subsurface soil samples to be collected based on historical locations of MEC or MD finds, or depths of previous munitions-related activities.
Number of Samples Required	A. 17 incremental sampling (IS) surface soil samples (exclusive of background and QC replicates) B. 3 IS subsurface soil samples (exclusive of background and QC replicates) C. 8 discrete subsurface samples in the AOI-01 burial pit area (exclusive of QC samples) D. 7 IS surface and subsurface background soil samples (exclusive of QC replicates)
Reference Concentration of Interest or Other Performance Criteria	USEPA Regional Screening Levels (RSLs), S-1 Soil & GW-1 Standards as given in Massachusetts Contingency Plan (MCP) Table 2, 310 CMR 40.0975(6)(a), and background metals. Comparisons to these criteria to be utilized along with comparisons to background results, to evaluate the need for additional soil sampling to determine contaminant extent, and, subsequently as warranted, to select chemicals of potential concern (COPCs) and chemicals of potential ecological concern (COPECs) for an HHRA and SLERA.
Sampling Methods and Depths	A. Incremental Sampling (IS) method for surface soil in the 0-6 inches bgs interval using a step probe. B. IS subsurface soil samples will be at 0.5 ft to 3 ft bgs. IS subsurface soil samples will be collected using a step probe. C. Discrete subsurface samples will be collected from the AOI-01 burial pit area at 8-10 ft bgs, using a hand auger.
Analytical Methods	Metals analysis by SW-846 Method 6010C; explosives analysis via SW-846 Method 8330B

3.4 Characterization of Munitions Constituents

MC soil sampling locations were collected from areas where previous investigations identified MEC/MD, portions of the site judgmentally considered to potentially contain the largest MC contaminant concentrations.

Although not currently a pathway of concern unless soil sampling results were to indicate a possible impact, groundwater was sampled at the request of the CCNS NPS (Supply Well B, used for drinking water).

3.4.1 General Approach

ERT's sampling approach reflected the approved Work plan procedures intended to minimize impacts to the various ecosystems and sensitive plant communities as referenced in Section 2.1.8. NPS provided oversight of the entire field operation to ensure that field staff were always aware of, and did not adversely impact, NHESP Estimated Habitats of Rare Wildlife and Priority Habitats of Rare Species.

The general approach was to collect surface and subsurface soil samples using the IS methodology. However, based on comments received from the Massachusetts Department of Environmental Protection (MassDEP) on this approach, a *Technical Memorandum* (ERT, 2018) was drafted to capture revisions to the original soil sampling plan. The revisions were largely based on MassDEP's request for additional increments using the IS methodology and a higher percentage of replicate (triplicate) sampling, as described in more detail in Section 3.4.3. In addition, discrete subsurface soil samples were recommended for the AOI-01 subsurface due to the difficulty of collecting multiple sample increments from the 8-10 foot bgs sampling interval. Upon Technical Memo concurrence, all revisions were incorporated into the Final Work Plan/UFP-QAPP (USACE, 2018), and all RI sampling was conducted accordingly.

MC sampling was conducted using a phased approach. As described in the **Table 3-3** DQOs, screening of initial sampling results against the project screening levels (PSLs) was conducted to evaluate the need for additional soil sampling to determine contaminant extent, and, subsequently as warranted, to select COPCs and COPECs for an HHRA and SLERA. Phase 2 follow-on sampling would only be conducted if the data screening determined it was warranted.

Figure 9 presents an overview of all sampling locations.

3.4.2 Comparison Criteria

As detailed in the Final Work Plan/UFP-QAPP, data results for IS soil samples were compared to USEPA RSLs for Residential Soil, S-1 & GW-1 Massachusetts Contingency Plan (MCP) Table 2, USEPA Ecological Soil Screening Levels, and background sampling results. Data results for discrete soil samples were also compared to USEPA RSLs for Residential Soil, S-1 & GW-1 Massachusetts Contingency Plan Table 2, USEPA Ecological Soil Screening Levels, as well as MassDEP, Technical Update Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil (natural soil values) (MassDEP, 2002) (MA BKG). The Supply Well B groundwater sampling results were compared to Massachusetts Maximum Contaminant Levels (MMCLs) and the Massachusetts Drinking Water Guidelines (MassDEP, 2017).

3.4.2.1 Background Screening Concentrations

Background data were evaluated to determine outliers and distribution (Goodness of Fit). Surface and subsurface soil background data were compared using analysis of variance (ANOVA) to determine if the surface and subsurface represented statistically different populations or if the statistical characteristics were comparable (i.e., from the same population) and could be pooled. ANOVA comparisons of surface and subsurface soil sampling results for antimony and manganese indicated that the surface and subsurface results were from statistically similar populations ($p > 0.05$). ANOVA comparisons of surface and subsurface soil sampling results for copper, lead, nickel, and zinc indicated that the surface and subsurface soil sampling results were from statistically different populations ($p \leq 0.05$).

To determine the background soil concentrations for comparison to site soil sampling results, ERT calculated the Background Threshold Values (BTVs) using the ProUCL, version 5.1, software. For each analyte for which there were no potential outliers, ERT selected the 95% upper simultaneous limit (USL) for the appropriate data distribution as the BTV. The use of the USL tends to provide a balance between false positives and false negatives provided the data represents a background data set.

For all analytes for which there were potential outliers, ERT selected the 95% upper threshold limit (UTL) with 95% coverage. The UTL was selected to cover the range of concentrations in the background population. Note that all calculated BTVs, except antimony, were less than the lower of the USEPA RSLs and the MCP screening levels. Therefore, except for antimony, the BTVs were not selected as the PSL for any of the MC metals, and the statistically different populations (surface and subsurface for the respective metals as described in the paragraph above) did not end up being meaningful to evaluating the results. Details of the statistical analysis of the background data are provided in Appendix D.1. The calculated BTVs are presented in **Table 3-4**.

Table 3-4. Background Threshold Values (BTVs) for Metals

Analyte	Surface Soil BTV (mg/kg)	Subsurface Soil BTV (mg/kg)	Combined Surface and Subsurface Soil BTV (mg/kg)
Antimony	NA	NA	3.4
Copper	4.145	3.76	N/A
Lead	23.1	4.242	N/A
Manganese	N/A	N/A	109.8
Nickel	1.924	2.81	N/A
Zinc	7.69	19.19	N/A

mg/kg – milligrams per kilogram
N/A – not applicable

3.4.2.2 Project Screening Levels-Incremental Sampling Method Soil Samples

PSLs for IS surface and subsurface soil sampling results were determined by first selecting the lower of the USEPA RSLs and the MCP standards, and then comparing this value to the BTVs and selecting the larger value (**Table 3-5**). Because the BTVs were less than the USEPA RSLs and the MCPs for all metals except antimony, the PSLs for all metals, except antimony, are the lower of the USEPA RSLs and the MCP standards.

Table 3-5. RSLs, BTVs, and PSLs for IS Method Metals in Surface and Subsurface Soil

Analyte	Unit	RSL	MCP	Surface BTV	Subsurface BTV	Surface PSL	Subsurface PSL
Antimony	mg/kg	3.1	20	3.4	3.4	**3.4**	**3.4**
Copper	mg/kg	310	NS	4.145	3.76	**310**	**310**
Lead	mg/kg	400	200	23.1	4.242	**200**	**200**
Manganese	mg/kg	180	NS	109.4	109.84	**180**	**180**

Table 3-5. RSLs, BTVs, and PSLs for IS Method Metals in Surface and Subsurface Soil

Analyte	Unit	RSL	MCP	Surface BTV	Subsurface BTV	Surface PSL	Subsurface PSL
Nickel	mg/kg	150	600	1.24	2.81	**150**	**150**
Zinc	mg/kg	2,300	1,000	7.69	19.19	**1,000**	**1,000**

RSL *June 2017 USEPA RSL for Residential Soil, with hazard quotient = 0.1, except for lead, which is based on blood-lead modeling (USEPA, 2017)*

MCP *S-1 & GW-1 Massachusetts Contingency Plan Table 2; used for screening potential impacts to groundwater.*

3.4.2.3 Project Screening Levels-Discrete Sampling Method Soil Samples

PSLs for metals in discrete subsurface soil were determined by first selecting the lower of the USEPA RSLs and the MCP standards, and then comparing this value to the MA BKG, and then selecting the larger value. PSLs for discrete subsurface soil samples are shown in **Table 3-6**.

Table 3-6. RSLs, Background, and PSLs for Discrete Sampling Method Metals in Subsurface Soil (mg/kg)

Analyte	RSL	MCP	MA BKG	PSL
Antimony	3.1	20	1	**3.1**
Copper	310	NS	40	**310**
Lead	400	200	100	**200**
Manganese	180	NS	300	**300**
Nickel	150	600	20	**150**
Zinc	2,300	1,000	100	**1,000**

MA BKG *MassDEP, Technical Update Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil. 2002*

NS *None Specified*

3.4.2.4 Project Screening Levels-Explosives in Soil

PSLs for explosives in soil sampling results were determined by selecting the lower of the USEPA RSLs and the MCP standards. PSLs for explosives in soil (surface and subsurface by IS or discrete sampling methods) are shown in **Table 3-7**.

Table 3-7. RSLs, Background, and PSLs for Discrete Sampling Method Explosives in Subsurface Soil (mg/kg)

Analyte	RSL	MCP	PSL
2,4-Dinitrotoluene	1.7	0.7	**0.7**
2,6-Dinitrotoluene	0.36	NS	**0.36**
Nitroglycerin	0.63	NS	**0.63**
Nitroguanidine	630	NS	**630**
Tetryl	16	NS	**16**
TNT	3.6	NS	**3.6**
RDX	6.1	1	**1**

3.4.2.5 Project Screening Levels-Groundwater Sample

PSLs for analytes in groundwater sampling results were determined using the Massachusetts Maximum Contaminant Levels (MMCL) and Massachusetts Office of Research and Standards Guidelines (ORSG) Drinking Water Guidelines, MassDEP, 2017. PSLs for groundwater samples are shown in **Table 3-8**. Note that no screening levels were identified for explosives in groundwater.

Table 3-8. PSLs for Groundwater Sampling Results

Analyte	Unit	MMCL	ORSG	PSL
Antimony	µg/L	6	NS	**6**
Copper	µg/L	1,300	NS	**1,300**
Lead	µg/L	15	NS	**15**
Manganese	µg/L	NS	300	**300**
Nickel	µg/L	NS	100	**100**
Zinc	µg/L	NS	NS	**NS**

µg/L micrograms per liter
MMCL Massachusetts Maximum Contaminant Levels, MassDEP, 2017
ORSG Massachusetts Drinking Water Guidelines, MassDEP, 2017

3.4.2.6 Ecological Screening Levels – Soil Samples

The ecological screening levels for analytes in site soil samples were determined using the USEPA Eco-SSLs (USEPA, 2015, 2017a, 2017b, 2017c, and 2017d). The Eco-SSLs are shown in Table 3-9. Note that no Eco-SSLs were identified for explosives.

Table 3-9. Eco-SSLs for Soil Sampling Results

Analyte	Unit	Eco-SSL
Antimony	mg/kg	**0.27**
Copper	mg/kg	**28**
Lead	mg/kg	**11**
Manganese	mg/kg	**220**
Nickel	mg/kg	**38**
Zinc	mg/kg	**49**

mg/kg milligrams per kilogram
Eco-SSL USEPA Ecological Soil Screening Levels, https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents, last accessed 25 September 2018

3.4.3 Soil Sampling

Each IS soil sampling unit (SU) was a defined volume of soil from which increments were collected to determine an estimate of the mean concentration for that volume of soil. For the Former Camp Wellfleet sampling, the SUs for surface and subsurface soil were approximately 1/4 acre. Surface and subsurface IS soil sampling was conducted using a step-probe. All surface IS soil samples were collected from 0 to 0.5 ft bgs, and all subsurface soil IS samples were collected from 0.5 to 3 ft bgs. Each surface IS soil sample consisted of 50 increments, and each subsurface

IS soil sample consisted of 30 increments. Discrete subsurface soil samples were collected from 8 to 10 ft bgs using a hand auger.

The SU size, approximately 1/4 acre, was selected to provide ample coverage around significant finds, and provide a representative and reproducible estimate of the mean concentrations of MC within each SU.

ERT collected all soil samples in accordance with the Final Work Plan/UFP-QAPP (including the Technical Memo). All samples were analyzed for the select metals and explosives listed in **Table 3-3**. All soil sampling, including background sampling, is summarized in **Table 3-10** below, and all sample locations are shown in Figure 9.

Table 3-10. RI Soil Sampling

Sampling Unit	Previous Activities or Findings	Surface Soil Increments	Surface ISM Replicate (Triplicate) Sampling	Subsurface Soil Sampling	Rationale for Subsurface Sampling	Total Samples (including QC)
AOI-01						
AOI1-SU1	Burial/Disposal Pit	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI1-SU2	Burial/Disposal Pit	50	100%	4 borings with discrete sampling of 8-10 ft interval, random within investigation pit in the SU	Target depth of previous trenching and sampling of the OB/OD	Surface – 1 in triplicate, Subsurface – 4 (with duplicate)
AOI1-SU3	Burial/Disposal Pit	50	100%	4 borings with discrete sampling of 8-10 ft interval, random in SU	Target depth of previous trenching and sampling of the OB/OD	Surface – 1 in triplicate, Subsurface – 4 (with MS/MSD)
AOI-02						
AOI2-SU1	Disturbed Ground/Ground Scars	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI2-SU2	Metal Fragment, Fuze Shipping Clip	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI2-SU3	1,000 lb Dove Practice Bomb	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI-03						
AOI3-SU1	Fuze Shipping Clips; ASP	50	100%	30 increment ISM sampling of 0.5-3 ft interval, with triplicate sampling	Target depth of previous MD finds	Surface – 1 in triplicate, Subsurface – 1 in triplicate

Table 3-10. RI Soil Sampling						
Sampling Unit	**Previous Activities or Findings**	**Surface Soil Increments**	**Surface ISM Replicate (Triplicate) Sampling**	**Subsurface Soil Sampling**	**Rationale for Subsurface Sampling**	**Total Samples (including QC)**
AOI3-SU2	Fuze Shipping Spacers; ASP	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI3-SU3	Rifle Smoke Grenade; Ground Scars	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI-04						
AOI4-SU1	M28A1 Flash Tubes	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI4-SU2	EE/CA Grid C-29 (Burn Pit)	50	100%	30 increment ISM sampling of 0.5-3 ft interval, with triplicate sampling	Target deepest observed burn pit depth	Surface – 1 in triplicate, Subsurface – 1 in triplicate
AOI4-SU3	1,000 lb Dove Practice Bomb	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI4-SU4	1,000 lb Dove Practice Bomb	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI4-SU5	1,000 lb Dove Practice Bomb, 250 lb Bomb, South Burial Site	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI-05						
AOI5-SU1	Metal Fragments; Rocket Range	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI5-SU2	Metal Fragments; Rocket Range; Zapata Removal Area	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI5-SU3	5 in Rocket Venturi, 3.5 in Rocket Frag, 105mm Frag; Zapata Removal Area	50	100%	30 increment ISM sampling of 0.5-3 ft interval, with triplicate sampling	Target depth of previous MD finds	Surface – 1 in triplicate, Subsurface – 1 in triplicate

Table 3-10. RI Soil Sampling

Sampling Unit	Previous Activities or Findings	Surface Soil Increments	Surface ISM Replicate (Triplicate) Sampling	Subsurface Soil Sampling	Rationale for Subsurface Sampling	Total Samples (including QC)
BACKGROUND						
BKG-SU1 through BKG-SU7	Background areas with no history of munitions activities	50	1 of 7 BG samples collected in triplicate	30 increment ISM sampling of 0.5-3 ft interval, with one triplicate sample	Mirror depth of site subsurface ISM samples	Surface – 1 in triplicate, Subsurface – 1 in triplicate

ISM replicate (triplicate) samples were collected using the same number of increments (50) and at the same depth (0-0.5 ft bgs for surface soil samples) and 30 increments (0.5 – 3 ft bgs for subsurface soil samples) using a different location within the SU (i.e., alternative path). Discrete subsurface soil field duplicates were collected from the same location and interval (8-10 ft bgs) as the parent sample. To reduce sample variability, all ISM samples were sieved by the laboratory; ISM sample materials analyzed for antimony, copper, lead, zinc, and explosives were also ground by the laboratory in accordance with ITRC guidance and the Final Work Plan/UFP-QAPP (including the Technical Memo).

3.4.4 Background Sampling

Figure 5 identifies the primary soil types of the areas to be sampled as Carver or Hooksan sands. However, further review of these two soil types indicated that they are very similar. Both soil types are coarse sands with the same soil classification: Soil Order (Entisols), Suborder (Psamments), Great Group (Quartzipsamments), and Subgroup (Typic Quartzipsamments). Both soil types are very deep, excessively drained sandy soils that may be found on level to steep terrain, and both types indicate moderate moisture content with similar physical properties of grain size and hydraulic conductivity. Therefore, compositional and distributional heterogeneity issues were not expected to be significant, and the background samples were collected, as described below, without making a distinction between the soil types.

The goal of the background soil sampling was to determine an estimate of the variability and mean of analyte concentrations in the background soil population to decrease the likelihood of false positive decisions (i.e., determining that a site soil sampling result was greater than background when it was not). To accomplish this goal, ERT collected single IS samples from six of seven of the background SUs and replicate (triplicate) IS samples from one background SU. Collecting a single replicate sample allowed validation of the selected SU size and increment number, while collecting single IS samples from multiple SUs provided a better estimate of the background concentration variability and, therefore, the BTV statistic is more likely to cover the upper range of the background soil sample population concentrations.

Background soil surface and subsurface samples (Figure 9) were collected using IS methodology at each of the seven SU background locations to develop a background dataset for metals due to determine the naturally occurring and/or anthropogenic sources not related to DoD activities. Consistent with the site IS soil sampling, background IS surface soil samples were collected in the

0-0.5 ft bgs interval and IS subsurface soil samples were collected in the 0.5-3 ft bgs interval. Each background surface IS soil sample consisted of 50 increments, and each background subsurface IS soil sample consisted of 30 increments.

3.4.5 Groundwater Sampling

As detailed in the Final Work Plan/UFP-QAPP (USACE, 2018), at the request of the CCNS NPS, ERT collected one groundwater sample from Supply Well B (Figure 9), a drinking water source. This groundwater was sampled under the oversight of NPS personnel, who directed ERT to collect the sample from a spigot in the waterline inside the wellhouse, where CCNS NPS has historically collected samples. The line was purged for approximately 20 minutes and a total of 15 gallons, and then the sample was collected directly into the laboratory supplied sample bottles. CCNS NPS indicated there was no filtering, treatment, or conditioning between the groundwater well and the spigot location from which it was collected.

The groundwater sample was analyzed for the select metals and explosives listed in **Table 3-3**.

4.0 DATA QUALITY ASSESSMENT

The data quality assessment (DQA) describes the evaluation of the data quality indicators (DQIs) that were used to assess the overall quality of the soil and groundwater analytical data collected during the RI field activities. The DQIs are assessed with respect to the DQOs. Project DQOs presented in Worksheet #11 of the UFP-QAPP (Work Plan Appendix E [USACE, 2018]) establish the data uses, users, and provides objective criteria by which the data quality can be measured. Moreover, the DQO process identifies the protocols, processes, procedures, and methods by which the DQOs can be met. Achievement of DQOs provides the basis for concluding that the acquired investigation data are scientifically sound, legally defensible, and adequate for their intended use.

An overview of the results of the DQA follows. The complete DQA analysis is presented in Appendix D.2 in the data validation reports. Statistical analysis of the relative standard deviations (RSDs) for IS replicates and relative percent difference calculations for discrete field duplicates are presented in Appendix D.1.

4.1 Data Quality

- The data validation process found no systematic problems, but indicated exceedances of QC limits. A total of 167 (14.6 percent) of the 1,144 results (sample and field QC samples) were qualified as estimated based on data validation review (e.g., “J” [estimated value], or “UJ” [not detected, Limit of Detection (LOD) is an estimated value due to analyte-specific quality control issues]). There were no rejected results.
- Completeness, regarding the number of regular and field QC samples collected compared to the number of regular and field QC samples that were planned to be collected, was 100 percent.
- Completeness, regarding the number of regular and field QC analytical results that were determined to be usable, was 100 percent.
- Data validation determined that the overall accuracy, based on the percentage of matrix spike (MS) and matrix spike duplicate (MSD) samples that were within the established percent recovery (%R) control limits, was acceptable. Of the 1,144 sampling results, a total of 70 results (6.1 percent) were qualified as estimated based on minor exceedances of MS/MSD %R limits.
- Data validation determined that the overall accuracy, based on the percentage of laboratory control samples (LCS) that were within the established %R control limits, was acceptable. Of the 1,144 sampling results, a total of 22 results (1.9 percent) were qualified as estimated based on minor exceedances of LCS %R limits.
- Data validation determined that the overall accuracy, based on the percentage of surrogate recoveries that were within the established %R control limits, was acceptable. Of the 1,144 sampling results, a total of 33 results (2.9 percent) were qualified as estimated based on minor exceedances of surrogate %R limits.
- Data validation determined that the overall accuracy, based on the percentage of serial dilution and/or post digestion spike recoveries that were within the established %R control limits, was acceptable. Of the 1,144 sampling results, a total of 30 results (2.6 percent) were qualified as estimated based on minor exceedances of serial dilution and/or post digestion spike %R limits.

- Overall MS/MSD duplicate precision for all samples was acceptable. Of the 1,144 sampling results, a total of three results (0.3 percent) were qualified as estimated based on minor exceedances of MS/MSD Relative Percent Difference (RPD) precision limits.
- Overall LCS replicate (either duplicate or triplicate) precision for all samples was acceptable. Of the 1,144 sampling results, a total of 16 results (1.4 percent) were qualified as estimated based on minor exceedances of LCS RPD or RSD precision limits.
- Overall column replicate precision for all samples was acceptable. Of the 1,144 sampling results, a total of 21 results (1.8 percent) were qualified as estimated based on minor exceedances of column RPD precision limits.
- Overall field replicate precision for site soil samples was 93.0 percent, based on the percentage of field replicates that met the established RSD precision limits. Of the 114 calculated RSDs, eight were greater than 35 percent (the RSD limit) but less than 50 percent.
- Overall field replicate precision for background soil samples was 91.7 percent, based on the percentage of background field replicates that met the established RSD precision limits. Of the 12 calculated RSDs, one was greater than 35 percent but less than 50 percent.
- Overall field duplicate precision for discrete subsurface soil samples was 100 percent, based on the percentage of parent/field duplicate pairs that met the established RPD precision limits.
- Representativeness was evaluated by comparing preservation and analytical procedures to those described in the UFP-QAPP, by evaluating holding times, and by examining blanks for possible contamination of samples during collection and analysis. All samples were preserved, prepared, and analyzed following methods specified in the UFP-QAPP. Therefore, representativeness was achieved.
- Comparability refers to the confidence with which one data set can be compared to another. To improve data comparability, the data set used for sampling activities for the RI was generated by employing standardized sampling, analytical, and data validation procedures. Project planning, including laboratory selection, incorporated various appropriate USEPA guidance documents, as well as direct input from USACE on field, laboratory, and data screening issues to ensure the comparability of the data. Because of the implementation of standard and consistent planning, field, analytical, and validation procedures during this investigation, the site data can be compared with confidence to historical site data of acceptable data quality. Therefore, comparability was achieved.
- All analytical limits of detection (LODs) and limits of quantitation (LOQ) for soil were less than the PSLs. The analytical LOQ (0.84 mg/kg) and LOD (0.42 mg/kg) for antimony in soil were greater than the Eco-SSL. Therefore, none of the antimony (Sb) non-detects less than the LOD or J-qualified detections less than the LOQ are usable (as individual values) for reliably demonstrating whether Sb is greater than or less than the Eco-SSL of 0.27 mg/kg. All other analytical LODs and LOQs for soil were less than the Eco-SSLs. The analytical LOQ (12 micrograms per liter [µg/L]) for antimony in groundwater was greater than the PSL (6 µg/L). Therefore, a J-qualified detection less than the LOQ does not provide reliable information regarding whether Sb contamination is greater than or less than the PSL. All other analytical LODs and LOQs for groundwater were less than their PSLs. Therefore, except as noted above, the sensitivity of laboratory limits to screening level benchmarks was met.

Laboratory Level IV reports are provided in Appendix D.4.

4.2 MC Data Uncertainty

As with all datasets, a level of uncertainty is typically associated with the data and its usability. In order to reduce the data uncertainties and biases, field instrument calibration, sample collection, and laboratory analyses were conducted in accordance with the standard operating procedures as outlined in the UFP-QAPP. Additionally, laboratory analytical techniques have a degree of uncertainty associated with them. These uncertainties are documented by using data qualifiers to reflect the uncertainty of the measurement. The presence of “J” and “UJ” qualified data in this dataset reflect this uncertainty. A J flag indicates the reported result is estimated, but the direction of bias, if present, is not specified or known. Note that the estimated result totals, as provided in the data validation reports (Appendix D.1), did not include sample concentrations that were qualified as estimated by the laboratory (reported results that were less than the analytical LOQ, but greater than the detection limit [DL]).

Data that are flagged with “J” or “UJ” qualifiers have more measurement uncertainty surrounding them than do non-qualified data. However, they were deemed valid and usable for purposes of this RI and these uncertainties are not likely to affect the project conclusions.

Soil and groundwater sampling laboratory limits for antimony were greater than the benchmark screening levels. When LOQs and /or LODs are greater than the screening levels, non-detect results (reported at LODs) and "J" qualified positive results cannot be quantitatively compared with the screening levels with certainty. However, all soil sampling results for antimony were less than the BTV for antimony (3.4 mg/kg) and there is no apparent source of antimony in soil that would impact groundwater. Therefore, uncertainties in the soil and groundwater antimony results are not likely to affect the project conclusions.

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5.0 INVESTIGATION RESULTS

5.1 MEC Results

As described in Section 3.1, sufficient data from prior field investigations were available to assess the nature and extent of MEC without the need for additional field investigation during this RI. Therefore, MEC findings presented in this section are based on previous investigation results.

5.1.1 MEC Risk Assessment Matrices

MEC risk was evaluated using the current USACE risk assessment methodology to define risk posed by MEC hazards. The method involves the use of four matrices to define acceptable and unacceptable risk from MEC hazards based on the likelihood of an encounter, the severity of incident, and the sensitivity of interaction based on expected land use activities, and is ultimately used to establish remedial action objectives to evaluate potential remedial action alternatives.

Each AOI was evaluated separately. The discussions below provide a summary of the detailed completed matrix tables and analysis presented in Appendix E.

5.1.1.1 AOI-01 MEC Risk

AOI-01 is an area of burial/disposal pits.

- **Matrix 1 – Likelihood of Encounter**: relates the site characterization data for amount of MEC to site use (including accessibility) to determine the likelihood of encountering MEC at a specific site.
  - **Amount of MEC:** AOI-01 was initially considered an Open Burn/Open Detonation, but findings from a removal action ultimately determined these to be disposal pits for MD and non-munitions debris. No MEC was found, and the matrix selection is that a DERP response action has been conducted to physically remove surface and subsurface MEC (but evidence that some residual hazard remains). Numerous MD items (1,040 lbs MD in a single burial pit), including 3.5” practice rockets, 3 expended M2 anti-personnel mines, 407 M48 flashtubes, 1 m7A3 2.36” practice rocket, and part of an inert filled M65 1,000lb “Dove” guided bomb.
  - **Access Conditions:** It is a low traffic area with rough trails and semi-dense natural vegetation that limit pedestrian access, however there are no man-made barrier restrictions. Therefore, access or frequency of use for AOI-01 was assessed as ‘often’, with an overall matrix score of **‘Seldom’.**
- **Matrix 2 – Severity of Incident**: assesses the likelihood of encounter rating (from Matrix 1) as related to the severity of an unintentional detonation. No MEC was found and no severity is associated with MD. Therefore, the severity is assessed as ‘improbable’, with an overall matrix score of **‘D’.**
- **Matrix 3 - Likelihood of Detonation**: relates sensitivity of the MEC items to the likelihood for energy to be imparted to an item during an encounter by specific land users. No MEC was found and no level of sensitivity is associated with MD. While accessible to park visitors, it is a largely undeveloped area, and not an area where workers perform significant maintenance operations such as excavating or grading. Therefore, the likelihood to impart energy is assessed as ‘modest’, with an overall matrix score of **‘3’**.

- **Matrix 4 - Acceptable and Unacceptable Site Conditions**: combines the results of Matrices 2 and 3 to differentiate Acceptable and Unacceptable site conditions. Due to the absence of MEC and the resulting combination of severity of incident and likelihood of detonation factors, the overall MEC hazard matrix score for AOI-01 is **'Acceptable'**.

5.1.1.2 AOI-02 MEC Risk

AOI-02 is the Former Artillery Firing Line. These were firing points for 90mm and other artillery, primarily firing out to sea (the ocean range is AOI-06).

- **Matrix 1 – Likelihood of Encounter**:
    - **Amount of MEC:** MEC presence has been established; while no MEC were found during the EE/CA or 2004-2005 Removal Actions, a 76mm anti-aircraft artillery MEC round was found in October 2016. Remnants of packaging material were present on the item, indicating it had not been fired, and therefore it is classified as DMM. Thus, MEC amount is based on physical evidence although there is no indication that the area is a CMUA (the 76mm MEC round was not considered an isolated discovery as the EE/CA report includes documentation of many "OE" items being found in this area over the years). As this AOI includes most of the Former Camp Wellfleet FUDS shoreline, although the MEC item likely resulted from erosion of the bluffs and the subsequent migration of the item to the surface, it is also possible that munition items could wash ashore following storm events. Additionally, MD items including 50 caliber machine gun ammunition, fuze cans, shipping clips for 90mm fuzes, 30 caliber ammunition cans, calcium hydride canisters, and unknown frag, were found during previous investigations.
    - **Access Conditions:** This is a moderate to high traffic beach area with essentially open access. Therefore, the access or frequency of use for AOI-02 is assessed as 'regular'**,** with an overall matrix score of **'Likely'.**
- **Matrix 2 – Severity of Incident**: Detonation of the MEC item would likely result in at least partial disability or hospitalization. Therefore, the severity is assessed as 'catastrophic/critical', with an overall matrix score of ***'A'.***
- **Matrix 3 - Likelihood of Detonation**: The MEC item contained some amount of high explosive (HE). It appeared to contain packaging remnants indicating it had not been fired and is was therefore considered to be DMM. As HE, the sensitivity is assessed as 'moderate'. AOI-02 is an open access area, and park workers and visitors (e.g., treasure hunters) could discover and excavate MEC, or MEC could be found following erosion from the bluffs and migration to the surface. Therefore, the likelihood to impart energy is assessed as 'modest', with an overall matrix score of **'2'.**
- **Matrix 4 - Acceptable and Unacceptable Site Conditions**: Due to MEC presence and the resulting combination of severity of incident and likelihood of detonation factors, the overall MEC hazard matrix score for AOI-02 is **'Unacceptable'.**

5.1.1.3 AOI-03 MEC Risk

AOI-03 is the former Ammunition Supply Point, with U-shaped revetments possibly used to store ammunition. It also includes an area of multiple ground scars identified from aerial photos.

- **Matrix 1 – Likelihood of Encounter**:

  - **Amount of MEC:** A single Rifle Smoke Grenade, found in Area L during the EE/CA, is considered to be MEC (pyrotechnic). This MEC finding is considered to be an isolated discovery because no other munitions use is historically known in the area. The rifle smoke grenade was found in a grid with no other MEC or MD, approximately 1,000 feet to the south of the other grids that did contain MD (mostly shipping-related and not indicative of a CMUA). Additional MD items found included multiple fuze shipping spacers, and some small arms debris.
  - **Access Conditions:** It is a moderate traffic area with some semi-dense natural vegetation and rough terrain that limits pedestrian access, however there are no man-made barrier restrictions to pedestrians. Therefore, the access or frequency of use for AOI-03 is assessed as 'often'**,** with an overall matrix score of **'Seldom'.**
- **Matrix 2 – Severity of Incident**: Detonation of the Rifle Smoke Grenade would likely result in injury with emergency medical treatment, without hospitalization. Therefore, the severity is assessed as 'modest', with an overall matrix score of **'C'**.
- **Matrix 3 - Likelihood of Detonation**: The identified item contained some pyrotechnics. Therefore, the sensitivity is assessed as 'moderate'. While accessible to park visitors, it is a largely undeveloped area, and not an area where workers perform significant maintenance operations such as excavating or grading. Therefore, the likelihood to impart energy is assessed as 'modest', with an overall matrix score of **'2'**.
- **Matrix 4 - Acceptable and Unacceptable Site Conditions**: Due to MEC presence and the resulting combination of severity of incident and likelihood of detonation factors, the overall MEC hazard matrix score for AOI-03 is **'Acceptable'.**

5.1.1.4 AOI-04 MEC Risk

AOI-04 combines EE/CA investigation areas C, F, and J. These are bomb target areas and a burial site.

- **Matrix 1 – Likelihood of Encounter**:
  - **Amount of MEC:** Only MD has been found, but not all targets were dug during previous removal actions and it is possible that suspected hazards may remain. Thus the amount of MEC matrix selection is that a removal action has occurred (associated with single point anomaly excavations) to physically remove subsurface MEC (only MD was found), but since not all targets were dug, it is possible that suspected hazards may remain. MD items included fuze shipping spacers, small arms debris, an empty Dove Missile/1000-pound bomb, an empty 250-pound bomb, 186 M28A1 flash tubes from 106mm projectile cartridge cases, and fragments of grenade spoons.
  - **Access Conditions:** It is a moderate traffic area with some semi-dense natural vegetation and rough terrain that limits pedestrian access, however there are no man-made barrier restrictions. Therefore, access or frequency of use for AOI-04 is assessed as 'often', with an overall matrix score of **'Seldom'.**
- **Matrix 2 – Severity of Incident**: No MEC was found and no severity is associated with MD. Therefore, the severity is assessed as 'improbable', with an overall matrix score of **'D'.**

- **Matrix 3 - Likelihood of Detonation**: No MEC was found and no level of sensitivity is associated with MD. While accessible to park visitors, it is a largely undeveloped area, and not an area where workers perform significant maintenance operations such as excavating or grading. Therefore, the likelihood to impart energy is assessed as 'modest', with an overall matrix score of **'3'**.
- **Matrix 4 - Acceptable and Unacceptable Site Conditions**: Due to the absence of MEC and the resulting combination of severity of incident and likelihood of detonation factors, the overall MEC hazard matrix score for AOI-04 is **'Acceptable'.**

5.1.1.5 AOI-05 MEC Risk

AOI-05 is a former Rocket Range and Small Arms Range.

- **Matrix 1 – Likelihood of Encounter**:
  - **Amount of MEC:** Multiple pieces of frag from 3.5-inch rockets and 105mm projectiles are considered HE frag or MD indicative of MEC. MEC amount is based on physical evidence (MD indicative of MEC) although there is no indication that the area is a CMUA. As this AOI includes portions of the Former Camp Wellfleet FUDS shoreline, MEC finds could result from erosion of the bluffs and the subsequent migration of the item to the surface, or munition items could wash ashore following storm events. Miscellaneous MD scrap and 50 caliber bullets were also found during previous investigations.
  - **Access Conditions:** This is a moderate to high traffic beach area with essentially open access. Therefore, the access or frequency of use for AOI-05 is assessed as 'regular'**,** with an overall matrix score of **'Likely'.**
- **Matrix 2 – Severity of Incident**: Detonation of possible MEC items would likely result in at least partial disability or hospitalization. Therefore, the severity is assessed as 'catastrophic/critical', with an overall matrix score of ***'A'.***
- **Matrix 3 - Likelihood of Detonation**: Possible or suspected MEC items may contain some amount of HE. Therefore, the sensitivity is assessed as 'moderate'. AOI-05 is an open access area, and park workers and visitors (treasure hunters', etc) could discover and excavate MEC, or MEC could be found following erosion from the bluffs and migration to the surface. The likelihood to impart energy is assessed as 'modest', with an overall matrix score of **'2'.**
- **Matrix 4 - Acceptable and Unacceptable Site Conditions**: Due to MD Indicative of MEC presence and the resulting combination of severity of incident and likelihood of detonation factors, the overall MEC hazard matrix score for AOI-05 is **'Unacceptable'.**

5.1.1.6 AOI-06 MEC Risk

AOI-06 is the Range Fan of Artillery Targets in Ocean.

- **Matrix 1 – Likelihood of Encounter**:
  - **Amount of MEC:** MEC presence is assumed based on historical evidence of munitions use as this is an ocean range fan where anti-aircraft and rocket firing was conducted for approximately 20 years. However, there is no documentation of munition finds by divers or fishermen. Based on historical activities, the following munition items could be present in the ocean range fan: 76mm anti-aircraft artillery, 90mm and 105mm projectiles, 3.5" rockets.

  - **Access Conditions:** It is considered to be open access with daily use for recreational swimming, as well as fishing and diving. As there are no barriers to these waters, the access or frequency of use for AOI-06 is assessed as 'regular', with an overall matrix score of **'Seldom'**.
- **Matrix 2 – Severity of Incident**: Detonation of any of the assumed MEC items would likely result in at least partial disability or hospitalization. Therefore, the severity is assessed as 'catastrophic/critical', with an overall matrix score of ***'B'*.**
- **Matrix 3 - Likelihood of Detonation**: The assumed MEC items would contain some amount of HE. Therefore, the sensitivity is assessed as 'moderate'. AOI-06 is an open access area and while, recreational users are not very likely to encounter MEC, it is possible. Therefore, the likelihood to impart energy is assessed as 'modest', with an overall matrix score of **'2'.**
- **Matrix 4 - Acceptable and Unacceptable Site Conditions**: Due to the assumed MEC presence and the resulting combination of severity of incident and likelihood of detonation factors, the overall MEC hazard matrix score for AOI-06 is **'Unacceptable'.**

Unacceptable baseline site conditions typically proceed to the next phase of the CERCLA response process, where some type of remedial action for MEC is required, while Acceptable baseline conditions do not warrant further action with regard to MEC.

Table 5-1 summarizes the above discussions. The completed risk matrix tables for all AOIs are presented in Appendix E.

Table 5-1: Summary of Risk Assessment Matrix Analysis – Baseline Conditions

Area	Matrix 1: Likelihood of Encounter	Matrix 2: Severity of Incident	Matrix 3: Likelihood of Detonation	Matrix 4: Acceptable and Unacceptable Site Conditions
AOI-01	Seldom (No MEC, Often Access)	D - (Improbable Severity, Seldom Likelihood)	3 - (Not Sensitive, Modest Likelihood)	**Acceptable**
AOI-02	Likely (Confirmed MEC, Regular Access)	A - (Catastrophic Severity, Likely Likelihood)	2 - (Moderate Sensitivity, Modest Likelihood)	**Unacceptable**
AOI-03	Seldom (MEC, Often Access)	C - (Modest Severity, Seldom Likelihood)	2 - (Moderate Sensitivity, Modest Likelihood)	**Acceptable**
AOI-04	Seldom (No MEC, Often Access)	D - (Improbable Severity, Seldom Likelihood)	3 - (Not Sensitive, Modest Likelihood)	**Acceptable**
AOI-05	Likely (MD Indicative of MEC, Regular Access)	A - (Catastrophic Severity, Likely Likelihood)	2 - (Moderate Sensitivity, Modest Likelihood)	**Unacceptable**
AOI-06	Seldom (MEC Suspected, Regular Access)	B - (Catastrophic Severity, Seldom Likelihood)	2 - (Moderate Sensitivity, Modest Likelihood)	**Unacceptable**

5.1.2 MEC CSM Update

Detailed review of existing MEC or MD findings from previous investigations did not change the preliminary MEC CSM presented in Section 3.1.3.

5.1.3 MEC Data Uncertainty

There is uncertainty in any geophysical investigation, specific to the types of instruments used, the conditions under which they were operated, and the nature of the targets being investigated. As detailed in Section 3.1, analysis concluded that sufficient MEC data existed from the many previous investigations to make nature and extent conclusions, and that no additional field investigation for MEC was required to complete this RI. MEC data uncertainty is a function of those previous investigations; those respective reports provide discussions of uncertainty associated with those findings, and while they are not reproduced here, some of the key issues providing uncertainty are summarized below.

- The helicopter magnetometry survey was limited by vegetation, such that the sensor height above ground was a limiting factor in the usefulness of the data; some UXO targets would not be detected when the sensor was 5 meters or more above ground surface.
- Depending on the particular investigation procedures in effect at the time, not all anomalies were excavated. For example, for the EE/CA, if enough targets in a grid had been identified to make conclusions about the site, not all anomalies were investigated in that grid.
- The TEC analysis of aerial photos involves subjective interpretation that may be a source of uncertainty.
- The lack of comprehensive descriptions of past operations in a given area provides uncertainty about what may have occurred there.
- The amount of geophysical coverage required during older investigations was typically lower and might not meet today’s standards, resulting in uncertainty.

However, as described in more detail in Appendix B, these uncertainties were incorporated into the analysis of whether additional data were required, using conservative assumptions about coverage to derive conclusions from the data.

5.1.4 MEC Fate and Transport

Fate and transport mechanisms for MEC at the Former Camp Wellfleet are governed by various physical factors and processes, including:

- Natural erosion of soil or sand from the high bluffs by wind and water exposing buried MEC items; and,
- Transport via removal or relocation of MEC; and
- Transport by ocean currents or sediment migration with MEC washing up on shore.

Due to the close proximity of the Atlantic Ocean to historic target locations, practice bombs may have landed on the beaches or in the Atlantic Ocean. At these locations, MEC or MD would be subject to ocean currents that could facilitate the movement of these items out to sea or laterally along the beach.

Subsurface MEC or MD has the potential to migrate to the surface based on the significant coastal erosion in a beach environment. This commonly results in the exposure of buried items by the removal of the overlying sand or soil. Note that the MEC item found in AOI -02 was a result of the erosion of the high bluff with the item ultimately found in the beach area.

An additional concern at public park areas such as the Former Camp Wellfleet is the movement of potential MEC items by the public. For example, treasure hunters and clam diggers can discover MEC or MD items and remove them as souvenirs or simply move and discard them in other areas.

5.2 MRSPP

DoD developed the MRSPP as a methodology for prioritizing sites known or suspected to contain MEC or MC for response actions, assigning a relative priority based on various safety and environmental factors. The MRSPP consists of three modules to evaluate the unique characteristics of each hazard type at an MRS:

- The Explosive Hazard Evaluation (EHE) Module addresses explosive hazards posed by MEC and MC in high enough concentrations to pose an explosive hazard;
- The Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE) Module addresses hazards associated with the effects of CWM; and
- The Health Hazard Evaluation (HHE) Module addresses chronic health and environmental hazards posed by MC and incidental non-munitions-related contaminants.

Each of the modules is assigned a rating from "G" (lowest) to "A" (highest), with alternative ratings of Evaluation Pending (insufficient information available), No Known or Suspected Hazard (NKSH), or No Longer Required (NLR) (cleanup is complete). The highest of the three module ratings is used to assign a priority ranking, ranging from 1 to 8, with Priority 1 having the highest relative priority and Priority 8 having the lowest.

Presented in detail in Appendix F, the MRSPP ratings for each AOI are summarized in **Table 5-2** below. CWM was not associated with any AOI. Where the MEC Risk Assessment Matrices determined 'acceptable' conditions, the EHE module was rated as NLR. Where MC sampling was conducted, but the results indicate no exceedance of levels of concern (Section 5.3), the HHE module was rated as NKSH.

Table 5-2: Summary of MRSPP Ratings

Area	EHE Rating/Priority	CHE Rating/Priority	HHE Rating/Priority	Priority Ranking
AOI-01	NLR	NKSH	NKSH	**NLR**
AOI-02	A-2	NKSH	NKSH	**2**
AOI-03	NLR	NKSH	NKSH	**NLR**
AOI-04	NLR	NKSH	NKSH	**NLR**
AOI-05	C-4	NKSH	NKSH	**4**
AOI-06	C-4	NKSH	NKSH	**4**

5.3 MC Results Overview

MC soil sampling locations were collected from areas where previous investigations identified MEC/MD, portions of the site judgmentally considered to potentially contain the largest MC contaminant concentrations. Section 3.4.3 details the MC sampling approach, including locations, rationale, quantity, depth, and sample type (see Figure 9 for an overview of all sample locations). The analytical parameters included select metals (antimony, copper, lead, manganese, nickel, and zinc) and select explosives (RDX, TNT, nitroglycerin, 2,4-dinitrotoluene, 2,6-dinitrotoluene, tetryl, and nitroguanidine).

This discussion reviews the sampling results by type while the next section reviews the AOI-specific sampling results.

5.3.1 Site IS Surface and Subsurface Soil Sampling Results

With regard to soil samples collected from the site using the IS methodology, including surface and subsurface, all MC metals were detected in at least one IS site sample. Nitroguanidine was the only explosive compound detected. However, there were no reported results greater than the PSLs in any soil sample. In addition, no calculated 95 percent upper confidence limit of the mean (95% UCL) for the IS soil sampling data was greater than the PSLs. All results for the site IS soil samples are presented in Appendix D.3, Table D-1.

5.3.2 Site Subsurface Discreet Soil Sampling Results

With regard to discrete subsurface soil samples collected from AOI-01 using a hand auger to take discrete samples, all MC metals were detected in at least one discrete subsurface soil site sample. However, there were no reported results greater than the PSLs in any discrete subsurface soil samples. There were no reported detections of explosive compounds in the discrete subsurface soil samples. All results for the site discrete subsurface soil samples are presented in Appendix D.3, Table D-2.

5.3.3 Background IS Surface and Subsurface Soil Sampling Results

All MC metals were detected in the surface and subsurface background IS samples. The reported result for antimony in one background surface soil IS sample was greater than the PSL. Nitroguanidine was the only explosive compound detected in background soil. However, there were no reported nitroguanidine results greater than the PSL soil in any background soil sample. In addition, nitroguanidine is a component of triple-base smokeless powder and, since hunting is allowed on the project site, it is possible that the nitroguanidine is from a non-DoD source. Also, concentrations of metals in all three replicates from this location were similar, as indicated by the RSD (Appendix D). Therefore, other than the low-level detection of nitroguanidine, these sample results appear to be from the background and not affected by historical DoD site uses.

All results for the background IS soil samples are presented in Appendix D.3, Table D-3.

5.3.4 Groundwater Sampling Analytical Results

With regard to the one groundwater sample collected from drinking water Supply Well B, antimony, copper, lead, manganese, and zinc were reported at concentrations greater than the detection limit, but less than the PSLs. There were no detections of nickel or any of the explosive compounds in the groundwater sample. All results for the groundwater sample are presented in Appendix D.3, Table D-4.

5.4 AOI-Specific MC Results

The results of MC sampling for the background and for each AOI are discussed in the sections below.

5.4.1 Background

ERT collected IS surface and subsurface soil samples from seven SUs within the background sampling area. The result for antimony (3.4 mg/kg) in the surface soil sample collected from BKG-SU4-SA was greater than the PSL (the adjusted USEPA RSL for residential soil [hazard quotient (HQ) of 0.1 (3.1 mg/kg)]), but less than the unadjusted USEPA RSL for residential soil [HQ of 1 (31 mg/kg)]. All other reported results for MC metals in background surface and subsurface soil samples were less than the PSL.

The only detected explosive compound, nitroguanidine (0.730 J mg/kg), in a surface soil IS sample (BKG-SU2-SA-REP1) was less than the PSL (630 mg/kg). Neither of the other two replicates samples (BKG-SU2-SA-REP2 and BKG-SU2-SA-REP3) reported a detection of nitroguanidine. There were no additional reported detections of explosives in background surface or subsurface soil samples.

Figure 10 shows the individual sample locations.

5.4.2 AOI-01

ERT collected IS surface soil samples from three SUs within the burial pits, and eight discrete subsurface soil samples from two SUs. Figure 11 shows the individual sample locations. All results were less than the PSLs and the Eco-SSLs.

5.4.3 AOI-02

ERT collected IS surface soil samples from three SUs. As described in Table 3-10, SU locations were based on TEC ground scars and/or previous munitions debris finds. Figure 12 shows the individual sample locations. All results were less than the PSLs and the Eco-SSLs.

5.4.4 AOI-03

ERT collected IS surface soil samples from three SUs and IS subsurface soil samples from one SU. As described in Table 3-10, SU locations were based on previous munitions debris finds. Figure 13 shows the individual sample locations. All results were less than the PSLs and the Eco-SSLs.

5.4.5 AOI-04

ERT collected IS surface soil samples from five SUs and IS subsurface soil samples from one SU. As described in Table 3-10, SU locations were based on the location of a possible burn pit or previous munitions debris finds. Figure 14 shows the individual sample locations. All results were less than the PSLs and the Eco-SSLs.

5.4.6 AOI-05

ERT collected IS surface soil samples from three SUs and IS subsurface soil samples from one SU. As described in Table 3-10, SU locations were based on previous munitions debris finds. Figure 15 shows the individual sample locations. All results were less than the PSLs and the Eco-SSLs.

5.4.7 MC CSM Update

The preliminary CSM described in Section 3.3.1 identified contaminant sources and transport mechanisms, potential human or ecological receptors, and exposure scenarios. Many pathways were assessed as potentially complete. However, a complete pathway requires a source of contaminants, and based on site sampling results, no MC contaminant source was identified. The updated CSM, Figure 16, shows that there are no complete pathways for MC based on the sample results.

5.4.8 Human Health and Ecological Risk Assessment

Screening of initial MC sampling results against the PSLs and the Eco-SSLs was conducted and it was determined that additional soil sampling was not warranted. The screening indicated that there were no MC releases, and therefore, no HHRA or SLERA were conducted.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The goal of the RI was to determine the nature and extent of MEC and MC contamination at the Former Camp Wellfleet, potentially caused by prior military operations, and to recommend whether further actions are warranted.

6.1 Conclusions

6.1.1 MEC

No additional field investigations were required to determine the nature and extent of MEC. Using existing data from previous investigations and removal actions, MEC risk was evaluated using the current USACE risk assessment methodology to define risk posed by MEC hazards. As discussed in Section 5.1, the method involves the use of four matrices to define acceptable and unacceptable risk from MEC hazards and is ultimately used to establish remedial action objectives to evaluate potential remedial action alternatives. Table 6-1 summarizes the conclusions of the MEC risk analysis for each AOI.

Table 6-1: MEC Risk Conclusions

AOI	Acreage	MEC Risk	Further Action Warranted?
AOI-01	33.1	Acceptable	No
AOI-02	275.0	**Unacceptable**	**Yes**
AOI-03	120.2	Acceptable	No
AOI-04	141.8	Acceptable	No
AOI-05	56.10	**Unacceptable**	**Yes**
AOI-06	167,856	**Unacceptable**	**Yes**

Baseline conditions that are assessed to be Acceptable do not warrant further action with regard to MEC. However, Unacceptable baseline site conditions warrant further action and proceed to the next phase of the CERCLA response process.

6.1.2 MC

ERT conducted the MC field sampling activities in April 2018. IS soil sampling included collecting surface soil from 17 SUs, subsurface soil from three SUs, and surface and subsurface soil from seven background SUs. Eight discrete subsurface soil samples were collected from AOI-01. One groundwater sample was collected from Supply Well B.

No site soil sampling results were greater than their PSLs or Eco-SSLs. Based on these results, no release of MC metals or explosives that would present a risk to human health has occurred, and therefore, no additional soil sampling for MC metals or explosives is warranted.

No site groundwater sampling results were greater than their PSLs. Based on these results, no release of MC metals or explosives that would present a risk to human health has occurred. In addition, all site soil sampling results were less than the impact to groundwater screening levels, and therefore, no additional groundwater sampling for MC metals or explosives is warranted.

6.2 Recommendations

6.2.1 MEC

The MEC risk matrix analyses, as summarized in Table 6-1, indicate AOIs with Acceptable MEC risk and AOIs posing Unacceptable MEC risk. Baseline conditions that are assessed to be Acceptable do not warrant further action with regard to MEC, and it is recommended that a 'No Further Action' (NFA) PP and DD be prepared to address those AOIs posing acceptable MEC risk (AOI-01, AOI-03, and AOI-04).

However, Unacceptable baseline site conditions warrant further action, and it is therefore recommended that a Feasibility Study be conducted to address those AOIs determined to pose unacceptable explosive risks (AOI-02, AOI-05, and AOI-06). An FS will evaluate remedial alternatives to address unacceptable MEC risk for these AOIs. A PP and DD will also be required as part of the CERCLA response process.

6.2.2 MC

The RI indicates that there are no MC releases to soil or groundwater, and it is recommended that the NFA PP and DD be prepared to address the MC results at the Former Camp Wellfleet.

7.0 REFERENCES

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APPENDIX A: FIGURES

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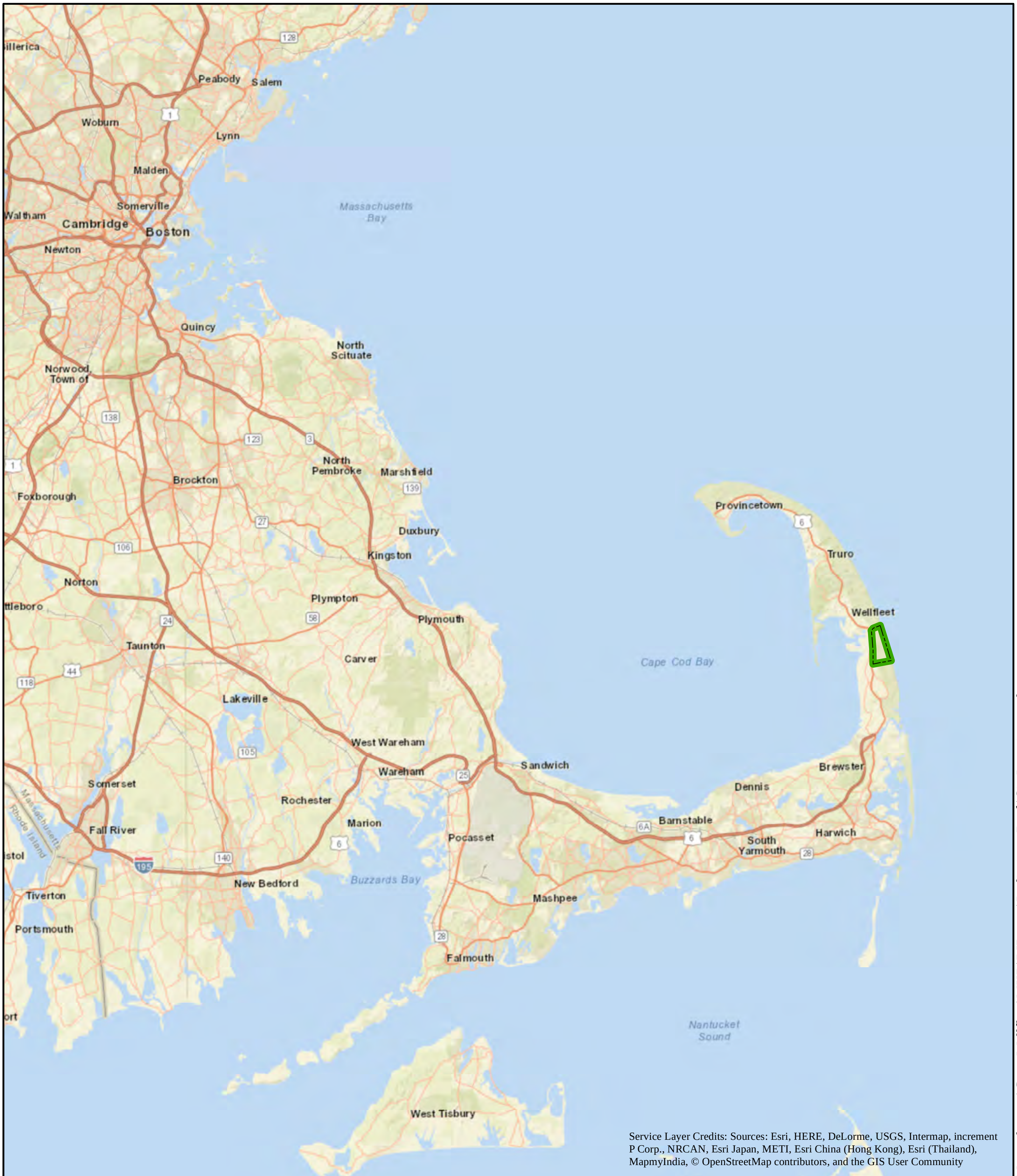

US Army Corps of Engineers
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Legend

Former Camp Wellfleet Boundary

N
W E
S

0 5 10
Miles

Figure 1
Site Location

Former Camp Wellfleet
Wellfleet, Barnstable County, Massachusetts

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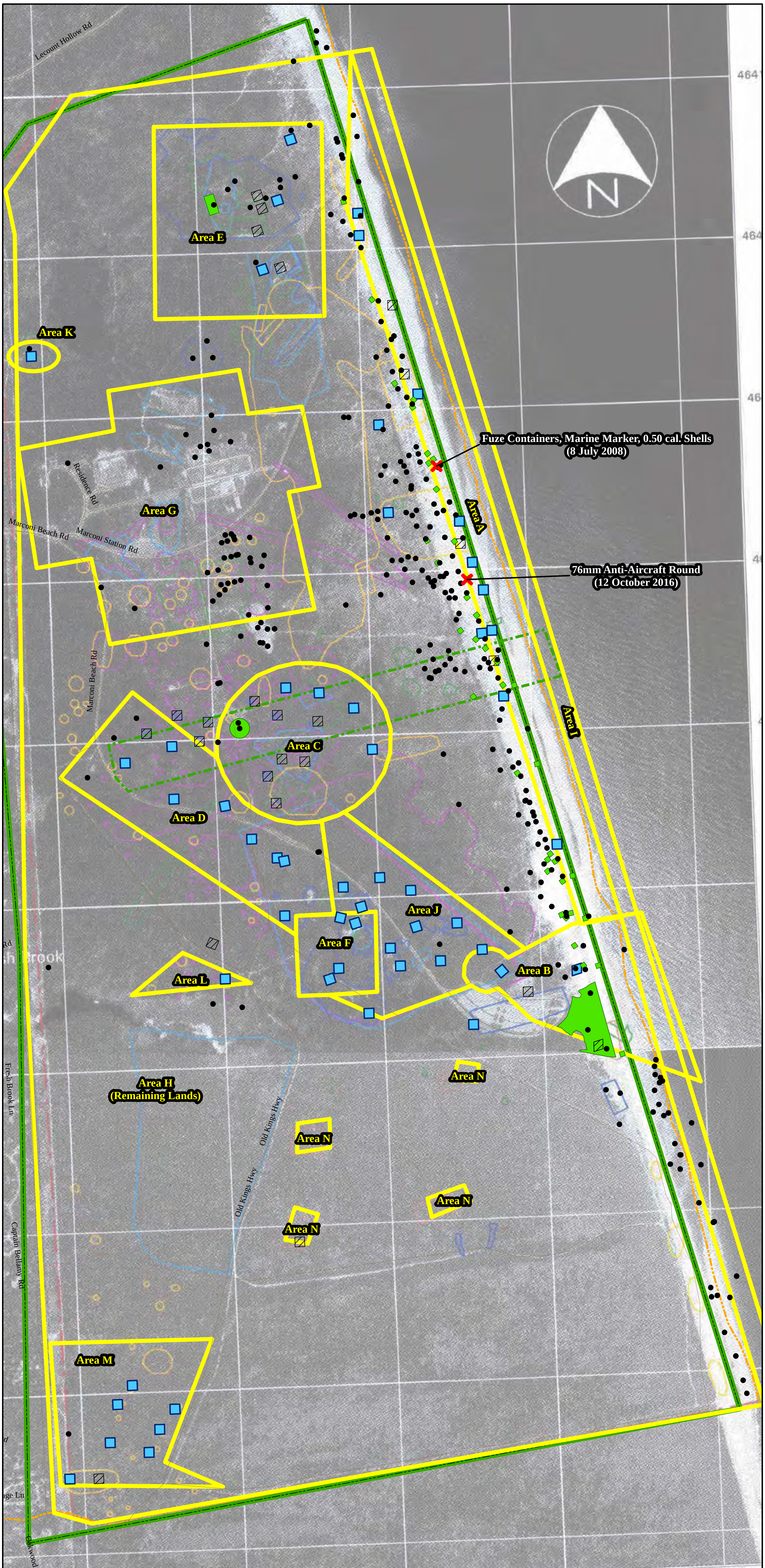

Legend

EE/CA Grids (100% of Anomalies Excavated, 2000)

EE/CA Grid (Partial Excavation of Anomalies, 2000)

Additional Finds

Single Point Anomaly (100% Excavated, 2003 - 2004)

Removal Area (100% of Anomalies Excavated, 2004 and 2005)

EE/CA Areas

Town of Wellfleet Parcel

Former Camp Wellfleet Boundary

Wellfleet (Town) Boundary

U.S. Highway

Roads

Ground Scars (Year Identified)

Name

1943

1945

1947

1951

1960

1961

Aerial: TEC 1994 Orthophoto showing location of 1943, 1945, 1947, 1951, 1960, and 1961 identified significant features.

N W E S

0 500 1,000

Feet

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Figure 2
Previous Investigation/Removal Action Areas
Former Camp Wellfleet
Wellfleet, Barnstable County, Massachusetts

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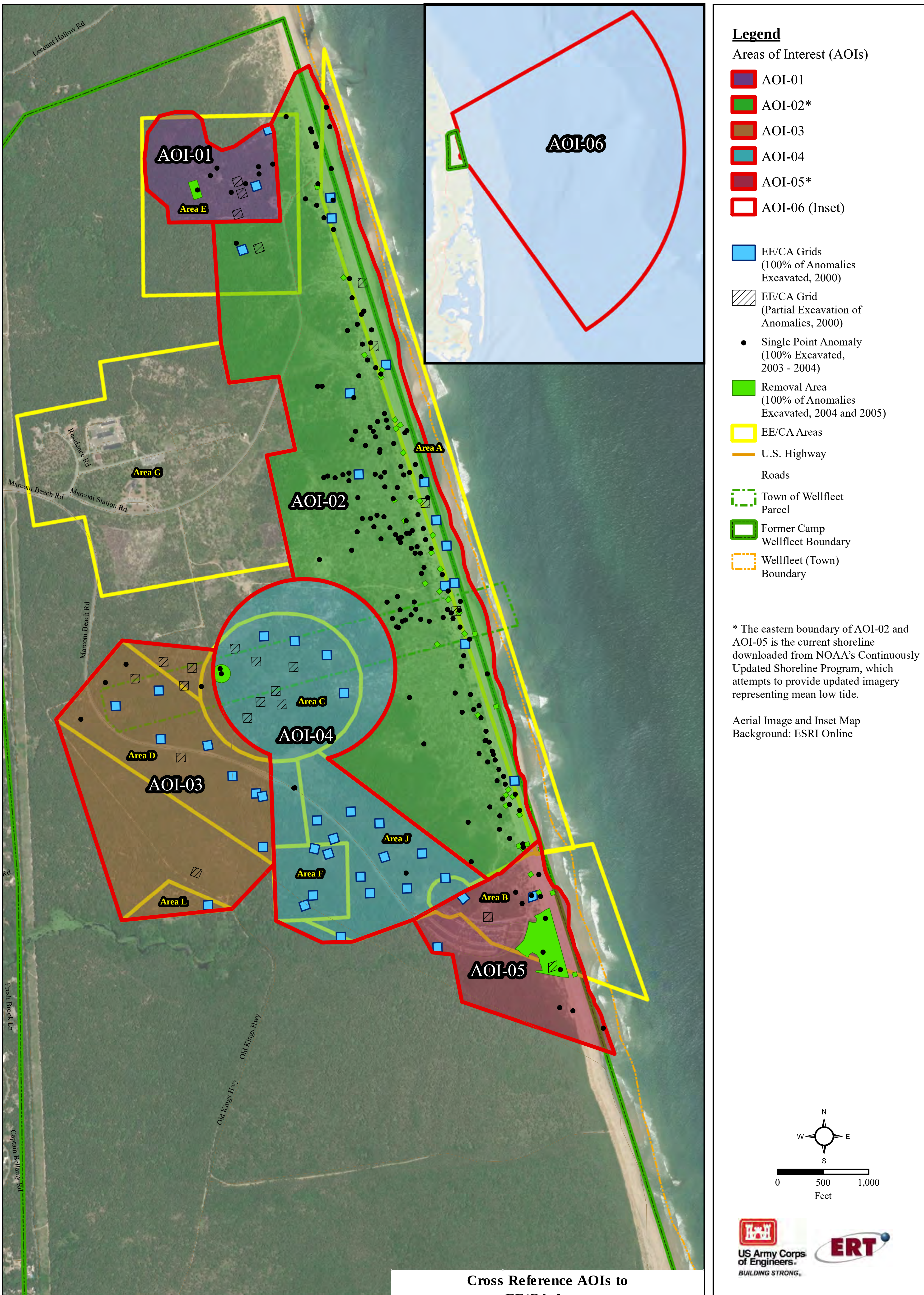
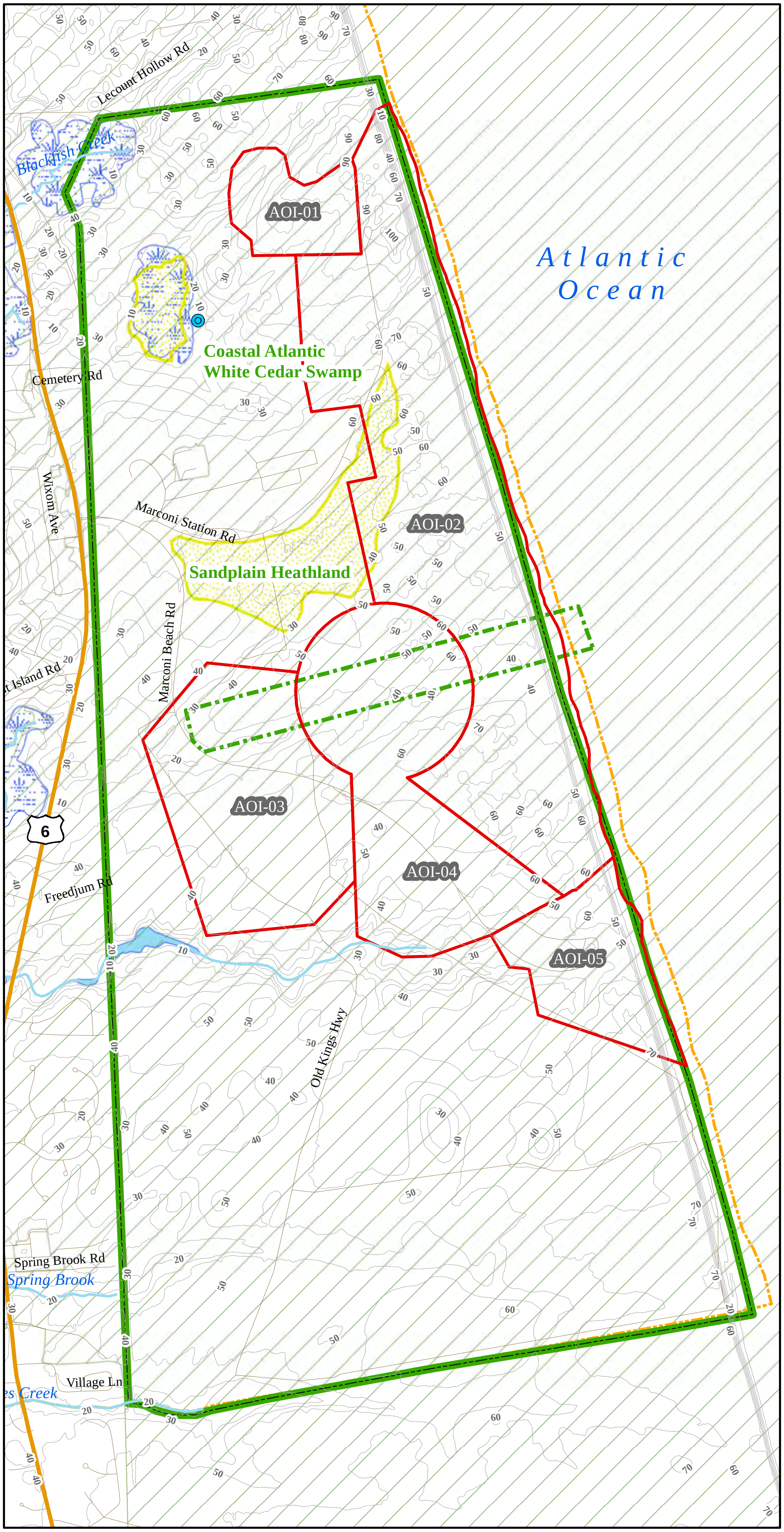


Cross Reference AOIs to EE/CA Areas

Area of Interest	Former Area Name
AOI-01	Area E, as reduced
AOI-02	Area A as expanded
AOI-03	Areas D and L and the acreage between them
AOI-04	Areas C, F, and J
AOI-05	Area B, as expanded
AOI-06	Area I

Figure 3
Site Layout
Former Camp Wellfleet
Wellfleet, Barnstable County, Massachusetts

Document Path: N:\GIS\Northeast\Massachusetts\CampWellfleet\MXD\RIReport\DraftFinal\AOIs.mxd



Legend

- Streams
- Elevation Contours (ft NAVD88)
- U.S. Highway
- Roads
- Vernal Pond
- Ponds
- Wetlands
- NHESP Natural Community
- NHESP Priority Habitats
- Areas of Interest (AOIs)
- Town of Wellfleet Parcel
- Former Camp Wellfleet Boundary
- Wellfleet (Town) Boundary

N W E S

0 825 1,650
Feet

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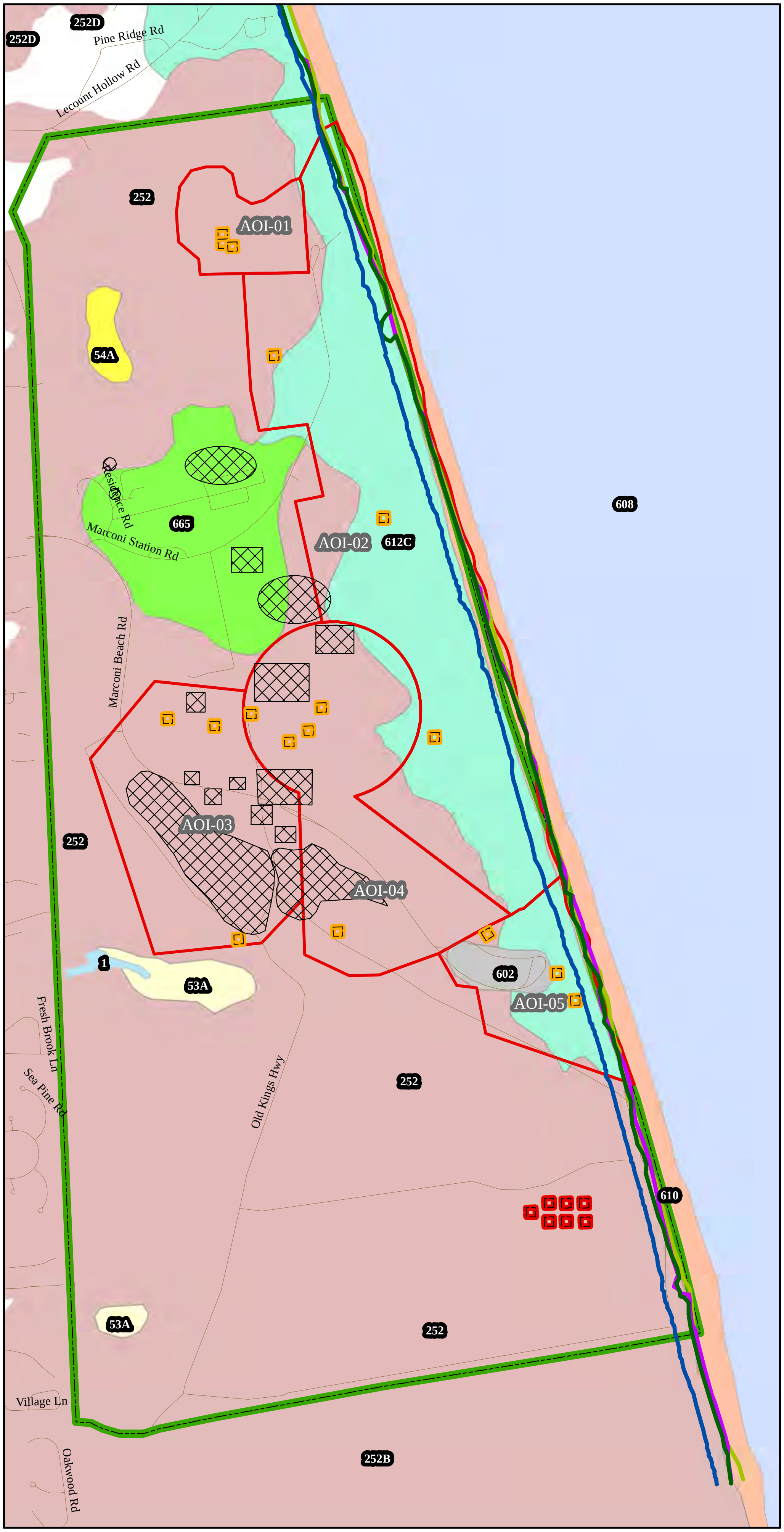
Map Data : DENIX, USGS, 2016; NHD, 2016

Figure 4
Natural Features

Former Camp Wellfleet
Wellfleet, Barnstable County, Massachusetts

Document Path: N:\GIS\Northeast\Massachusetts\CampWellfleet\MXD\RIReport\DraftFinal\NaturalFeatures.mxd



Legend

Sampling Units (SUs)

Background SUs

Areas of Interest (AOIs)

Areas Ineligible for Sampling by Request of the Cape Cod National Seashore National Park Service (CCNS NPS) due to Ongoing Research or Habitat Establishment

SSURGO Soil Data

Map Label: Description

1:Water

53A:Freetown muck, ponded, coastal lowland, 0 to 1 percent slopes

54A:Freetown and Swansea mucks, coastal lowland, 0 to 1 percent slopes

602:Urban land

608:Water, ocean

610:Beaches

612C:Hooksan sand, rolling

665:Udipsamments, smoothed

252:Carver coarse sand

Approximate Bluff Location

(by Year)

1944

1958

1972

2015

N
W E
S

0 825 1,650
Feet

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Map Data : DENIX, USDA, 2016

Figure 5
Site Soils

Former Camp Wellfleet
Wellfleet, Barnstable County, Massachusetts

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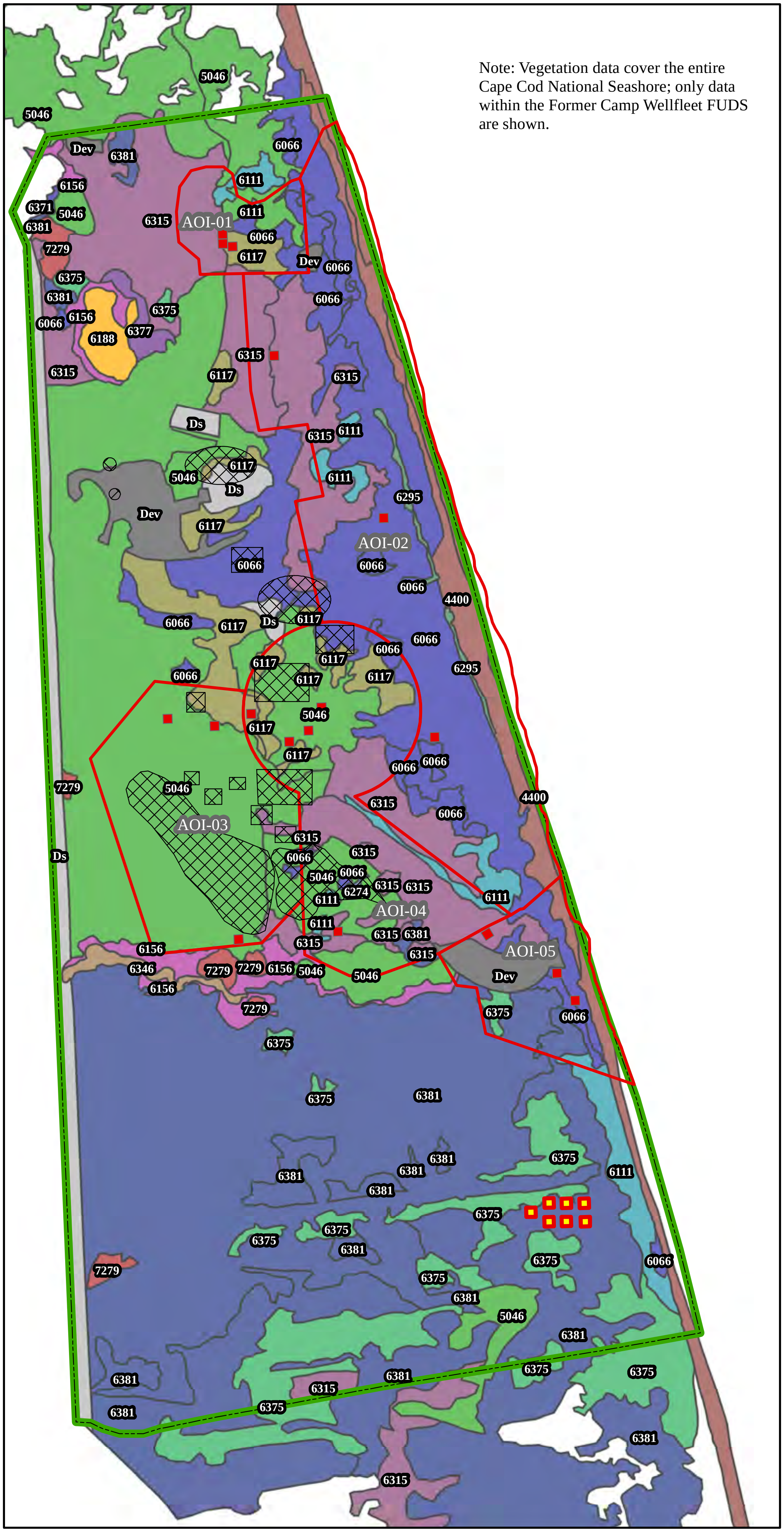

Legend

- Areas of Interest (AOIs)
- Sampling Area
- Background Sampling Area
- Former Camp Wellfleet Boundary
- Areas Ineligible for Sampling by Request of the Cape Cod National Seashore National Park Service (CCNS NPS) due to Ongoing Research or Habitat Establishment

Plant Communities

Map ID: Name

- 4400:North Atlantic Upper Ocean Beach
- 5046:Pitch Pine - Heath Barrens
- 6066:Sandplain Heathland
- 6111:Outwash Scrub Oak Barrens
- 6117:Pitch Pine Dune Woodland
- 6156:Lower New England Red Maple - Blackgum Swamp
- 6188:Coastal Plain Atlantic White-Cedar Swamp
- 6274:Northern Beachgrass Dune
- 6295:Northern Bayberry Dune Shrubland
- 6315:Coastal Pitch Pine / Scrub Oak Barren
- 6346:Pipewort Sandy Pondshore
- 6371:Blueberry Wetland Thicket
- 6375:Northeastern Coastal Oak - Heath Forest
- 6377:Northeastern Atlantic Coastal Oak - Beech Forest
- 6381:Pitch Pine - Oak Forest
- 7279:Black Locust Successional Forest
- Dev:Developed Land
- Ds:Disturbed

N W E S

0 825 1,650

Feet

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Vegetation data: USDOI NPS, 2010
http://www1.usgs.gov/vip/caco/cacogeodata.zip

Figure 6
Plant Communities

Former Camp Wellfleet
Wellfleet, Barnstable County, Massachusetts

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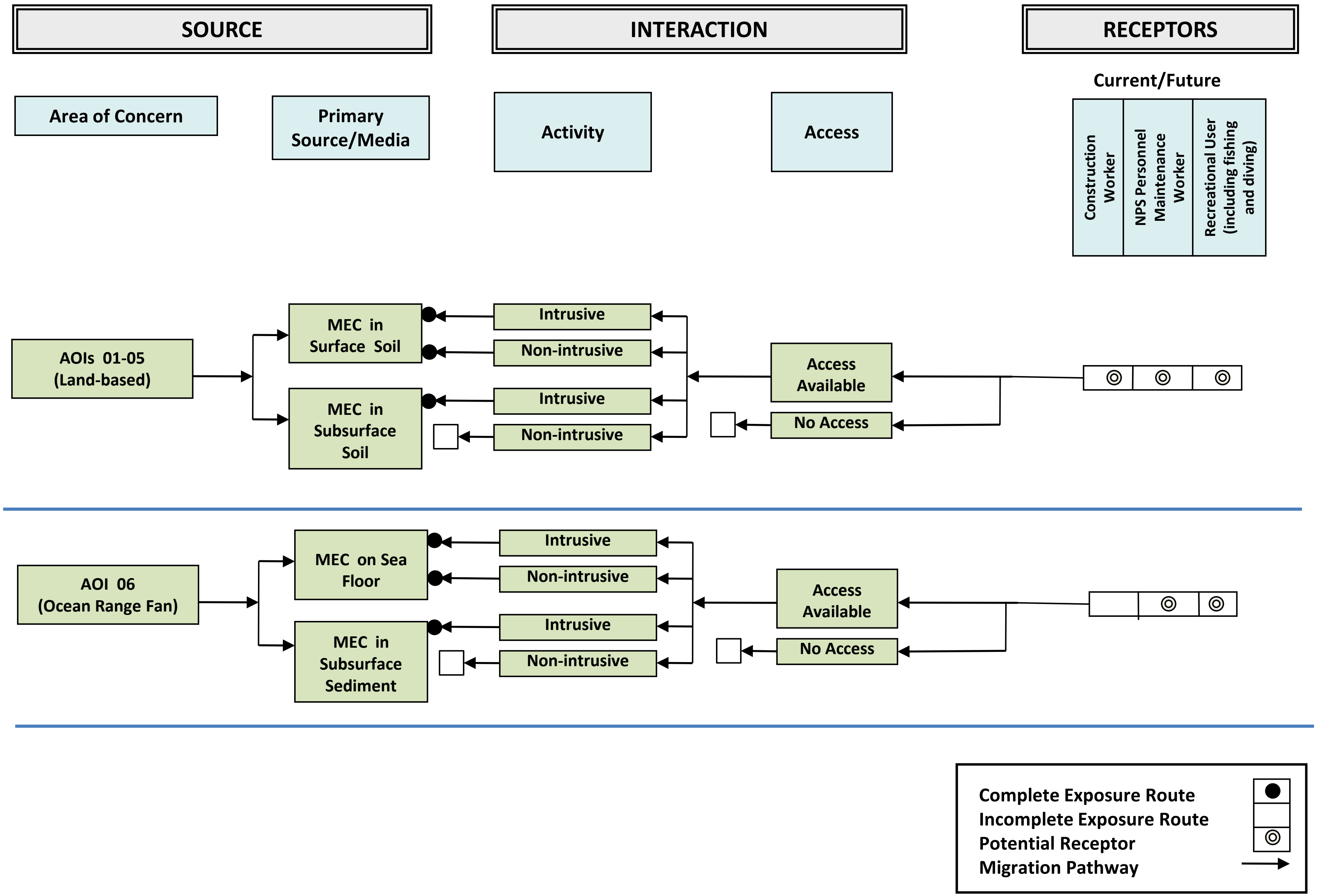
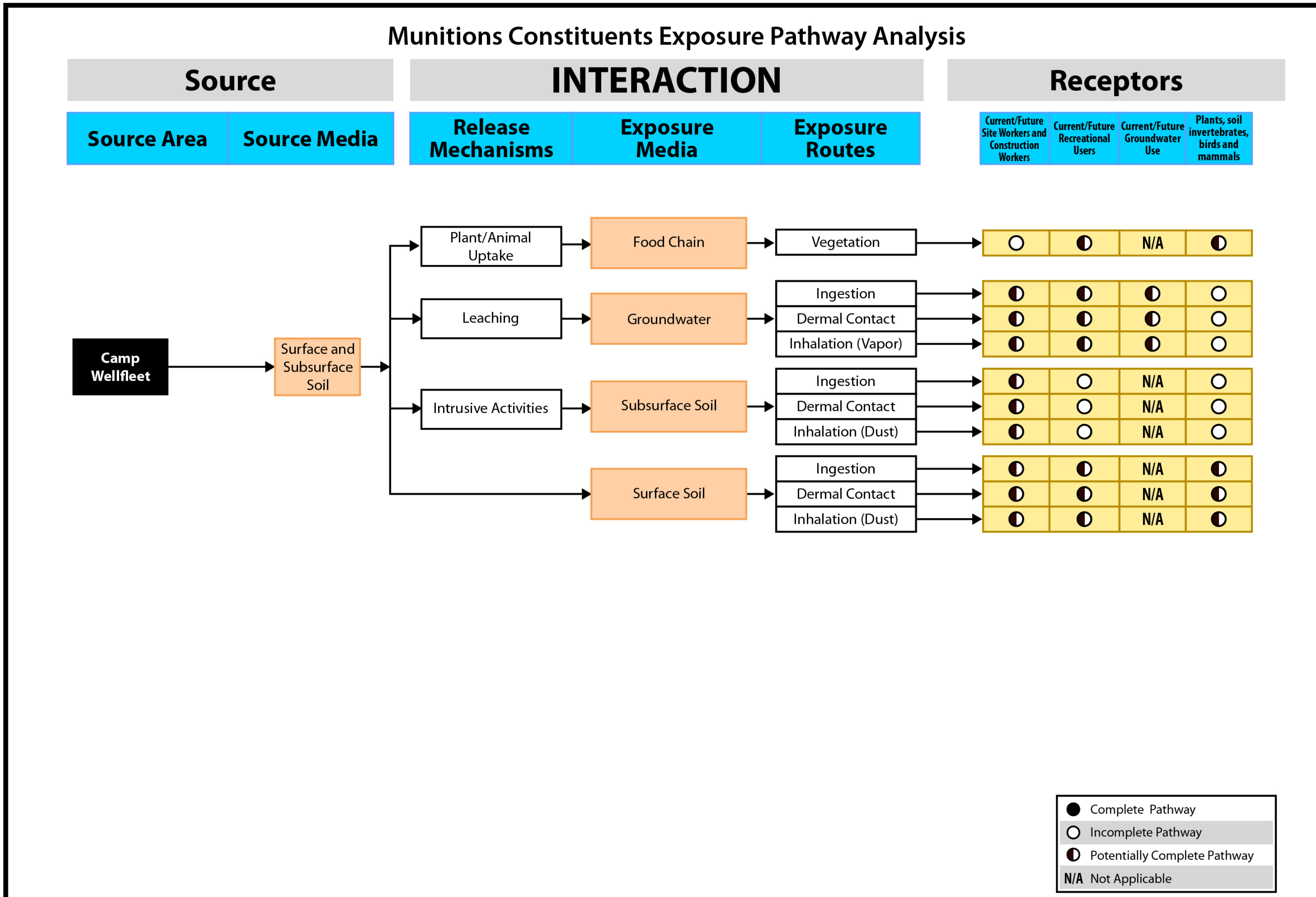
Figure 7. MEC CSM for Former Camp Wellfleet





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Former Camp Wellfleet
Wellfleet, Barnstable County,
Massachusetts

Figure 8
Preliminary Munitions Constituent Conceptual Site Model (CSM)

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Legend

Supply Well B

Roads

Sampling Units

Sampling Protocol

- Surface Soil IS with Replicate (Triplicate) Sampling
- Surface and Subsurface Soil IS Sampling
- Surface and Subsurface Soil IS with Replicate (Triplicate) Sampling
- Surface Soil IS with Replicate (Triplicate) Subsurface Soil Discrete

Background Sampling Units

Sampling Protocol

- Surface and Subsurface Soil IS Sampling
- Surface and Subsurface Soil IS with Replicate (Triplicate) Sampling

Areas of Interest (AOIs)*

Areas Ineligible for Sampling by Request of the Cape Cod National Seashore National Park Service (CCNS NPS) due to Ongoing Research or Habitat Establishment

Wellfleet Property Boundary (DENIX)

Town of Wellfleet Parcel

* The eastern boundary of AOI-02 and AOI-05 is the current shoreline downloaded from NOAA's Continuously Updated Shoreline Program, which attempts to provide updated imagery representing mean low tide.

Basemap: TEC 1994 Orthophoto showing location of 1943, 1945, 1947, 1951, 1960, and 1961 identified significant features.

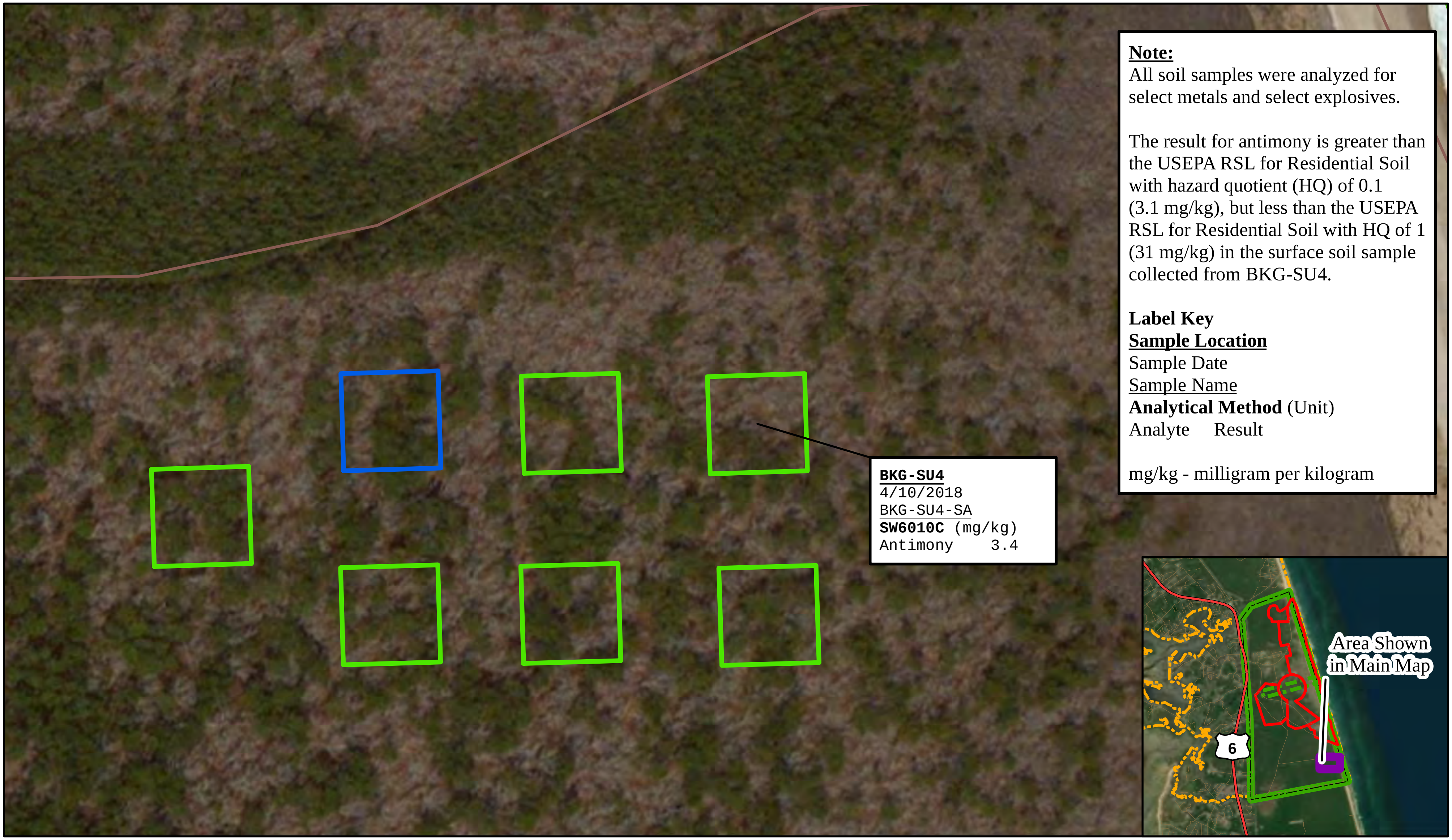
N
W E
S

0 600 1,200
Feet

Map Data : DENIX, U.S. Census, ESRI Online

Figure 9
Overview of Soil Sampling Locations
Former Camp Wellfleet
Wellfleet, Barnstable County, Massachusetts

Document Path: N:\GIS\Northeast\Massachusetts\CampWellfleet\MXD\RIReport\Draft\SamplingLocationsOverview.mxd



Note:
All soil samples were analyzed for select metals and select explosives.

The result for antimony is greater than the USEPA RSL for Residential Soil with hazard quotient (HQ) of 0.1 (3.1 mg/kg), but less than the USEPA RSL for Residential Soil with HQ of 1 (31 mg/kg) in the surface soil sample collected from BKG-SU4.

Label Key
Sample Location
Sample Date
Sample Name
Analytical Method (Unit)
Analyte Result

mg/kg - milligram per kilogram

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Legend
Sampling Units
Incremental Sampling Protocol
- Surface and Subsurface Soil Sampling
- Surface and Subsurface Soil with Replicate (Triplicate) Sampling
- U.S. Highway
- Roads
- AOI Boundaries
- Former Camp Wellfleet Boundary
- Wellfleet (Town) Boundary
- Town of Wellfleet Parcel

N W E S
0 75 150
Feet

Figure 10
Background Surface and Subsurface Soil Sampling Units
Former Camp Wellfleet
Wellfleet, Barnstable County, Massachusetts

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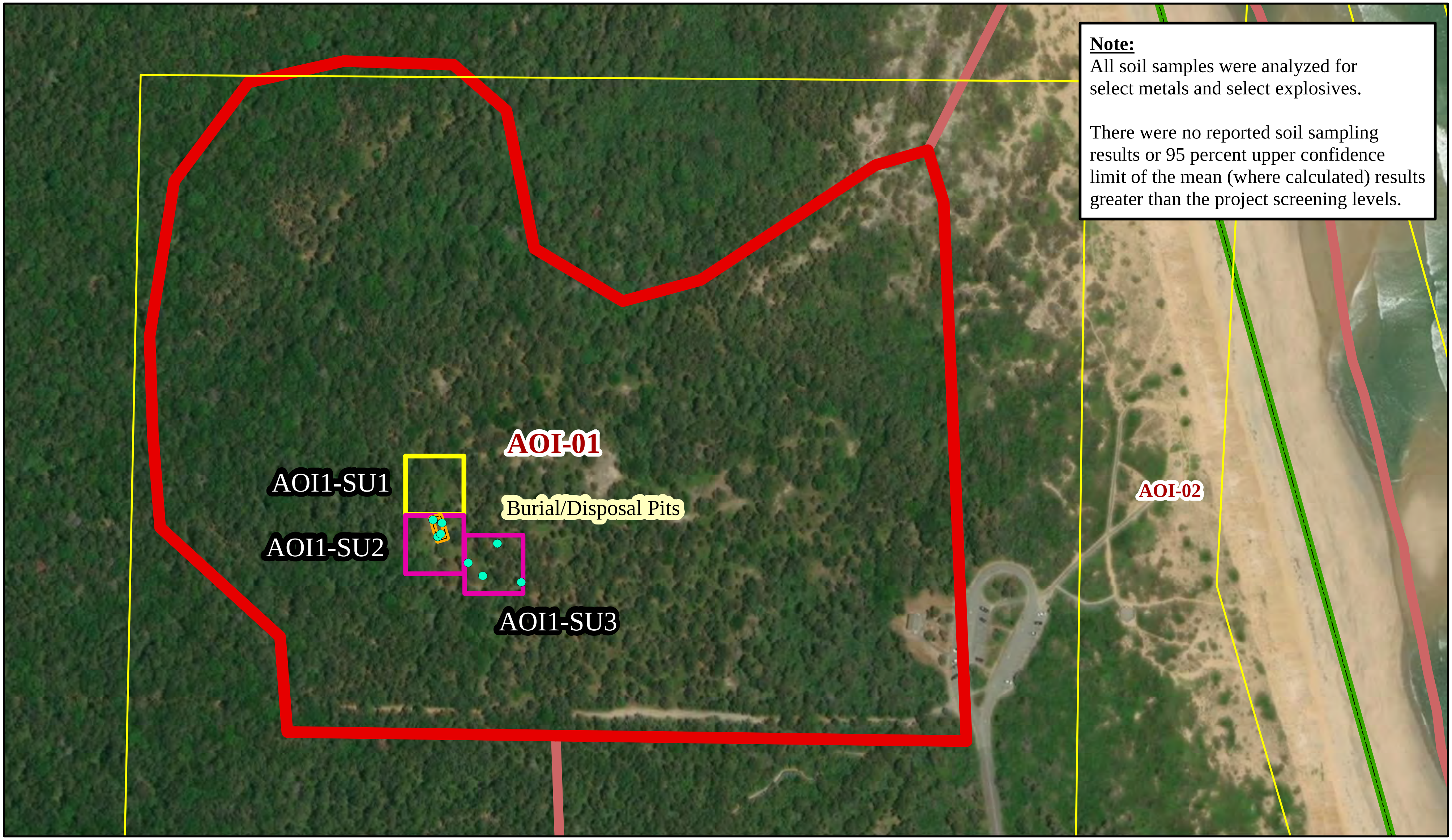

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Legend

Subsurface Soil Discrete Sampling Location

Sampling Units

Surface Soil IS with Replicate (Triplicate) Sampling

Surface Soil IS with Replicate (Triplicate) Sampling Subsurface Soil Discrete Sampling

AOI-01 Boundary

2006 Removal Action Grid Where All MD was Found

Other AOI Boundaries

EE/CA Areas of Concern (AOCs)

Camp Wellfleet Boundary

N W E S

0 125 250
Feet

Aerial: ESRI Online

Figure 11
AOI-01 - Soil Sampling Locations
Former Camp Wellfleet
Wellfleet, Barnstable County, Massachusetts

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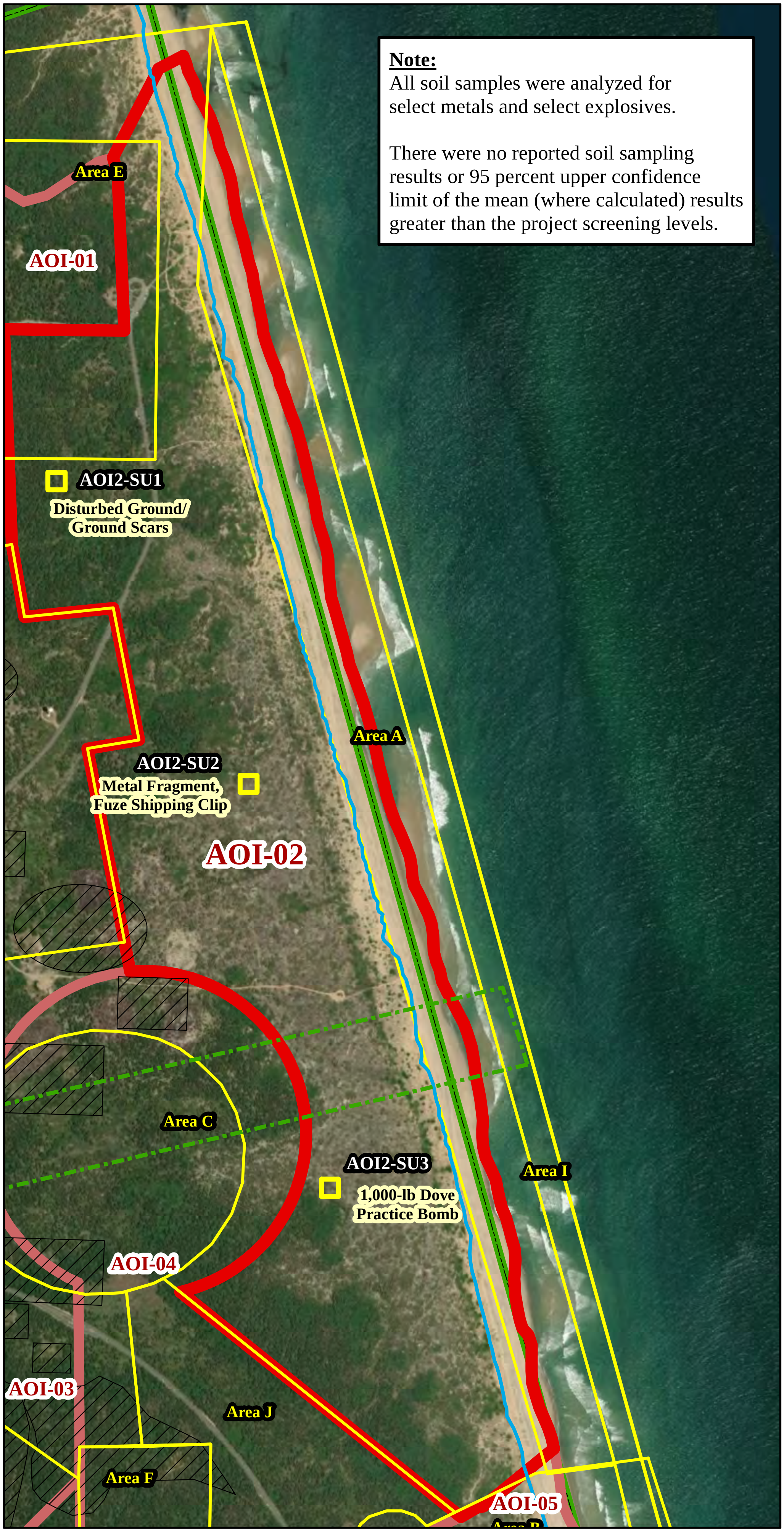

Legend

Sampling Units

Incremental Sampling Protocol

Surface Soil with Replicate (Triplicate) Sampling

Approximate Bluff Location (2015)

AOI-02 Boundary

Other MRS Boundaries

EE/CA Areas of Concern (AOCs)

Areas Ineligible for Sampling by Request of the Cape Cod National Seashore National Park Service (CCNS NPS) due to Ongoing Research or Habitat Establishment

Camp Wellfleet Boundary

Town of Wellfleet Parcel

Aerial: ESRI Online

N W E S

0 450 900

Feet

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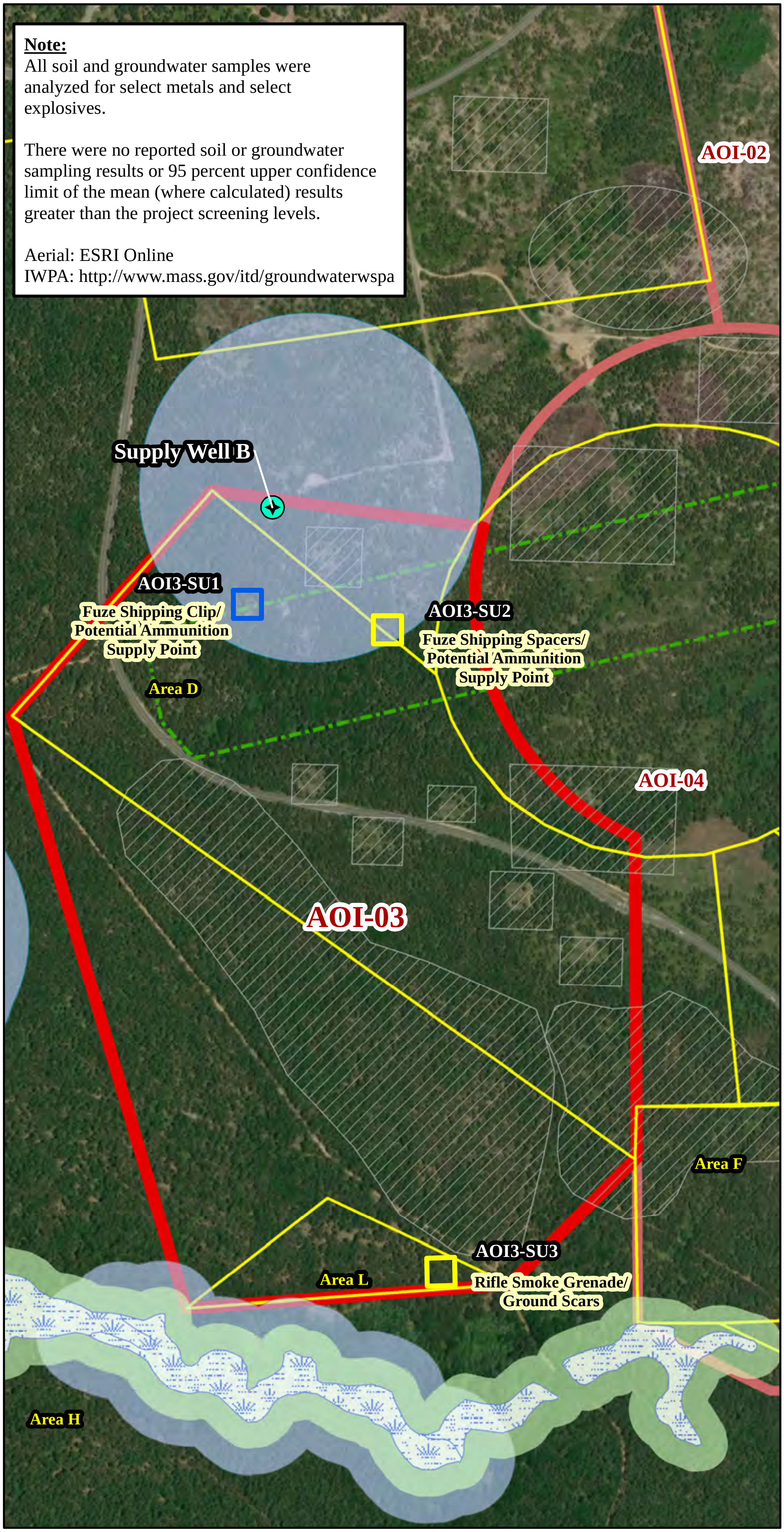
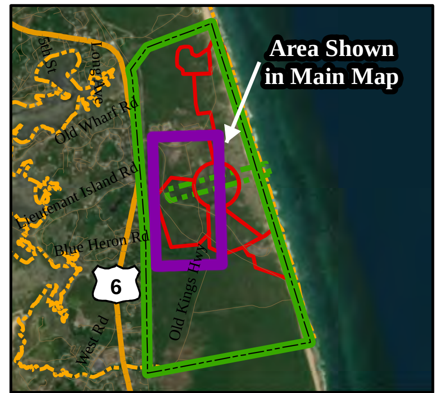
Document Path: N:\GIS\Northeast\Massachusetts\CampWellfleet\MXD\RIReport\Draft\AOI02Sampling.mxd

Figure 12
AOI-02 - Soil Sampling Locations

Former Camp Wellfleet
Wellfleet, Barnstable County, Massachusetts





Legend

Sampling Units

Incremental Sampling Protocol

- Surface Soil with Replicate (Triplicate) Sampling
- Surface and Subsurface Soil with Replicate (Triplicate) Sampling
- Potable Supply Well
- AOI-03 Boundary
- Other AOI Boundaries
- Interim Wellhead Protection Area (IWPA)
- Wetland
- Massachusetts Wetlands Protection Act 100-ft Wetland Buffer
- Massachusetts Wetlands Protection Act 200-ft River Buffer
- EE/CA Areas of Concern (AOCs)
- Areas Ineligible for Sampling by Request of the Cape Cod National Seashore National Park Service (CCNS NPS) due to Ongoing Research or Habitat Establishment
- Camp Wellfleet Boundary
- Town of Wellfleet Parcel

N W E S

0 275 550
Feet

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Figure 13
AOI-03 - Soil and Groundwater Sampling Locations
Former Camp Wellfleet
Wellfleet, Barnstable County, Massachusetts

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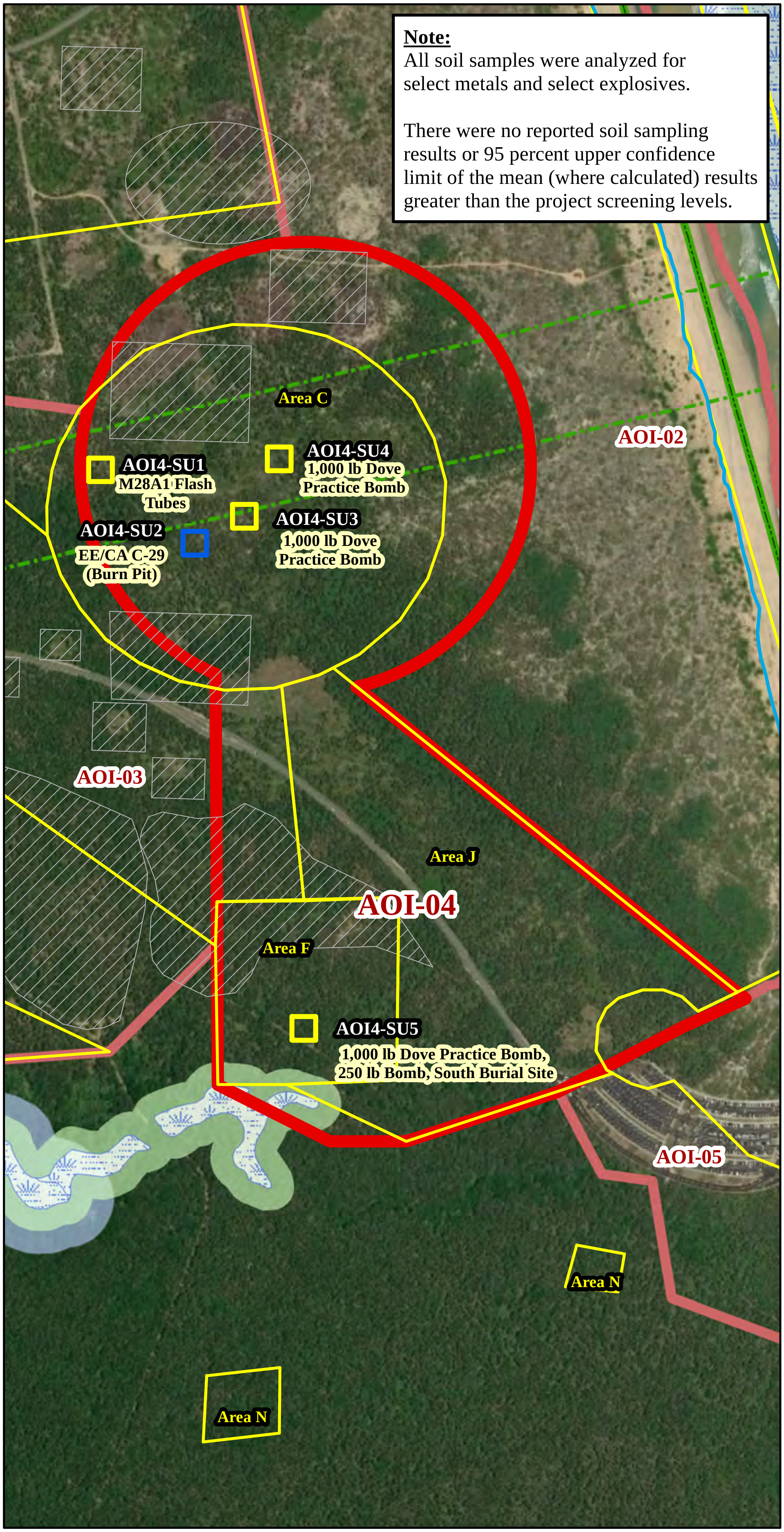

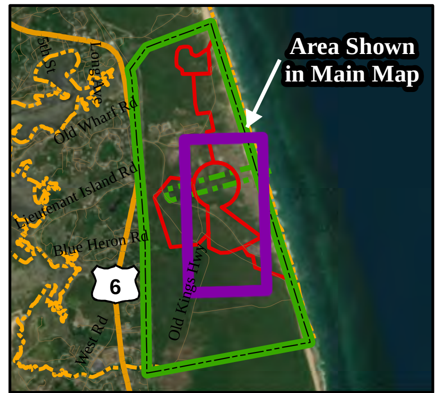

Legend

Sampling Units

Incremental Sampling Protocol

- Surface Soil with Replicate (Triplicate) Sampling
- Surface and Subsurface Soil with Replicate (Triplicate) Sampling
- Approximate Bluff Location (2015)
- AOI-04 Boundary
- Other AOI Boundaries
- EE/CA Areas of Concern (AOCs)
- Areas Ineligible for Sampling by Request of the Cape Cod National Seashore National Park Service (CCNS NPS) due to Ongoing Research or Habitat Establishment
- Camp Wellfleet Boundary
- Wetland
- Massachusetts Wetlands Protection Act 100-ft Wetland Buffer
- Massachusetts Wetlands Protection Act 200-ft River Buffer
- Town of Wellfleet Parcel

0 325 650
Feet

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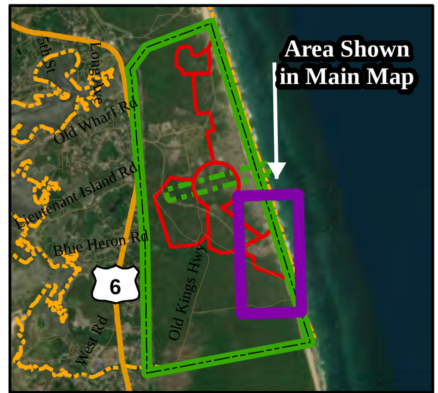
Document Path: N:\GIS\Northeast\Massachusetts\CampWellfleet\MXD\RIReport\Draft\AOI04Sampling.mxd

Figure 14
AOI-04 - Soil Sampling Locations
Former Camp Wellfleet
Wellfleet, Barnstable County, Massachusetts



Legend

Sampling Units

Incremental Sampling Protocol

- Surface Soil with Replicate (Triplicate) Sampling
- Surface and Subsurface Soil with Replicate (Triplicate) Sampling
- Approximate Bluff Location (2015)
- Removal Action Area (Zapata)
- AOI-05 Boundary
- Other AOI Boundaries
- EE/CA Areas of Concern (AOCs)
- Camp Wellfleet Boundary

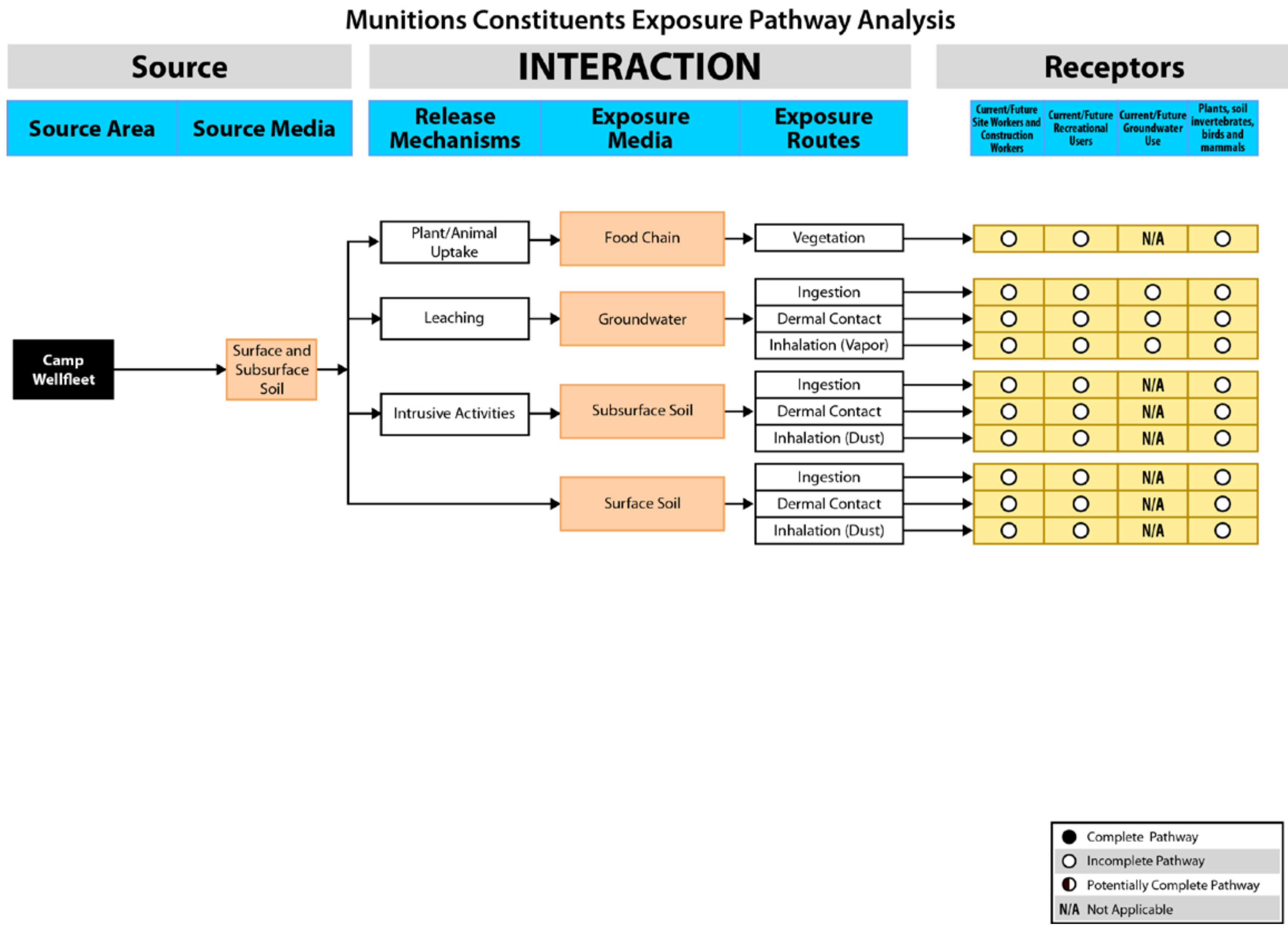
N W E S

0 250 500
Feet

Figure 15
AOI-05 - Soil Sampling Locations

Former Camp Wellfleet
Wellfleet, Barnstable County, Massachusetts

Document Path: N:\GIS\Northeast\Massachusetts\CampWellfleet\MXD\RIReport\Draft\AOI05Sampling.mxd



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Former Camp Wellfleet
Wellfleet, Barnstable County,
Massachusetts

Figure 16
Final Munitions Constituent Conceptual Site Model (CSM)

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APPENDIX B: MEC DATA QUALITY OBJECTIVES

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MEC Data Quality Objectives

DQOs are qualitative and quantitative statements that specify the quality and level of data required to support the decision-making processes for a project. A typical MEC DQO is to have sufficient data to state that the density of MEC within the study area is below a threshold with a confidence expressed as a percentage.

For the Former Camp Wellfleet, the DQO was designed to determine whether nature and extent of MEC could be characterized using only previous/existing geophysical data, or whether each of the AOIs required additional field investigation during the RI.

The DQO for determining the need for further fieldwork was determined by the PDT to be: *for each AOI, there should be at least 80% confidence that the TOI/acre should be less than 1.0*.

Visual Sample Plan (VSP), a statistically-based software published by Pacific Northwest National Laboratory, was used in the analysis of the previous data collected at the Former Camp Wellfleet. The module within the program used was *Sampling Goals > Remedial Investigation (UXO) > Target of Interest (TOI) Rate Estimation*. Required inputs include a map of the AOI, the area of "valid" geophysical coverage, and the number of MEC items found within the area. Valid geophysical coverage means that all geophysical anomalies within the area (e.g., grid) were intrusively investigated.

With regard to quality of geophysical coverage in the previous work, during the EE/CA, only up to 20 anomalies per grid were excavated, thus, assuming greater than 20 anomalies, not all were excavated and that particular grid could not be used for valid geophysical coverage. The quality of the helicopter geophysical coverage by ORNL, although over 100% of the Former Camp Wellfleet, is considered to be negligible due to the sensor height being too great to detect typical UXO with equivalent sensitivity to a ground-based sensor. With regard to MEC removal actions, all anomalies were dug in areas where removal actions took place, so all removal action grids are valid coverage.

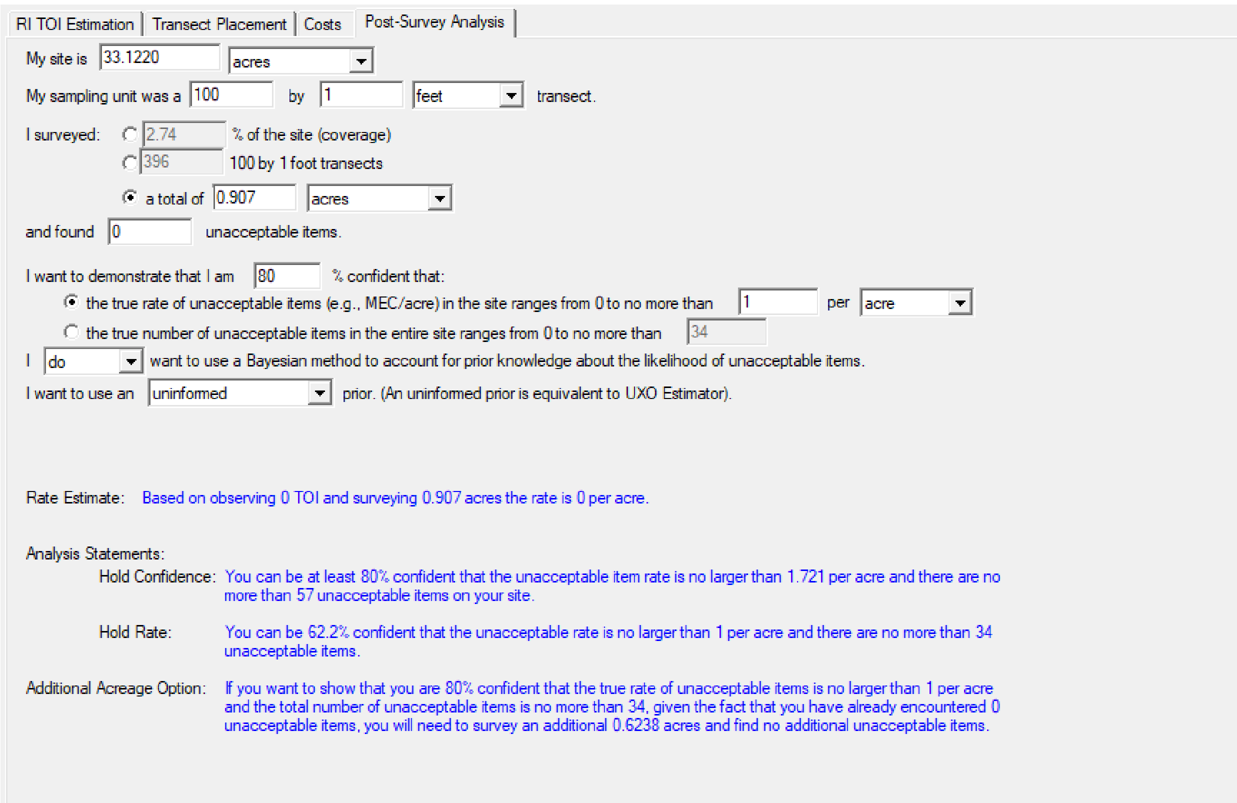
The Post-survey Analysis within the VSP module, was run (Figure B-1 below presents a screen capture of the analysis of AOI-01 as an example). The area of the AOI calculated and the valid geophysical coverage is entered as total acres surveyed, along with the number of unacceptable items (MEC) found. The desired confidence is entered as a percentage along with the rate of unacceptable items (MEC/acre) to test. The resulting analysis statements indicate the MEC density at the entered confidence, as well as the confidence at a given MEC density (the rate).

This analysis was conducted for each of the five AOIs using both 80% and 95% confidence and both 1.0 TOI/acre and 5.0 TOI/acre. Table B-1 shows the likely upper bound of the TOI/acre in each AOI, holding the confidence at 95%. The density varies from 3.228 in AOI-01 to 0.4454 in AOI-05, approximately inversely proportional to valid coverage. The table then shows the confidence in the density in adjacent columns, with TOI/acre held at 5.0 and 1.0.

The DQO *(at least 80% confidence that the TOI/acre should be less than 1.0 per AOI)* was met in AOI-02 through AOI-5, with confidence ranging from 86.5% to 99.9%, i.e., no further field work was required. Due to low geophysical coverage (less than 1 acre), the DQO was not met in AOI-01, but the PDT concurred that no further fieldwork was necessary because it is a burial pit/possible landfill, where MD was found in only one grid, along with a significant amount of non-munition related debris, and it was estimated that, assuming coverage credit for the 3 grids that were not completely excavated (but for which no MEC or MD were found in the excavated portions) the confidence calculation would likely exceed the 80% goal.

Statistical coverage notes on the table list grids and removal action areas that were used for valid coverage acres. The last column on the table lists grids where not all targets were dug, but in all cases no MEC or MD were found. Thus, these grids qualitatively add confidence that the TOI density is lower than that predicted using only the valid coverage area.

Figure B-1. Screen capture of VSP analysis module.



As shown in Appendix B, Table B-1, column K, it was concluded that sufficient MEC data existed and that no additional field investigation for MEC was required to complete this RI.

Appendix B, Table B-1
Former Camp Wellfleet MEC DQOs

AOI	EE/CA Area	area (acres)	TOI	Summary of MEC/MD Finds	coverage acres \a	Density	Confidence (%)		Additional MEC Field Investigation Warranted?	Statistical Coverage notes	Additional Coverage notes (the grids listed in this column were not counted as coverage acres, since not all targets were investigated in the grids)
						TOI/ac at 95% confidence	< 5.0 TOI/ac	< 1.0 TOI/ac			
AOI-01	E (as altered)	33.1	0	0 MEC. 1040 lbs MD in single burial pit \b	0.9068	3.228	99.1%	62.2%	Although TOI/ac is somewhat high, the PDT does not recommend further investigation. This AOI is identified as a landfill, and only one grid confirmed that MD is buried within this area, along with a significant amount of other non-munition related debris. Assuming credit for the 3 grids that were not completely excavated (but for which no MEC or MD were found) the confidence calculation would likely exceed the 80% goal.	Includes 2 EECA grids (E-47, E-51) and SPA grid 279 (100'x200')	No MEC or MD were found in EECA grids E-48, E49, E-50 (not all targets dug). These grids were not included in the confidence goal calculation, but if they had been, it is likley that the 80% confidence goal would have been met.
AOI-02	A (as expanded)	275.0	1	1 MEC (76 mm round). Multiple MD finds \c	4.7715	0.9872	100.0%	95.3%	No further MEC field investigation recommended	Includes EECA grids A-1, A-2, A-3, A-4, A-5, A-7, A-8, A-10 through A-13, A-16, E-54, and many RA grids	No MEC or MD were found in EECA grids E-52, A-6, A-9, A-14, A-15 (not all targets dug)
AOI-03	D, L, and area between	120.2	1	1 MEC (Rifle Smoke Grenade). Multiple MD finds \d	1.9606	1.964	100.0%	70.1%	Although the confidence that the TOI/ac is less than 1 is slightly below the DQO, the single MEC item is considered to be an isolated find and no further investigation was recommended.	Includes EECA grids D-34, D-35, D-36, D-37, D-39, D-40, D-41, D-43, and L-71	No MEC or MD were found in EECA grids D-38, D-42, D-44, D-45, D-46, L-70 (not all targets dug)
AOI-04	C, F, J	141.8	0	0 MEC. Multiple MD finds \e	4.722	0.6202	100.0%	99.2%	No further MEC field investigation recommended	Includes RA area 100' radius around SPA 329 and EECA grids C-25, C-26, C-32, C-33, J-57 through J-68, and F-54 through F-56	No MEC or MD were found in EECA grids C-22, C-23, C-24, C-27, C-28, C-29, C-30, C-31 (not all targets dug)
AOI-05	B (as expanded)	56.1	0	0 MEC. Multiple MD finds \f	6.244	0.4454	100.0%	99.9%	No further MEC field investigation recommended	Includes B EECA grids (B-17, B-19, B-21), many RA grids, and large RA area (which overlies B-20)	No MEC or MD were found in EECA grid B-18 (not all targets dug)
AOI-06	I	167856.0			Ocean portion of Artillery Range Fan has not been investigated				The RI assumes that MEC is potentially present in the ocean range fan, since antiaircraft and rocket firing at targets over the ocean was conducted for approximately 20 years. It is likely that the current 3Rs education program will be sufficient to address the risk from MEC presence in the ocean. Both MassDEP and NPS (property owner) have been satisfied with this MEC risk managment approach.		Land portion of fan is covered by AOI-2 and AOI-5

Notes:

The MEC DQO is that sufficient data coverage exists to state that we are 80% confident that there is < 1 Target of Interest per acre in the AOI.

\a - Coverage conservatively assumes that only grids where 100% of targets were dug count as coverage. Many EE/CA grids did not meet this criterion, although all RA grids did.

\b - pit # 4: 43 M29 3.5" practice rockets, 3 expended M2 anti-personnel mines, 407 M48 flashtubes, 1 m7A3 2.36" practice rocket, and a large portion of an inert filled M65 1000lb "Dove" guided bomb

\c - No MEC were found during the EE/CA or Zapata Removal Actions, but a 76 mm round was found within this area (Marconi Beach) in October 2016 and was considered to be MEC. MD includes 50 caliber machine gun ammunition, fuze cans, shipping clips for 90 mm fuzes, and 30 caliber ammunition cans, calcium hydride canisters, and unknown frag.

\d - Single, isolated Rifle Smoke Grenade found in grid L-71 is considered MEC (pyrotechnic). Abundant fuze shipping spacers, some small arms debris.

\e - MD includes abundant fuze shipping spacers, some small arms debris, one empty Dove Missile/1000-pound bomb, one empty 250-pound bomb, 186 M28A1 flash tubes from 106mm projectile cartridge cases, fragments of grenade spoons

\f - MD includes abundant frag from 3.5" Rockets (motors, nose caps, warhead fragments, etc), frag from 105 mm projectiles, frag from unknown projectiles, 50 cal bullet

- VSP version 7.9 was used for this analysis, using TOI Estimation/Comparison, Post-survey Analysis, using Bayesian method with uninformed prior knowledge.

- This analysis does not include the negligible coverage (in terms of minimal acreage) of the intrusive investigation of Single Point Anomalies (SPAs) identified by the ORNL airmag survey of 2002.

APPENDIX C: TECHNICAL MEMORANDUM – ISM SAMPLING APPROACH

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TECHNICAL MEMORANDUM

<u>Additional Information in Support of the USACE Proposed IS Approach for Camp Wellfleet</u>

US Army Corps of Engineers, <u>Revised</u> April 10, 2018

General

The intent of this technical memo is to provide additional information for MassDEP's consideration with regard to the overall sampling approach for Camp Wellfleet. The current USACE sample design is based on previous Camp Wellfleet history and findings.

The past history of Camp Wellfleet investigations does not indicate munitions-related findings suggestive of significant areas of MC contamination. Therefore, the Camp Wellfleet investigation is proposed as a phased approach, where presence/absence, or SI-level sampling will be conducted in Phase 1, and nature and extent sampling will be conducted in a Phase 2, if necessary.

The specific issues described below focus on establishing a surface soil interval or depth, and justifying the number of replicates required to obtain defensible surface soil IS data.

Surface Soil Depth Interval (0-6 inches)

While USACE had initially proposed a 0-12 inch depth interval based on ecological risk concerns, further research supports the use of 0-6 inches for surface soil sampling. The EPA ecological risk sampling guidance recommends sampling the 'A' horizon (which is considered to be the most biologically active), typically 10-12 inches. Most of the Camp Wellfleet sample areas are mapped as either Carver or Hooksan soils. Official NRCS descriptions of these soils indicate that an 'A' layer is present to 3-7 inches (Carver) and 6 inches (Hooksan). At Wellfleet, many of the sample locations are in forested areas or heathland where soils should tend to have a developed 'A' horizon.

Based on review of site soil classification and EPA Eco Risk guidance, USACE proposes a 0-6 inch surface sampling depth that is appropriate for a CERCLA compliant ecological and human health risk assessment.

Based on MassDEP's April 6, 2018 email, concurrence has been obtained for this surface soil interval.

Number of Increments for IS Surface Soil Sampling

USACE proposed 50 increments per surface soil IS as appropriate and sufficient for all sampling units (SUs). Most guidance suggests a typical increment range of 30-100. USACE believes that using 50 increments is justified based on previous site history and findings. During the multiple previous investigations, only one item categorized as MEC has been found. As described below, the limited MC sampling did not indicate significant MC issues. Further, 50 increments is a reasonable approach for a site where the property owner has asked that the sampling impact footprint be minimized due to sensitive plant communities.

Additional rationale for using 50 increments follows:

Demonstrated Low Variability Conditions

In general, no munitions-related items suggesting significant MC contamination have been found. Previous MC sampling was limited, but samples were collected at the OB/OD area, a presumed likely contaminant area. MassDEP's suggested sampling table categorizes AOI-01 as a likely area of high potential variability, based on the reported use as an Open Burn/Open Detonation (OB/OD. However, the historical sampling data indicate a low variability (indicating low heterogeneity). Based on the 10 subsurface soil sampling results from the potential OB/OD in AOI-01, the coefficient of variation (CV) for detected metals is approximately 0.6. The ITRC ISM guidance suggests that anything less than 1.5 CV is indicative of low variability.

USACE concludes that since this area of expected high variability and significant MC contamination did not exhibit high variability, it is reasonable to assume that the remainder of Camp Wellfleet site soils would be no more variable. Therefore, the proposed surface soil sampling protocol using IS with 50 increments will adequately characterize sampling units within Camp Wellfleet.

Sample Mass

50 increments in the 0-6 inch interval, will result in approximately 1.5 kilograms (kg) of soil mass for laboratory processing and sample analysis. According to IG 09-02, "*The number of increments must be balanced with the mass of each individual increment to yield a total sample mass to sufficiently average the compositional heterogeneity of particles. Adequate total sample mass for typical soil-size particles (< 2 mm) is <u>empirically demonstrated to be 1 to 2 kg</u>.*" Thus, 50 increments represents the amount of soil that is recommended for this type of analysis.

% Relative Standard Deviation (RSD):

Some of the following is taken from the ITRC ISM guidance, the USACE Engineer Research and Development Center [ERDC], TR-13-5, August 2013 [Clausen, *et al*, 2013]), and the *Interim Final Technical Guidance Manual for the Implementation of the Hawai'i State Contingency Plan* (State of Hawai'i, Department of Health, November 12, 2008).

% RSD provides a measure of the precision of the ISM used to estimate the mean contaminant concentration for the SU in terms of combined field and laboratory error. While increasing the number of increments may help obtain low % RSD, this is only one of many factors to consider.

An RSD of less than or equal to 35 percent (%) is considered to indicate good reproducibility and reliable data for decision making. However, it is important to note that, as TR-13-5 states, "*However, the RSD is not a measure of data usability. The RSD is a descriptive statistic that measures precision based on the variance and standard deviation. Higher RSD means poorer data quality;* ***however, higher RSD does not always mean poorer data usability*** *(emphasis added). For example, the amount of acceptable variability for replicate samples will usually depend on the magnitude of the analyte concentrations relative to the levels of interest (e.g., regulatory, or* *risk-based thresholds or action levels). Larger variability can be tolerated when samples' concentrations are much smaller or larger than the project screening levels of interest as opposed to when the concentrations are near the decision limits. However, in general, the amount of variability that is acceptable should be determined by the tolerances for decision errors and the magnitude of the analyte concentrations relative to the levels of interest (e.g., regulatory or risk-based thresholds)*" (Clausen, et al, 2013).

This indicates that the data can be usable even if the RSD is larger than 35%. Replicate results that are greater than 35% require evaluation to assess the likely sources of error and use of the appropriate statistical methods for calculation of the 95% UCL of the mean contaminant concentrations.

Based on MassDEP's April 6, 2018 email, concurrence has been obtained for using 50 increments for IS for surface soil.

Revised Replicate Sampling Approach

MassDEP forwarded a suggested sampling table (March 20, 2018) recommending a higher frequency of replicate sampling than USACE had originally proposed. MassDEP based this on individual Conceptual Site Models (CSMs) for the different SUs within a given AOI. For example, in AOI 04, this involves considering 'burn pit' or 'burial site' to represent different CSMs.

USACE understands that an increased number of replicates will provide more useful information about the site rather than simply increasing the number of increments. That is, collecting more replicate samples within an SU will provide a better estimate of the mean and a better estimate of the UCL, and will reduce the probability of false positives and will provide more options for doing statistical analysis of the data. Therefore, USACE agreed to replicate sampling based upon the CSM model, but this approach did not increase the replicate sampling frequency to 100%.

However, in an April 6 email, MassDEP cited the following from *ERDC, Incremental Sampling Methodology (ISM) for Metallic Residues, August 2013*:

"It is critical to determine during project planning the number of replicate ISM samples required for each DU. At least three independent replicate ISM samples are typically needed to assess the total variability of the mean metal concentrations or to perform a calculation of the upper confidence of the mean (UCL). Three replicates are acceptable in situations where large deviations from normality of the sample population are not expected (ITRC 2012)."

Following internal discussion, USACE will collect surface soil samples using ISM with 100% replicates (as described in the table below).

Subsurface Sampling Approach

Based on discussion with MassDEP on a conference call on April 9, a soil sampling approach for the subsurface soil at Camp Wellfleet has been developed. It is USACE's understanding that MassDEP allows discretion for USACE to conduct a subsurface sampling investigation that is defensible in terms of achieving the project objectives. To that end, USACE will conduct the following subsurface soil sampling investigation at Camp Wellfleet:

Five locations have previously been identified as being appropriate for subsurface sampling. Each targeted horizon is based on previous MD finds or munitions-related activity.

To ensure the most defensible data, USACE proposes ISM for the targeted 0.5-3 ft horizon for the subject SUs in AOI-3 (SU1), AOI-4 (SU2), and AOI-5 (SU3). 30 increments for each of these SUs will be collected at the 0.5-3 ft depth interval, using ISM. Each of these will be collected in triplicate (replicate). For background, each of the 7 background SUs will also be sampled by collecting 30 increments at 0.5-3 ft using ISM.

However, for AOI-1, the site of the OB/OD area, SU2 and SU3 will be sampled at the deepest depth of the OB/OD trenches (10 ft) by collecting 4 discrete borings from within each SU, at the 8-10 ft interval. A field duplicate and MS/MSD samples will also be collected. Because most MD items within AOI-01 were found within the removal investigation pit, the SU2 borings will be randomly located within the investigation pit in this SU. The SU3 borings will also be randomly located within the SU.

The metals data will be screened against the MassDEP Identified Background Levels in Soil, USEPA RSLs, and S-1 & GW-1 table 2 MCP standards. The rationale reflects the difficulty in obtaining anything other than discrete samples at these depths on this site where the property owner prohibits powered sampling equipment and requires the minimization of sampling footprints. Note that 10 discrete samples were previously collected during the removal action from within this OB/OD area and analyzed for RCRA metals and explosive compounds. No release of RCRA metals or explosive compounds was identified. Therefore, the discrete samples USACE will collect are intended to represent confirmation of the previous findings.

AOI-01								
Sampling Unit	**CSM**	**Potential Variability**	**Sampling Unit Size (Acres)**	**Number of Surface Soil Increments**	**Surface ISM Replicate (Triplicate) Sampling**	**Subsurface Soil Sampling**	**Rationale for Subsurface Sampling**	**Total Samples (including QC)**
AOI1-SU1	Potential OB/OD	Low (based on previous MC data)	1/4	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI1-SU2	Potential OB/OD	Low	1/4	50	100%	4 borings with discrete sampling of 8-10 ft interval, random within investigation pit in the SU	Target depth of previous trenching and sampling of the OB/OD	Surface – 1 in triplicate Subsurface – 4 + duplicate
AOI1-SU3	Potential OB/OD	Low	1/4	50	100%	4 borings with discrete sampling of 8-10 ft interval, random within SU	Target depth of previous trenching and sampling of the OB/OD	Surface – 1 in triplicate Subsurface – 4 + MS/MSD
Surface soil is ISM with 100% replicate sampling. Subsurface soil is 4 random discrete borings per SU to specified depth.								

AOI-02								
Sampling Unit	**CSM**	**Potential Variability**	**Sampling Unit Size (Acres)**	**Number of Surface Soil Increments**	**Surface ISM Replicate (Triplicate) Sampling**	**Subsurface Soil Sampling**	**Rationale for Subsurface Sampling**	**Total Samples (including QC)**
AOI2-SU1	Disturbed Ground/Ground Scars	Unknown – no data to support	1/4	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI2-SU2	Metal Fragment, Fuze Shipping Clip	Unknown	1/4	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI2-SU3	1,000 lb Dove Practice Bomb	Unknown	1/4	50	100%	N/A	N/A	Surface – 1 in triplicate
Surface soil is ISM with 100% replicate sampling.								

AOI-03								
Sampling Unit	**CSM**	**Potential Variability**	**Sampling Unit Size (Acres)**	**Number of Surface Soil Increments**	**Surface ISM Replicate (Triplicate) Sampling**	**Subsurface Soil Sampling**	**Rationale for Subsurface Sampling**	**Total Samples (including QC)**
AOI3-SU1	Fuze Shipping Clips; ASP	Unknown	1/4	50	100%	30 increment ISM sampling of 0.5-3 ft interval	Target depth of previous MD finds	Surface – 1 in triplicate Subsurface – 1 in triplicate
AOI3-SU2	Fuze Shipping Spacers; ASP	Unknown	1/4	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI3-SU3	Rifle Smoke Grenade; Ground Scars	Unknown	1/4	50	100%	N/A	N/A	Surface – 1 in triplicate
Surface soil is ISM with 100% replicate sampling. **Subsurface soil is ISM with 100% replicate sampling.**								

AOI-04								
Sampling Unit	**CSM**	**Potential Variability**	**Sampling Unit Size (Acres)**	**Number of Surface Soil Increments**	**Surface ISM Replicate (Triplicate) Sampling**	**Subsurface Soil Sampling**	**Rationale for Subsurface Sampling**	**Total Samples (including QC)**
AOI4-SU1	M28A1 Flash Tubes	Unknown	1/4	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI4-SU2	EE/CA C-29 (Burn Pit)	Unknown	1/4	50	100%	30 increment ISM sampling of 0.5-3 ft interval	Target deepest observed depth of burn pit	Surface – 1 in triplicate Subsurface – 1 in triplicate
AOI4-SU3	1,000 lb Dove Practice Bomb	Unknown	1/4	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI4-SU4	1,000 lb Dove Practice Bomb	Unknown	1/4	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI4-SU5	1,000 lb Dove Practice Bomb, 250 lb Bomb, South Burial Site	Unknown	1/4	50	100%	N/A	N/A	Surface – 1 in triplicate
Surface soil is ISM with 100% replicate sampling. Subsurface soil is ISM with 100% replicate sampling.								

AOI-05								
Sampling Unit	**CSM**	**Potential Variability**	**Sampling Unit Size (Acres)**	**Number of Surface Soil Increments**	**Surface ISM Replicate (Triplicate) Sampling**	**Subsurface Soil Sampling**	**Rationale for Subsurface Sampling**	**Total Samples (including QC)**
AOI5-SU1	Metal Fragments; Rocket Range	Unknown	1/4	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI5-SU2	Metal Fragments; Rocket Range; Zapata Removal Area	Unknown	1/4	50	100%	N/A	N/A	Surface – 1 in triplicate
AOI5-SU3	5 in Rocket Venturi, 3.5 in Rocket Frag, 105mm Frag, Unknown Metal Frag; Zapata Removal Area	Unknown	1/4	50	100%	30 increment ISM sampling of 0.5-3 ft interval	Target depth of previous MD finds	Surface – 1 in triplicate Subsurface – 1 in triplicate
Surface soil is ISM with 100% replicate sampling. Subsurface soil is ISM with 100% replicate sampling.								

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APPENDIX D: ANALYTICAL DATA

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APPENDIX D.1: STATISTICAL ANALYSIS

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Statistical Analysis of Background and Site Soil Sampling Data for the Former Camp Wellfleet FUDS Remedial Investigation Through Decision Document

Wellfleet, Massachusetts

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TABLE OF CONTENTS

List of Attachments

List of Tables

ACRONYMS AND ABBREVIATIONS

ANOVA	Analysis of Variance
BTV	Background Threshold Value
DoD	Department of Defense
ERT	Earth Resources Technology, Inc.
GOF	Goodness of Fit
ISM	Incremental Sampling Method
ITRC	Interstate Technology & Regulatory Council
kg	Kilogram
MC	Munitions Constituent
mg	Milligram
ND	Not Detected
PSL	Project Screening Level
RI	Remedial Investigation
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SU	Sampling Unit
UCL	Upper Confidence Limit
USL	Upper Simultaneous Limit
UTL	Upper Threshold Limit
UFP-QAPP	Uniform Federal Policy Quality Assurance Project Plan
USEPA	U.S. Environmental Protection Agency

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1.0 Introduction

ERT, Inc. (ERT) performed a statistical analysis of the site and background surface and subsurface soil samples collected for the Former Camp Wellfleet Remedial Investigation (RI). Background soil samples were collected using the Incremental Sampling Methodology (ISM). Site soil samples were collected using both discrete methods and ISM sampling. Section 2 documents the development of the background threshold values (BTVs), used for screening site soil sampling results. Section 3 documents the relative standard deviation (RSD) and relative percent difference (RPD) calculations for the site and background soil sampling results and 95 percent (%) Upper Confidence Limit calculations for the site soil sampling results. Details of the sampling and analysis can be found in the RI Report.

2.0 Analysis of Background Data

ERT conducted background soil sampling to determine the concentrations of select munitions constituent (MC) metals due to naturally occurring and anthropogenic (non-Department of Defense [DoD]) sources. All MC metals were detected in every background soil sample collected (uncensored data). Note that ERT used the arithmetic mean of the results for the replicates collected for sampling units (SUs) BKG-SU2-SA and BKG-SU2-SB for the background data statistical analysis. ERT performed the statistical analysis using ProUCL version 5.1 software and technical guidance (USEPA, 2015). This section presents the results of the statistical analysis for the development of the BTVs. ProUCL output and other summary tables are provided in the tables at the end of this report.

ERT used the following steps in the statistical analysis of metals in background soil:

1. Evaluate outliers for each analyte grouped by horizon (surface soil and subsurface soil),
2. Evaluate goodness of fit (GOF) for each analyte grouped by horizon,
3. Evaluate the Analysis of Variance (ANOVA) to compare surface soil to subsurface soil,
4. Combine surface and subsurface sampling results based on ANOVA results,
5. Evaluate outliers in combined data sets,
6. Evaluate GOF in combined data sets,
7. Calculate the grouped or combined data set BTVs.

Each of the steps is discussed below.

2.1 Outliers by Horizon (Surface/Subsurface Soil)

ERT analyzed the background MC metals data to determine potential outliers in the background data set using the "Outlier Tests, Full (w/o NDs)" tool in ProUCL. Outlier analysis was used to determine the appropriate statistic for the BTVs (see Section 2.7). During the initial outlier evaluation, data were grouped by horizon; each data set had seven measurements for each MC metal. The results of the outlier tests showed potential upper tail outliers at all significance levels for antimony in surface soil, copper in subsurface soil, lead in surface soil, and manganese in surface soil. The ProUCL output of the outlier evaluations is provided in Table D-1.

2.2 Goodness of Fit by Horizon (Surface/Subsurface Soil)

After analyzing the outliers in the background MC metals data, ERT ran the "Goodness-of-Fit Tests, Full (w/o NDs), G.O.F. Statistics" to evaluate the potential data distribution(s) for each analyte and each horizon. With the exception of lead in the surface soil samples, all data appeared normal, gamma, and/or lognormal at the 0.05 significance level. The ProUCL output of the GOF tests is provided in Table D-2.

2.3 Analysis of Variance (ANOVA)

In accordance with the Uniform Federal Policy – Quality Assurance Project Plan (UFP-QAPP) (Appendix Final E of the Final Work Plan, ERT, 2012), ERT performed a statistical comparison (ANOVA at p=0.05) of the background surface soil ISM samples to the background subsurface soil ISM samples to determine if the if the background surface soil and background subsurface soil are likely from the same population. Using the GOF results from step 2 to evaluate the distributions of each metal, ERT performed "Oneway ANOVA, Classical" (all metals except lead) or "Oneway ANOVA, Nonparametric" (lead).

The results of the ANOVA indicated that the mean/median characteristics of the surface and subsurface data are comparable for antimony and manganese. Therefore, the data for surface and subsurface soil for antimony will be combined for further analysis and the data for surface and subsurface soil for manganese will be combined for further analysis (step 4). The ProUCL output of the ANOVA is provided in Table D-3 (Classical One-Way ANOVA) and Table D-4 (Nonparametric One-Way ANOVA [lead]).

2.4 Outliers in Combined Data Sets

Based on the results of the ANOVA, ERT performed an examination of the combined antimony and the combined manganese data set to evaluate potential outliers within the combined data sets. The results of the outlier tests showed potential upper tail outliers at all significance levels for antimony and manganese in the combined surface/subsurface soil. Outlier analysis was used to determine the appropriate statistic for the BTVs (see Section 2.7). The ProUCL output of the outlier evaluations is provided in Table D-5.

2.5 GOF in Combined Data Sets

Based on the results of the ANOVA, ERT performed an analysis of the GOF for the combined antimony and combined manganese data sets. The manganese combined data set appeared either gamma or lognormal at the 0.05 significance level. The antimony data do not follow a discernible distribution at the 0.05 significance level. The ProUCL output of the GOF evaluations is provided in Table D-6.

2.6 Background Threshold Values

To determine the background soil concentrations for comparison to site soil sampling results, ERT calculated the BTVs using the ProUCL, version 5.1, software.

For each analyte for which there were no potential outliers (copper in surface soil, lead in subsurface soil, nickel in surface and subsurface soil, and zinc in surface and subsurface soil), ERT selected the 95% upper simultaneous limit (USL) for the normal data distribution as the BTV. The use of the USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and many onsite observations need to be compared with the BTV.

The use of the USL may be inappropriate for background data sets that contain outliers. For all analytes for which there were potential outliers (antimony in the combined data, copper in subsurface soil, lead in surface soil, and manganese in the combined data), ERT selected the 95% upper threshold limit (UTL) with 95% coverage for the lognormal distribution as the BTV. The UTL was selected to cover the range of concentrations in the background population.

ProUCL outputs for the BTV analysis are provided in Tables D-7 through D-10. A summary of the ANOVA results, selected distributions, selected BTV statistic, and rationale for the selected BTV statistic is provided in Table D-11.

It should be noted that other data distributions and/or alternate upper limit statistics could have been selected for this analysis. However, the outcome of the analysis would not have been affected by these alternatives. Only the BTV for antimony (3.4 mg/kg) was greater than the lower of the USEPA Regional Screening Levels for Residential Soil and the Massachusetts Contingency Plan screening levels. All site soil sampling results were less than the lower of the USEPA Regional Screening Levels for Residential Soil and the Massachusetts Contingency Plan screening levels. Therefore, selecting the BTVs as the Project Screening Level (PSL) for any of the MC metals would not have been meaningful to evaluating the site sampling results. See Section 3.4.2 of the RI Report for the selected PSLs.

3.0 Analysis of Relative Standard Deviation, Relative Percent Difference, and 95% Upper Confidence Limit of the Mean

ERT calculated the ISM replicate sample RSDs and the discrete sample field duplicate RPDs as part of the evaluation of data precision.

ERT also calculated the 95% Upper Confidence Limit of the Mean (UCL) for ISM replicate samples. In accordance with the UFP-QAPP (Appendix Final E of the Final Work Plan, ERT, 2012), the method for calculating the UCL (Student's t or Chebyshev) is based on the calculated RSD.

This section presents the results of the RSD, RPD, and UCL calculations.

3.1 RSD Calculations and Results

ERT calculated the RSD for the replicate ISM soil samples collected at the Former Camp Wellfleet in accordance with the Interstate Technology Regulatory Council (ITRC) Incremental Sampling Methodology Technical and Regulatory Guidance (ITRC, 2012). The RSD reflects the total sum of field and laboratory error in the data (i.e., field sampling error, lab processing/subsampling error, and lab analysis error). The standard deviation is a well-known measure of the variation from the mean among a group of samples. The lower the standard deviation (i.e., the closer the replicate data are to the mean) the more precise the site data are as an estimate of average contaminant concentration in the SU under investigation. When the mean concentration of a contaminant reported for a set of ISM replicate samples is close to the PSLs, a lower standard deviation for the replicates provides stronger evidence that the true SU mean is less than the action level. A low standard deviation for soil sample data is achieved by minimizing error in sample collection, processing, and analysis to the extent feasible. The RSD represents the ratio of the standard deviation of the replicate set over the mean of the replicate set, expressed as a percentage:

$$RSD\ (\%) = \frac{replicate\ standard\ deviation}{replicate\ mean} * 100\%$$

An RSD less than 35% is considered to reflect good precision for estimates of the average (ITRC 2012). Good precision implies that the sampling method used, including the SU size, number, spacing, and size/shape of increments collected were adequate to capture and reflect small-scale heterogeneity of contaminant distribution within the SU and that error in the laboratory processing and analysis methods was low. Of the 114 calculated RSDs, eight (7%) were greater than 35% but less than 50%. All other RSDs were less than or equal to 35%. The calculated RSDs for site replicate samples are provided in Table D-12 and the calculated RSDs for background replicate samples are provided in Table D-13.

3.2 RPD Calculations and Results

ERT calculated the RPDs for the discrete subsurface soil samples collected from AOI1 (parent sample AOI1-SU2-SO04-8-10 and field duplicate Wellfleet-FD1). RPDs are calculated using the following equation:

$$RPD = \frac{|A - B|}{mean} * 100$$

Where:

A = result of parent sample

B = result of duplicate sample

mean = mean of parent and duplicate results

The RPDs for the detected metals in subsurface soil ranged from 6.06% to 15.79% and were less that the RPD quality control limit of 20%. The calculated RPD results for discrete subsurface soil sampling results are provided in Table D-14.

The majority (93%) of the RSD results were within project limits and no RSD results were greater than 50% and all RPDs were within project limits therefore, the RSD and RPD results indicate that there were no systematic field sampling and/or laboratory processing errors associated with the data. The demonstrated precision implies that the sampling method used, including the SU size, increment number, spacing, and size/shape of increments collected were adequate to capture and reflect small-scale heterogeneity of contaminant distribution within the SUs and that error in the laboratory processing and analysis methods was low.

3.3 95% Upper Confidence Limit of the Mean

To compare the site sampling results to the PSLs, ERT calculated the 95% UCL using the ITRC "ISM Calculator for 1-sided Upper Confidence Limit (UCL) for the Mean". Each replicate data set was entered into the ISM calculator with alpha = 0.05 and the calculated UCL was recorded in Table D-12. Details on calculation of the UCLs are provided in the UFP-QAPP (Appendix Final E of the Final Work Plan, ERT, 2012).

ERT selected the Chebychev UCL for all replicates even though the RSD results may have indicated that the Student's t method would have also been appropriate. The Chebychev method does not assume a normal distribution and provides a more conservative estimate of the 95% UCL for comparison to the PSLs than does the Student's t method.

No individual replicate, calculated mean, or calculated 95% UCL result was greater than the PSLs for site soil sampling.

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4.0 REFERENCES

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United States Environmental Protection Agency (USEPA), Office of Research and Development, 2015. *ProUCL Version 5.1.002 Technical Guide Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations*. October.

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Tables

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	A	B	C	D	E	F	G	H	I	J	K
1				Table D-1.	Outlier Tests by Horizon for Selected Uncensored Variables - All Site Data						
2				User Selected Options							
3	Date/Time of Computation			ProUCL 5.112/13/2018 1:55:18 PM							
4				From File	ProUCL_input.xls						
5				Full Precision	OFF						
6											
7											
8	Dixon's Outlier Test for Antimony (subsurface)										
9											
10	Number of Observations = 7										
11	10% critical value: 0.434										
12	5% critical value: 0.507										
13	1% critical value: 0.637										
14											
15	1. Observation Value 0.38 is a Potential Outlier (Upper Tail)?										
16											
17	Test Statistic: 0.174										
18											
19	For 10% significance level, 0.38 is not an outlier.										
20	For 5% significance level, 0.38 is not an outlier.										
21	For 1% significance level, 0.38 is not an outlier.										
22											
23	2. Observation Value 0.15 is a Potential Outlier (Lower Tail)?										
24											
25	Test Statistic: 0.087										
26											
27	For 10% significance level, 0.15 is not an outlier.										
28	For 5% significance level, 0.15 is not an outlier.										
29	For 1% significance level, 0.15 is not an outlier.										
30											
31											
32	Dixon's Outlier Test for Antimony (surface)										
33											
34	Number of Observations = 7										
35	10% critical value: 0.434										
36	5% critical value: 0.507										
37	1% critical value: 0.637										
38											
39	1. Observation Value 3.4 is a Potential Outlier (Upper Tail)?										
40											
41	Test Statistic: 0.914										
42											
43	For 10% significance level, 3.4 is an outlier.										
44	For 5% significance level, 3.4 is an outlier.										
45	For 1% significance level, 3.4 is an outlier.										
46											
47	2. Observation Value 0.16 is a Potential Outlier (Lower Tail)?										
48											
49	Test Statistic: 0.015										
50											
51	For 10% significance level, 0.16 is not an outlier.										
52	For 5% significance level, 0.16 is not an outlier.										

For 1% significance level, 0.16 is not an outlier.

Dixon's Outlier Test for Copper (subsurface)

Number of Observations = 7
10% critical value: 0.434
5% critical value: 0.507
1% critical value: 0.637

1. Observation Value 3 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.647

For 10% significance level, 3 is an outlier.
For 5% significance level, 3 is an outlier.
For 1% significance level, 3 is an outlier.

2. Observation Value 1.3 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.000

For 10% significance level, 1.3 is not an outlier.
For 5% significance level, 1.3 is not an outlier.
For 1% significance level, 1.3 is not an outlier.

Dixon's Outlier Test for Copper (surface)

Number of Observations = 7
10% critical value: 0.434
5% critical value: 0.507
1% critical value: 0.637

1. Observation Value 3.6 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.105

For 10% significance level, 3.6 is not an outlier.
For 5% significance level, 3.6 is not an outlier.
For 1% significance level, 3.6 is not an outlier.

2. Observation Value 1.7 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.368

For 10% significance level, 1.7 is not an outlier.
For 5% significance level, 1.7 is not an outlier.
For 1% significance level, 1.7 is not an outlier.

Dixon's Outlier Test for Lead (subsurface)

Number of Observations = 7
10% critical value: 0.434
5% critical value: 0.507
1% critical value: 0.637

1. Observation Value 4.1 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.286

For 10% significance level, 4.1 is not an outlier.
For 5% significance level, 4.1 is not an outlier.
For 1% significance level, 4.1 is not an outlier.

2. Observation Value 2.7 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.429

For 10% significance level, 2.7 is not an outlier.
For 5% significance level, 2.7 is not an outlier.
For 1% significance level, 2.7 is not an outlier.

Dixon's Outlier Test for Lead (surface)

Number of Observations = 7
10% critical value: 0.434
5% critical value: 0.507
1% critical value: 0.637

1. Observation Value 23.1 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.921

For 10% significance level, 23.1 is an outlier.
For 5% significance level, 23.1 is an outlier.
For 1% significance level, 23.1 is an outlier.

2. Observation Value 5.4 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.006

For 10% significance level, 5.4 is not an outlier.
For 5% significance level, 5.4 is not an outlier.
For 1% significance level, 5.4 is not an outlier.

Dixon's Outlier Test for Manganese (subsurface)

Number of Observations = 7
10% critical value: 0.434
5% critical value: 0.507

1% critical value: 0.637

1. Observation Value 83.2 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.425

For 10% significance level, 83.2 is not an outlier.
For 5% significance level, 83.2 is not an outlier.
For 1% significance level, 83.2 is not an outlier.

2. Observation Value 18.2 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.022

For 10% significance level, 18.2 is not an outlier.
For 5% significance level, 18.2 is not an outlier.
For 1% significance level, 18.2 is not an outlier.

Dixon's Outlier Test for Manganese (surface)

Number of Observations = 7
10% critical value: 0.434
5% critical value: 0.507
1% critical value: 0.637

1. Observation Value 35 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.637

For 10% significance level, 35 is an outlier.
For 5% significance level, 35 is an outlier.
For 1% significance level, 35 is an outlier.

2. Observation Value 7.7 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.121

For 10% significance level, 7.7 is not an outlier.
For 5% significance level, 7.7 is not an outlier.
For 1% significance level, 7.7 is not an outlier.

Dixon's Outlier Test for Nickel (subsurface)

Number of Observations = 7
10% critical value: 0.434
5% critical value: 0.507
1% critical value: 0.637

1. Observation Value 2.7 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.230

For 10% significance level, 2.7 is not an outlier.
For 5% significance level, 2.7 is not an outlier.
For 1% significance level, 2.7 is not an outlier.

2. Observation Value 1.7 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.300

For 10% significance level, 1.7 is not an outlier.
For 5% significance level, 1.7 is not an outlier.
For 1% significance level, 1.7 is not an outlier.

Dixon's Outlier Test for Nickel (surface)

Number of Observations = 7
10% critical value: 0.434
5% critical value: 0.507
1% critical value: 0.637

1. Observation Value 1.7 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.198

For 10% significance level, 1.7 is not an outlier.
For 5% significance level, 1.7 is not an outlier.
For 1% significance level, 1.7 is not an outlier.

2. Observation Value 0.69 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.188

For 10% significance level, 0.69 is not an outlier.
For 5% significance level, 0.69 is not an outlier.
For 1% significance level, 0.69 is not an outlier.

Dixon's Outlier Test for Zinc (subsurface)

Number of Observations = 7
10% critical value: 0.434
5% critical value: 0.507
1% critical value: 0.637

1. Observation Value 17 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.049

For 10% significance level, 17 is not an outlier.
For 5% significance level, 17 is not an outlier.

For 1% significance level, 17 is not an outlier.

2. Observation Value 6.7 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.029

For 10% significance level, 6.7 is not an outlier.
For 5% significance level, 6.7 is not an outlier.
For 1% significance level, 6.7 is not an outlier.

Dixon's Outlier Test for Zinc (surface)

Number of Observations = 7
10% critical value: 0.434
5% critical value: 0.507
1% critical value: 0.637

1. Observation Value 7.4 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.235

For 10% significance level, 7.4 is not an outlier.
For 5% significance level, 7.4 is not an outlier.
For 1% significance level, 7.4 is not an outlier.

2. Observation Value 5.7 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.412

For 10% significance level, 5.7 is not an outlier.
For 5% significance level, 5.7 is not an outlier.
For 1% significance level, 5.7 is not an outlier.

Table D-2. Goodness-of-Fit Test Statistics by Horizon for Full Site Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.112/19/2018 10:15:12 AM
From File	ProUCL_input.xls
Full Precision	OFF
Confidence Coefficient	0.95

Antimony (subsurface)

Raw Statistics	
Number of Valid Observations	7
Number of Distinct Observations	7
Minimum	0.15
Maximum	0.38
Mean of Raw Data	0.266
Standard Deviation of Raw Data	0.0879
Khat	9.762
Theta hat	0.0272
Kstar	5.673
Theta star	0.0468
Mean of Log Transformed Data	-1.377
Standard Deviation of Log Transformed Data	0.358
Normal GOF Test Results	
Correlation Coefficient R	0.981
Shapiro Wilk Test Statistic	0.941
Shapiro Wilk Critical (0.05) Value	0.803
Approximate Shapiro Wilk P Value	0.837
Lilliefors Test Statistic	0.16
Lilliefors Critical (0.05) Value	0.304
Data appear Normal at (0.05) Significance Level	
Gamma GOF Test Results	
Correlation Coefficient R	0.965
A-D Test Statistic	0.313
A-D Critical (0.05) Value	0.709
K-S Test Statistic	0.188
K-S Critical(0.05) Value	0.312
Data appear Gamma Distributed at (0.05) Significance Level	
Lognormal GOF Test Results	
Correlation Coefficient R	0.97
Shapiro Wilk Test Statistic	0.922
Shapiro Wilk Critical (0.05) Value	0.803
Approximate Shapiro Wilk P Value	0.664
Lilliefors Test Statistic	0.186
Lilliefors Critical (0.05) Value	0.304
Data appear Lognormal at (0.05) Significance Level	

Antimony (surface)	
Raw Statistics	
Number of Valid Observations	7
Number of Distinct Observations	7
Minimum	0.16
Maximum	3.4
Mean of Raw Data	0.724
Standard Deviation of Raw Data	1.183
Khat	0.907
Theta hat	0.798
Kstar	0.614
Theta star	1.18
Mean of Log Transformed Data	-0.966
Standard Deviation of Log Transformed Data	1.019
Normal GOF Test Results	
Correlation Coefficient R	0.705
Shapiro Wilk Test Statistic	0.526
Shapiro Wilk Critical (0.05) Value	0.803
Approximate Shapiro Wilk P Value	2.1890E-5
Lilliefors Test Statistic	0.452
Lilliefors Critical (0.05) Value	0.304
Data not Normal at (0.05) Significance Level	
Gamma GOF Test Results	
Correlation Coefficient R	0.906
A-D Test Statistic	1.227
A-D Critical (0.05) Value	0.731
K-S Test Statistic	0.386
K-S Critical(0.05) Value	0.321
Data not Gamma Distributed at (0.05) Significance Level	
Lognormal GOF Test Results	
Correlation Coefficient R	0.857
Shapiro Wilk Test Statistic	0.758
Shapiro Wilk Critical (0.05) Value	0.803
Approximate Shapiro Wilk P Value	0.00868
Lilliefors Test Statistic	0.3
Lilliefors Critical (0.05) Value	0.304
Data appear Approximate_Lognormal at (0.05) Significance Level	
Copper (subsurface)	
Raw Statistics	
Number of Valid Observations	7
Number of Distinct Observations	5
Minimum	1.3

	A–E	F
105	Maximum	3
106	Mean of Raw Data	1.814
107	Standard Deviation of Raw Data	0.573
108	Khat	13.86
109	Theta hat	0.131
110	Kstar	8.014
111	Theta star	0.226
112	Mean of Log Transformed Data	0.559
113	Standard Deviation of Log Transformed Data	0.282
114		
115	**Normal GOF Test Results**	
116		
117	Correlation Coefficient R	0.885
118	Shapiro Wilk Test Statistic	0.801
119	Shapiro Wilk Critical (0.05) Value	0.803
120	Approximate Shapiro Wilk P Value	0.028
121	Lilliefors Test Statistic	0.298
122	Lilliefors Critical (0.05) Value	0.304
123	**Data appear Approximate Normal at (0.05) Significance Level**	
124		
125	**Gamma GOF Test Results**	
126		
127	Correlation Coefficient R	0.923
128	A-D Test Statistic	0.541
129	A-D Critical (0.05) Value	0.708
130	K-S Test Statistic	0.254
131	K-S Critical(0.05) Value	0.312
132	**Data appear Gamma Distributed at (0.05) Significance Level**	
133		
134	**Lognormal GOF Test Results**	
135		
136	Correlation Coefficient R	0.927
137	Shapiro Wilk Test Statistic	0.871
138	Shapiro Wilk Critical (0.05) Value	0.803
139	Approximate Shapiro Wilk P Value	0.159
140	Lilliefors Test Statistic	0.242
141	Lilliefors Critical (0.05) Value	0.304
142	**Data appear Lognormal at (0.05) Significance Level**	
143		
144	**Copper (surface)**	
145		
146	**Raw Statistics**	
147	Number of Valid Observations	7
148	Number of Distinct Observations	7
149	Minimum	1.7
150	Maximum	3.6
151	Mean of Raw Data	2.833
152	Standard Deviation of Raw Data	0.677
153	Khat	18.05
154	Theta hat	0.157
155	Kstar	10.41
156	Theta star	0.272

	A–E	F
157	Mean of Log Transformed Data	1.013
158	Standard Deviation of Log Transformed Data	0.265
159		
160	**Normal GOF Test Results**	
161		
162	Correlation Coefficient R	0.965
163	Shapiro Wilk Test Statistic	0.926
164	Shapiro Wilk Critical (0.05) Value	0.803
165	Approximate Shapiro Wilk P Value	0.583
166	Lilliefors Test Statistic	0.225
167	Lilliefors Critical (0.05) Value	0.304
168	**Data appear Normal at (0.05) Significance Level**	
169		
170	**Gamma GOF Test Results**	
171		
172	Correlation Coefficient R	0.942
173	A-D Test Statistic	0.4
174	A-D Critical (0.05) Value	0.707
175	K-S Test Statistic	0.251
176	K-S Critical(0.05) Value	0.312
177	**Data appear Gamma Distributed at (0.05) Significance Level**	
178		
179	**Lognormal GOF Test Results**	
180		
181	Correlation Coefficient R	0.944
182	Shapiro Wilk Test Statistic	0.891
183	Shapiro Wilk Critical (0.05) Value	0.803
184	Approximate Shapiro Wilk P Value	0.295
185	Lilliefors Test Statistic	0.244
186	Lilliefors Critical (0.05) Value	0.304
187	**Data appear Lognormal at (0.05) Significance Level**	
188		
189	**Lead (subsurface)**	
190		
191	**Raw Statistics**	
192	Number of Valid Observations	7
193	Number of Distinct Observations	6
194	Minimum	2.7
195	Maximum	4.1
196	Mean of Raw Data	3.419
197	Standard Deviation of Raw Data	0.425
198	Khat	73.79
199	Theta hat	0.0463
200	Kstar	42.26
201	Theta star	0.0809
202	Mean of Log Transformed Data	1.222
203	Standard Deviation of Log Transformed Data	0.127
204		
205	**Normal GOF Test Results**	
206		
207	Correlation Coefficient R	0.951
208	Shapiro Wilk Test Statistic	0.931

	A–E	F
209	Shapiro Wilk Critical (0.05) Value	0.803
210	Approximate Shapiro Wilk P Value	0.377
211	Lilliefors Test Statistic	0.247
212	Lilliefors Critical (0.05) Value	0.304
213	**Data appear Normal at (0.05) Significance Level**	
214		
215	**Gamma GOF Test Results**	
216		
217	Correlation Coefficient R	0.953
218	A-D Test Statistic	0.418
219	A-D Critical (0.05) Value	0.708
220	K-S Test Statistic	0.254
221	K-S Critical(0.05) Value	0.311
222	**Data appear Gamma Distributed at (0.05) Significance Level**	
223		
224	**Lognormal GOF Test Results**	
225		
226	Correlation Coefficient R	0.944
227	Shapiro Wilk Test Statistic	0.919
228	Shapiro Wilk Critical (0.05) Value	0.803
229	Approximate Shapiro Wilk P Value	0.298
230	Lilliefors Test Statistic	0.268
231	Lilliefors Critical (0.05) Value	0.304
232	**Data appear Lognormal at (0.05) Significance Level**	
233		
234	**Lead (surface)**	
235		
236	**Raw Statistics**	
237	Number of Valid Observations	7
238	Number of Distinct Observations	7
239	Minimum	5.4
240	Maximum	23.1
241	Mean of Raw Data	8.357
242	Standard Deviation of Raw Data	6.52
243	Khat	3.36
244	Theta hat	2.487
245	Kstar	2.016
246	Theta star	4.146
247	Mean of Log Transformed Data	1.967
248	Standard Deviation of Log Transformed Data	0.524
249		
250	**Normal GOF Test Results**	
251		
252	Correlation Coefficient R	0.702
253	Shapiro Wilk Test Statistic	0.521
254	Shapiro Wilk Critical (0.05) Value	0.803
255	Approximate Shapiro Wilk P Value	1.9609E-5
256	Lilliefors Test Statistic	0.452
257	Lilliefors Critical (0.05) Value	0.304
258	**Data not Normal at (0.05) Significance Level**	
259		
260	**Gamma GOF Test Results**	

Correlation Coefficient R	0.828
A-D Test Statistic	1.573
A-D Critical (0.05) Value	0.711
K-S Test Statistic	0.428
K-S Critical(0.05) Value	0.313
Data not Gamma Distributed at (0.05) Significance Level	
Lognormal GOF Test Results	
Correlation Coefficient R	0.753
Shapiro Wilk Test Statistic	0.592
Shapiro Wilk Critical (0.05) Value	0.803
Approximate Shapiro Wilk P Value	1.2887E-4
Lilliefors Test Statistic	0.395
Lilliefors Critical (0.05) Value	0.304
Data not Lognormal at (0.05) Significance Level	
Non-parametric GOF Test Results	
Data do not follow a discernible distribution at (0.05) Level of Significanc	
Manganese (subsurface)	
Raw Statistics	
Number of Valid Observations	7
Number of Distinct Observations	7
Minimum	18.2
Maximum	83.2
Mean of Raw Data	35.51
Standard Deviation of Raw Data	24.8
Khat	3.101
Theta hat	11.45
Kstar	1.867
Theta star	19.02
Mean of Log Transformed Data	3.4
Standard Deviation of Log Transformed Data	0.595
Normal GOF Test Results	
Correlation Coefficient R	0.869
Shapiro Wilk Test Statistic	0.756
Shapiro Wilk Critical (0.05) Value	0.803
Approximate Shapiro Wilk P Value	0.014
Lilliefors Test Statistic	0.296
Lilliefors Critical (0.05) Value	0.304
Data appear Approximate Normal at (0.05) Significance Level	
Gamma GOF Test Results	
Correlation Coefficient R	0.956
A-D Test Statistic	0.752

A-D Critical (0.05) Value	0.712
K-S Test Statistic	0.315
K-S Critical(0.05) Value	0.314

Data not Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.911
Shapiro Wilk Test Statistic	0.819
Shapiro Wilk Critical (0.05) Value	0.803
Approximate Shapiro Wilk P Value	0.0792
Lilliefors Test Statistic	0.297
Lilliefors Critical (0.05) Value	0.304

Data appear Lognormal at (0.05) Significance Level

Manganese (surface)

Raw Statistics

Number of Valid Observations	7
Number of Distinct Observations	7
Minimum	7.7
Maximum	35
Mean of Raw Data	16.37
Standard Deviation of Raw Data	8.86
Khat	5.061
Theta hat	3.234
Kstar	2.987
Theta star	5.479
Mean of Log Transformed Data	2.693
Standard Deviation of Log Transformed Data	0.469

Normal GOF Test Results

Correlation Coefficient R	0.885
Shapiro Wilk Test Statistic	0.808
Shapiro Wilk Critical (0.05) Value	0.803
Approximate Shapiro Wilk P Value	0.0286
Lilliefors Test Statistic	0.302
Lilliefors Critical (0.05) Value	0.304

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.944
A-D Test Statistic	0.389
A-D Critical (0.05) Value	0.71
K-S Test Statistic	0.234
K-S Critical(0.05) Value	0.313

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

	A–E	F
365	Correlation Coefficient R	0.963
366	Shapiro Wilk Test Statistic	0.948
367	Shapiro Wilk Critical (0.05) Value	0.803
368	Approximate Shapiro Wilk P Value	0.561
369	Lilliefors Test Statistic	0.212
370	Lilliefors Critical (0.05) Value	0.304
371	**Data appear Lognormal at (0.05) Significance Level**	
372		
373	**Nickel (subsurface)**	
374		
375	**Raw Statistics**	
376	Number of Valid Observations	7
377	Number of Distinct Observations	6
378	Minimum	1.7
379	Maximum	2.7
380	Mean of Raw Data	2.181
381	Standard Deviation of Raw Data	0.324
382	Khat	52.97
383	Theta hat	0.0412
384	Kstar	30.36
385	Theta star	0.0718
386	Mean of Log Transformed Data	0.771
387	Standard Deviation of Log Transformed Data	0.149
388		
389	**Normal GOF Test Results**	
390		
391	Correlation Coefficient R	0.977
392	Shapiro Wilk Test Statistic	0.964
393	Shapiro Wilk Critical (0.05) Value	0.803
394	Approximate Shapiro Wilk P Value	0.791
395	Lilliefors Test Statistic	0.191
396	Lilliefors Critical (0.05) Value	0.304
397	**Data appear Normal at (0.05) Significance Level**	
398		
399	**Gamma GOF Test Results**	
400		
401	Correlation Coefficient R	0.981
402	A-D Test Statistic	0.25
403	A-D Critical (0.05) Value	0.708
404	K-S Test Statistic	0.171
405	K-S Critical(0.05) Value	0.311
406	**Data appear Gamma Distributed at (0.05) Significance Level**	
407		
408	**Lognormal GOF Test Results**	
409		
410	Correlation Coefficient R	0.979
411	Shapiro Wilk Test Statistic	0.968
412	Shapiro Wilk Critical (0.05) Value	0.803
413	Approximate Shapiro Wilk P Value	0.815
414	Lilliefors Test Statistic	0.166
415	Lilliefors Critical (0.05) Value	0.304
416	**Data appear Lognormal at (0.05) Significance Level**	

	A–E	F
417		
418	**Nickel (surface)**	
419		
420	**Raw Statistics**	
421	Number of Valid Observations	7
422	Number of Distinct Observations	6
423	Minimum	0.69
424	Maximum	1.7
425	Mean of Raw Data	1.167
426	Standard Deviation of Raw Data	0.391
427	Khat	10.32
428	Theta hat	0.113
429	Kstar	5.993
430	Theta star	0.195
431	Mean of Log Transformed Data	0.105
432	Standard Deviation of Log Transformed Data	0.341
433		
434	**Normal GOF Test Results**	
435		
436	Correlation Coefficient R	0.952
437	Shapiro Wilk Test Statistic	0.888
438	Shapiro Wilk Critical (0.05) Value	0.803
439	Approximate Shapiro Wilk P Value	0.375
440	Lilliefors Test Statistic	0.237
441	Lilliefors Critical (0.05) Value	0.304
442	**Data appear Normal at (0.05) Significance Level**	
443		
444	**Gamma GOF Test Results**	
445		
446	Correlation Coefficient R	0.95
447	A-D Test Statistic	0.464
448	A-D Critical (0.05) Value	0.708
449	K-S Test Statistic	0.256
450	K-S Critical(0.05) Value	0.312
451	**Data appear Gamma Distributed at (0.05) Significance Level**	
452		
453	**Lognormal GOF Test Results**	
454		
455	Correlation Coefficient R	0.96
456	Shapiro Wilk Test Statistic	0.906
457	Shapiro Wilk Critical (0.05) Value	0.803
458	Approximate Shapiro Wilk P Value	0.494
459	Lilliefors Test Statistic	0.239
460	Lilliefors Critical (0.05) Value	0.304
461	**Data appear Lognormal at (0.05) Significance Level**	
462		
463	**Zinc (subsurface)**	
464		
465	**Raw Statistics**	
466	Number of Valid Observations	7
467	Number of Distinct Observations	7
468	Minimum	6.7

Maximum	17
Mean of Raw Data	10.74
Standard Deviation of Raw Data	4.357
Khat	7.705
Theta hat	1.394
Kstar	4.498
Theta star	2.388
Mean of Log Transformed Data	2.308
Standard Deviation of Log Transformed Data	0.387

Normal GOF Test Results

Correlation Coefficient R	0.927
Shapiro Wilk Test Statistic	0.834
Shapiro Wilk Critical (0.05) Value	0.803
Approximate Shapiro Wilk P Value	0.149
Lilliefors Test Statistic	0.227
Lilliefors Critical (0.05) Value	0.304

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.948
A-D Test Statistic	0.491
A-D Critical (0.05) Value	0.709
K-S Test Statistic	0.21
K-S Critical(0.05) Value	0.312

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.952
Shapiro Wilk Test Statistic	0.879
Shapiro Wilk Critical (0.05) Value	0.803
Approximate Shapiro Wilk P Value	0.375
Lilliefors Test Statistic	0.186
Lilliefors Critical (0.05) Value	0.304

Data appear Lognormal at (0.05) Significance Level

Zinc (surface)

Raw Statistics

Number of Valid Observations	7
Number of Distinct Observations	6
Minimum	5.7
Maximum	7.4
Mean of Raw Data	6.657
Standard Deviation of Raw Data	0.535
Khat	174.9
Theta hat	0.0381
Kstar	100
Theta star	0.0665

	A	B	C	D	E	F	G	H	I	J	K	L
521	Mean of Log Transformed Data					1.893						
522	Standard Deviation of Log Transformed Data					0.0824						
523												
524	**Normal GOF Test Results**											
525												
526	Correlation Coefficient R					0.971						
527	Shapiro Wilk Test Statistic					0.959						
528	Shapiro Wilk Critical (0.05) Value					0.803						
529	Approximate Shapiro Wilk P Value					0.693						
530	Lilliefors Test Statistic					0.177						
531	Lilliefors Critical (0.05) Value					0.304						
532	**Data appear Normal at (0.05) Significance Level**											
533												
534	**Gamma GOF Test Results**											
535												
536	Correlation Coefficient R					0.969						
537	A-D Test Statistic					0.281						
538	A-D Critical (0.05) Value					0.708						
539	K-S Test Statistic					0.192						
540	K-S Critical(0.05) Value					0.311						
541	**Data appear Gamma Distributed at (0.05) Significance Level**											
542												
543	**Lognormal GOF Test Results**											
544												
545	Correlation Coefficient R					0.963						
546	Shapiro Wilk Test Statistic					0.944						
547	Shapiro Wilk Critical (0.05) Value					0.803						
548	Approximate Shapiro Wilk P Value					0.552						
549	Lilliefors Test Statistic					0.186						
550	Lilliefors Critical (0.05) Value					0.304						
551	**Data appear Lognormal at (0.05) Significance Level**											

Table D-3. Classical Oneway ANOVA Complete Site Data

Date/Time of Computation	ProUCL 5.112/19/2018 10:22:39 AM
From File	ProUCL_input.xls
Full Precision	OFF

Antimony

Group	Obs	Mean	SD	Variance
surface	7	0.724	1.183	1.4
subsurface	7	0.266	0.0879	0.00773
Grand Statistics (All data)	14	0.495	0.841	0.707

Classical One-Way Analysis of Variance Table

Source	SS	DOF	MS	V.R.(F Stat)	P-Value
Between Groups	0.736	1	0.736	1.045	0.327
Within Groups	8.449	12	0.704		
Total	9.185	13			

Pooled Standard Deviation	0.839
R-Sq	0.0801

Note: A p-value <= 0.05 (or some other selected level) suggests that there are significant differences in mean/median characteristics of the various groups at 0.05 or other selected level of significance

A p-value > 0.05 (or other selected level) suggests that mean/median characteristics of the various groups are comparable.

Copper

Group	Obs	Mean	SD	Variance
surface	7	2.833	0.677	0.458
subsurface	7	1.814	0.573	0.328
Grand Statistics (All data)	14	2.324	0.801	0.642

Classical One-Way Analysis of Variance Table

Source	SS	DOF	MS	V.R.(F Stat)	P-Value
Between Groups	3.631	1	3.631	9.236	0.0103
Within Groups	4.718	12	0.393		
Total	8.349	13			

Pooled Standard Deviation	0.627
R-Sq	0.435

Note: A p-value <= 0.05 (or some other selected level) suggests that there are significant differences in mean/median characteristics of the various groups at 0.05 or other selected level of significance

A p-value > 0.05 (or other selected level) suggests that mean/median characteristics of the various groups are comparable.

Manganese

Group	Obs	Mean	SD	Variance
surface	7	16.37	8.86	78.5

Group	Obs	Mean	SD	Variance
subsurface	7	35.51	24.8	614.9
Grand Statistics (All data)	14	25.94	20.46	418.8

Classical One-Way Analysis of Variance Table

Source	SS	DOF	MS	V.R.(F Stat)	P-Value
Between Groups	1283	1	1283	3.701	0.0784
Within Groups	4161	12	346.7		
Total	5444	13			

Pooled Standard Deviation	18.62
R-Sq	0.236

Note: A p-value <= 0.05 (or some other selected level) suggests that there are significant differences in mean/median characteristics of the various groups at 0.05 or other selected level of significance

A p-value > 0.05 (or other selected level) suggests that mean/median characteristics of the various groups are comparable.

Nickel

Group	Obs	Mean	SD	Variance
surface	7	1.167	0.391	0.152
subsurface	7	2.181	0.324	0.105
Grand Statistics (All data)	14	1.674	0.629	0.396

Classical One-Way Analysis of Variance Table

Source	SS	DOF	MS	V.R.(F Stat)	P-Value
Between Groups	3.601	1	3.601	27.96	1.9219E-4
Within Groups	1.545	12	0.129		
Total	5.146	13			

Pooled Standard Deviation	0.359
R-Sq	0.7

Note: A p-value <= 0.05 (or some other selected level) suggests that there are significant differences in mean/median characteristics of the various groups at 0.05 or other selected level of significance

A p-value > 0.05 (or other selected level) suggests that mean/median characteristics of the various groups are comparable.

Zinc

Group	Obs	Mean	SD	Variance
surface	7	6.657	0.535	0.286
subsurface	7	10.74	4.357	18.98
Grand Statistics (All data)	14	8.7	3.659	13.39

Classical One-Way Analysis of Variance Table

Source	SS	DOF	MS	V.R.(F Stat)	P-Value
Between Groups	58.43	1	58.43	6.064	0.0299
Within Groups	115.6	12	9.635		
Total	174	13			

Pooled Standard Deviation	3.104

	A	B	C	D	E	F	G	H	I	J	K	L
105			R-Sq	0.336								
106												
107	Note: A p-value <= 0.05 (or some other selected level) suggests that there are significant differences in											
108	mean/median characteristics of the various groups at 0.05 or other selected level of significance											
109	A p-value > 0.05 (or other selected level) suggests that mean/median characteristics of the various groups are comparable.											
110												

Table D-4. Nonparametric Oneway ANOVA (Kruskal-Wallis Test) for Lead

Date/Time of Computation	ProUCL 5.112/19/2018 10:28:57 AM
From File	ProUCL_input.xls
Full Precision	OFF

Lead

Group	Obs	Median	Ave Rank	Z
subsurface	7	3.4	4	-3.13
surface	7	5.8	11	3.13
Overall	14	4.75	7.5	

K-W (H-Stat)	DOF	P-Value	(Approx. Chisquare)
9.8	1	0.00175	
9.822	1	0.00172	(Adjusted for Ties)

Note: A p-value <= 0.05 (or some other selected level) suggests that there are significant differences in mean/median characteristics of the various groups at 0.05 or other selected level of significance

A p-value > 0.05 (or other selected level) suggests that mean/median characteristics of the various groups are comparabl

Table D-5. Outlier Tests for Combined Surface and Subsurface Sampling Results for Antimony and Mangan											
User Selected Options											
Date/Time of Computation			ProUCL 5.112/19/2018 10:32:20 AM								
From File				ProUCL_input.xls							
Full Precision				OFF							
Dixon's Outlier Test for Antimony											
Number of Observations = 14											
10% critical value: 0.492											
5% critical value: 0.546											
1% critical value: 0.641											
1. Observation Value 3.4 is a Potential Outlier (Upper Tail)?											
Test Statistic: 0.935											
For 10% significance level, 3.4 is an outlier.											
For 5% significance level, 3.4 is an outlier.											
For 1% significance level, 3.4 is an outlier.											
2. Observation Value 0.15 is a Potential Outlier (Lower Tail)?											
Test Statistic: 0.087											
For 10% significance level, 0.15 is not an outlier.											
For 5% significance level, 0.15 is not an outlier.											
For 1% significance level, 0.15 is not an outlier.											
Dixon's Outlier Test for Manganese											
Number of Observations = 14											
10% critical value: 0.492											
5% critical value: 0.546											
1% critical value: 0.641											
1. Observation Value 83.2 is a Potential Outlier (Upper Tail)											
Test Statistic: 0.688											
For 10% significance level, 83.2 is an outlier.											
For 5% significance level, 83.2 is an outlier.											
For 1% significance level, 83.2 is an outlier.											
2. Observation Value 7.7 is a Potential Outlier (Lower Tail)?											
Test Statistic: 0.198											
For 10% significance level, 7.7 is not an outlier.											
For 5% significance level, 7.7 is not an outlier.											

	A	B	C	D	E	F	G	H	I	J	K	L
53	For 1% significance level, 7.7 is not an outlier.											
54												

		Table D-6.	Goodness-of-Fit Test Statistics for Combined Surface and Subsurface Soil Data for Antimony and Manganese								
		User Selected Options									
		Date/Time of Computation	ProUCL 5.112/19/2018 10:34:16 AM								
		From File	ProUCL_input.xls								
		Full Precision	OFF								
		Confidence Coefficient	0.95								
Antimony											
			Raw Statistics								
				Number of Valid Observations	14						
				Number of Distinct Observations	13						
				Minimum	0.15						
				Maximum	3.4						
				Mean of Raw Data	0.495						
				Standard Deviation of Raw Data	0.841						
				Khat	1.206						
				Theta hat	0.41						
				Kstar	0.995						
				Theta star	0.497						
				Mean of Log Transformed Data	-1.172						
				Standard Deviation of Log Transformed Data	0.764						
			Normal GOF Test Results								
				Correlation Coefficient R	0.599						
				Shapiro Wilk Test Statistic	0.391						
				Shapiro Wilk Critical (0.05) Value	0.874						
				Approximate Shapiro Wilk P Value	1.1913E-7						
				Lilliefors Test Statistic	0.455						
				Lilliefors Critical (0.05) Value	0.226						
Data not Normal at (0.05) Significance Level											
			Gamma GOF Test Results								
				Correlation Coefficient R	0.792						
				A-D Test Statistic	2.356						
				A-D Critical (0.05) Value	0.756						
				K-S Test Statistic	0.356						
				K-S Critical(0.05) Value	0.234						
Data not Gamma Distributed at (0.05) Significance Level											
			Lognormal GOF Test Results								
				Correlation Coefficient R	0.83						
				Shapiro Wilk Test Statistic	0.717						
				Shapiro Wilk Critical (0.05) Value	0.874						
				Approximate Shapiro Wilk P Value	2.7655E-4						
				Lilliefors Test Statistic	0.252						
				Lilliefors Critical (0.05) Value	0.226						

Data not Lognormal at (0.05) Significance Level	
Non-parametric GOF Test Results	
Data do not follow a discernible distribution at (0.05) Level of Significanc	
Manganese	
Raw Statistics	
Number of Valid Observations	14
Number of Distinct Observations	14
Minimum	7.7
Maximum	83.2
Mean of Raw Data	25.94
Standard Deviation of Raw Data	20.46
Khat	2.545
Theta hat	10.19
Kstar	2.047
Theta star	12.67
Mean of Log Transformed Data	3.047
Standard Deviation of Log Transformed Data	0.632
Normal GOF Test Results	
Correlation Coefficient R	0.854
Shapiro Wilk Test Statistic	0.744
Shapiro Wilk Critical (0.05) Value	0.874
Approximate Shapiro Wilk P Value	6.9832E-4
Lilliefors Test Statistic	0.31
Lilliefors Critical (0.05) Value	0.226
Data not Normal at (0.05) Significance Level	
Gamma GOF Test Results	
Correlation Coefficient R	0.952
A-D Test Statistic	0.69
A-D Critical (0.05) Value	0.744
K-S Test Statistic	0.259
K-S Critical(0.05) Value	0.231
Data follow Appr. Gamma Distribution at (0.05) Significance Level	
Lognormal GOF Test Results	
Correlation Coefficient R	0.97
Shapiro Wilk Test Statistic	0.947
Shapiro Wilk Critical (0.05) Value	0.874
Approximate Shapiro Wilk P Value	0.453
Lilliefors Test Statistic	0.216
Lilliefors Critical (0.05) Value	0.226
Data appear Lognormal at (0.05) Significance Level	

	A	B	C	D	E	F	G	H	I	J	K	L
1			Table D-7.	Nonparametric Background Statistics for Combined Surface and Subsurface Soil Antimony								
2		User Selected Options										
3		Date/Time of Computation		ProUCL 5.112/19/2018 10:43:18 AM								
4			From File	ProUCL_input.xls								
5			Full Precision	OFF								
6		Confidence Coefficient		95%								
7			Coverage	95%								
8	Number of Bootstrap Operations			2000								
9												
10	Antimony											
11												
12	General Statistics											
13			Total Number of Observations			14			Number of Distinct Observations			13
14					Minimum	0.15					First Quartile	0.213
15					Second Largest	0.44					Median	0.275
16					Maximum	3.4					Third Quartile	0.34
17					Mean	0.495					SD	0.841
18				Coefficient of Variation		1.698					Skewness	3.673
19				Mean of logged Data		-1.172					SD of logged Data	0.764
20												
21					Critical Values for Background Threshold Values (BTVs)							
22			Tolerance Factor K (For UTL)			2.614					d2max (for USL)	2.372
23												
24					Nonparametric Distribution Free Background Statistics							
25					Data do not follow a Discernible Distribution (0.05)							
26												
27					Nonparametric Upper Limits for Background Threshold Values							
28					Order of Statistic, r	14				95% UTL with	95% Coverage	3.4
29			Approx, f used to compute achieved CC			0.737	Approximate Actual Confidence Coefficient achieved by UTL					0.512
30							Approximate Sample Size needed to achieve specified CC					59
31		95% Percentile Bootstrap UTL with			95% Coverage	**3.4**			95% BCA Bootstrap UTL with		95% Coverage	3.4
32					95% UPL	3.4					90% Percentile	0.422
33					90% Chebyshev UPL	3.105					95% Percentile	1.476
34					95% Chebyshev UPL	4.287					99% Percentile	3.015
35					95% USL	3.4						
36												
37		Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.										
38		Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers										
39				and consists of observations collected from clean unimpacted locations.								
40			The use of USL tends to provide a balance between false positives and false negatives provided the data									
41			represents a background data set and when many onsite observations need to be compared with the BTV.									
42												

Table D-8. Normal Background Statistics by Horizon for Copper, Nickel, and Zinc

User Selected Options	
Date/Time of Computation	ProUCL 5.112/19/2018 10:42:43 AM
From File	ProUCL_input.xls
Full Precision	OFF
Confidence Coefficient	95%
Coverage	95%
New or Future K Observations	1

Copper (subsurface)

General Statistics

Total Number of Observations	7	Number of Distinct Observations	5
Minimum	1.3	First Quartile	1.5
Second Largest	1.9	Median	1.7
Maximum	3	Third Quartile	1.85
Mean	1.814	SD	0.573
Coefficient of Variation	0.316	Skewness	1.729
Mean of logged Data	0.559	SD of logged Data	0.282

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.399	d2max (for USL)	1.938

Normal GOF Test

Shapiro Wilk Test Statistic	0.801	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.298	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	**3.761**	90% Percentile (z)	2.548
95% UPL (t)	3.004	95% Percentile (z)	2.756
95% USL	2.924	99% Percentile (z)	3.147

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Copper (surface)

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
Minimum	1.7	First Quartile	2.415
Second Largest	3.4	Median	3.1
Maximum	3.6	Third Quartile	3.3
Mean	2.833	SD	0.677
Coefficient of Variation	0.239	Skewness	-0.675
Mean of logged Data	1.013	SD of logged Data	0.265

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.399	d2max (for USL)	1.938

Normal GOF Test

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.225	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	5.134	90% Percentile (z)	3.7
95% UPL (t)	4.239	95% Percentile (z)	3.946
95% USL	**4.145**	99% Percentile (z)	4.408

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Nickel (subsurface)

General Statistics

Total Number of Observations	7	Number of Distinct Observations	6
Minimum	1.7	First Quartile	2.05
Second Largest	2.47	Median	2.1
Maximum	2.7	Third Quartile	2.335
Mean	2.181	SD	0.324
Coefficient of Variation	0.149	Skewness	0.307
Mean of logged Data	0.771	SD of logged Data	0.149

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.399	d2max (for USL)	1.938

Normal GOF Test

Shapiro Wilk Test Statistic	0.964	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.191	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	3.283	90% Percentile (z)	2.597
95% UPL (t)	2.855	95% Percentile (z)	2.715
95% USL	**2.81**	99% Percentile (z)	2.936

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data

represents a background data set and when many onsite observations need to be compared with the BTV.

Nickel (surface)

General Statistics

Total Number of Observations	7	Number of Distinct Observations	6
Minimum	0.69	First Quartile	0.89
Second Largest	1.5	Median	1
Maximum	1.7	Third Quartile	1.5
Mean	1.167	SD	0.391
Coefficient of Variation	0.335	Skewness	0.27
Mean of logged Data	0.105	SD of logged Data	0.341

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.399	d2max (for USL)	1.938

Normal GOF Test

Shapiro Wilk Test Statistic	0.888	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.237	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	2.494	90% Percentile (z)	1.668
95% UPL (t)	1.978	95% Percentile (z)	1.809
95% USL	**1.924**	99% Percentile (z)	2.076

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Zinc (subsurface)

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
Minimum	6.7	First Quartile	7.45
Second Largest	16.5	Median	9
Maximum	17	Third Quartile	13.8
Mean	10.74	SD	4.357
Coefficient of Variation	0.406	Skewness	0.815
Mean of logged Data	2.308	SD of logged Data	0.387

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.399	d2max (for USL)	1.938

Normal GOF Test

Shapiro Wilk Test Statistic	0.834	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.227	**Lilliefors GOF Test**

5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	25.55	90% Percentile (z)	16.33
95% UPL (t)	19.79	95% Percentile (z)	17.91
95% USL	**19.19**	99% Percentile (z)	20.88

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Zinc (surface)

General Statistics

Total Number of Observations	7	Number of Distinct Observations	6
Minimum	5.7	First Quartile	6.45
Second Largest	7	Median	6.8
Maximum	7.4	Third Quartile	6.9
Mean	6.657	SD	0.535
Coefficient of Variation	0.0804	Skewness	-0.673
Mean of logged Data	1.893	SD of logged Data	0.0824

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	3.399	d2max (for USL)	1.938

Normal GOF Test

Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.177	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	8.475	90% Percentile (z)	7.343
95% UPL (t)	7.768	95% Percentile (z)	7.537
95% USL	**7.694**	99% Percentile (z)	7.902

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

Table D-9.	Background Statistics by Horizon for Lead		
User Selected Options			
Date/Time of Computation	ProUCL 5.112/19/2018 10:44:14 AM		
From File	N:\Projects_Ongoing\3752-Camp Wellfleet\05_RI Report\DRAFT__REV Draft\Revised Appendices\Appendix D		
Full Precision	OFF		
Confidence Coefficient	95%		
Coverage	95%		
New or Future K Observations	1		
Number of Bootstrap Operations	2000		
Lead (subsurface)			
General Statistics			
Total Number of Observations	7	Number of Distinct Observations	6
Minimum	2.7	First Quartile	3.315
Second Largest	3.7	Median	3.4
Maximum	4.1	Third Quartile	3.55
Mean	3.419	SD	0.425
Coefficient of Variation	0.124	Skewness	-0.106
Mean of logged Data	1.222	SD of logged Data	0.127
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	3.399	d2max (for USL)	1.938
Normal GOF Test			
Shapiro Wilk Test Statistic	0.931	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.247	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level	
Data appear Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	4.862	90% Percentile (z)	3.963
95% UPL (t)	4.301	95% Percentile (z)	4.117
95% USL	**4.242**	99% Percentile (z)	4.407
Gamma GOF Test			
A-D Test Statistic	0.418	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.708	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.254	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.311	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	73.79	k star (bias corrected MLE)	42.26
Theta hat (MLE)	0.0463	Theta star (bias corrected MLE)	0.0809
nu hat (MLE)	1033	nu star (bias corrected)	591.6
MLE Mean (bias corrected)	3.419	MLE Sd (bias corrected)	0.526
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	4.373	90% Percentile	4.107
95% Hawkins Wixley (HW) Approx. Gamma UPL	4.384	95% Percentile	4.327

95% WH Approx. Gamma UTL with 95% Coverage	5.078	99% Percentile	4.759
95% HW Approx. Gamma UTL with 95% Coverage	5.112		
95% WH USL	4.303	95% HW USL	4.312
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.268	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	5.227	90% Percentile (z)	3.995
95% UPL (t)	4.42	95% Percentile (z)	4.184
95% USL	4.342	99% Percentile (z)	4.562
Nonparametric Distribution Free Background Statistics			
Data appear Normal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	7	95% UTL with 95% Coverage	4.1
Approx, f used to compute achieved CC	0.368	Approximate Actual Confidence Coefficient achieved by UTL	0.302
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	4.1	95% BCA Bootstrap UTL with 95% Coverage	4.1
95% UPL	4.1	90% Percentile	3.86
90% Chebyshev UPL	4.781	95% Percentile	3.98
95% Chebyshev UPL	5.398	99% Percentile	4.076
95% USL	4.1		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
Lead (surface)			
General Statistics			
Total Number of Observations	7	Number of Distinct Observations	7
Minimum	5.4	First Quartile	5.55
Second Largest	6.8	Median	5.8
Maximum	23.1	Third Quartile	6.55
Mean	8.357	SD	6.52
Coefficient of Variation	0.78	Skewness	2.614
Mean of logged Data	1.967	SD of logged Data	0.524
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	3.399	d2max (for USL)	1.938
Normal GOF Test			
Shapiro Wilk Test Statistic	0.521	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data Not Normal at 5% Significance Level	

Lilliefors Test Statistic	0.452	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	30.52	90% Percentile (z)	16.71
95% UPL (t)	21.9	95% Percentile (z)	19.08
95% USL	20.99	99% Percentile (z)	23.52
Gamma GOF Test			
A-D Test Statistic	1.573	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.711	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.428	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.313	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	3.36	k star (bias corrected MLE)	2.016
Theta hat (MLE)	2.487	Theta star (bias corrected MLE)	4.146
nu hat (MLE)	47.05	nu star (bias corrected)	28.22
MLE Mean (bias corrected)	8.357	MLE Sd (bias corrected)	5.887
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	21.47	90% Percentile	16.22
95% Hawkins Wixley (HW) Approx. Gamma UPL	21.41	95% Percentile	19.77
95% WH Approx. Gamma UTL with 95% Coverage	36.08	99% Percentile	27.65
95% HW Approx. Gamma UTL with 95% Coverage	37.28		
95% WH USL	20.22	95% HW USL	20.1
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.592	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.395	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.304	Data Not Lognormal at 5% Significance Level	
Data Not Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	42.38	90% Percentile (z)	13.99
95% UPL (t)	21.21	95% Percentile (z)	16.92
95% USL	19.72	99% Percentile (z)	24.17
Nonparametric Distribution Free Background Statistics			
Data do not follow a Discernible Distribution (0.05)			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	7	95% UTL with 95% Coverage	23.1
Approx, f used to compute achieved CC	0.368	Approximate Actual Confidence Coefficient achieved by UTL	0.302
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	**23.1**	95% BCA Bootstrap UTL with 95% Coverage	23.1
95% UPL	23.1	90% Percentile	13.32
90% Chebyshev UPL	29.27	95% Percentile	18.21
95% Chebyshev UPL	38.74	99% Percentile	22.12

	A	B	C	D	E	F	G	H	I	J	K	L
157					95% USL	23.1						
158												
159	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
160	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
161	and consists of observations collected from clean unimpacted locations.											
162	The use of USL tends to provide a balance between false positives and false negatives provided the data											
163	represents a background data set and when many onsite observations need to be compared with the BTV.											
164												

	A	B	C	D	E	F	G	H	I	J	K	L
1			Table D-10.	Lognormal Background Statistics for Combined Surface and Subsurface Soil Manganese								
2			User Selected Options									
3			Date/Time of Computation	ProUCL 5.112/19/2018 10:47:27 AM								
4			From File	ProUCL_input.xls								
5			Full Precision	OFF								
6			Confidence Coefficient	95%								
7			Coverage	95%								
8			New or Future K Observations	1								
9			Number of Bootstrap Operations	2000								
10												
11	Manganese											
12												
13	General Statistics											
14					Total Number of Observations	14					Number of Distinct Observations	14
15					Minimum	7.7					First Quartile	14.34
16					Second Largest	55.6					Median	18.9
17					Maximum	83.2					Third Quartile	28.05
18					Mean	25.94					SD	20.46
19					Coefficient of Variation	0.789					Skewness	2.083
20					Mean of logged Data	3.047					SD of logged Data	0.632
21												
22					Critical Values for Background Threshold Values (BTVs)							
23					Tolerance Factor K (For UTL)	2.614					d2max (for USL)	2.372
24												
25						Lognormal GOF Test						
26					Shapiro Wilk Test Statistic	0.947		Shapiro Wilk Lognormal GOF Test				
27					5% Shapiro Wilk Critical Value	0.874		Data appear Lognormal at 5% Significance Level				
28					Lilliefors Test Statistic	0.216		Lilliefors Lognormal GOF Test				
29					5% Lilliefors Critical Value	0.226		Data appear Lognormal at 5% Significance Level				
30					Data appear Lognormal at 5% Significance Level							
31												
32					Background Statistics assuming Lognormal Distribution							
33					95% UTL with 95% Coverage	109.8					90% Percentile (z)	47.3
34					95% UPL (t)	67.02					95% Percentile (z)	59.5
35					95% USL	94.18					99% Percentile (z)	91.52
36												
37	Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.											
38	Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers											
39	and consists of observations collected from clean unimpacted locations.											
40	The use of USL tends to provide a balance between false positives and false negatives provided the data											
41	represents a background data set and when many onsite observations need to be compared with the BTV.											
42												

Table D-11. Summary of Statistical Analysis of Background Threshold Values

Analyte	ANOVA Results	Horizon	Distribution	Selected BTV Statistic	BTV (mg/kg)	Rationale
Antimony	Similar	Data Combined	Normal	95% UTL with 95% Coverage	3.4	Data set may contain outlier therefore, use of USL is not indicated. UTL selected to cover background population.
Copper	Not Similar	Surface	Normal	95% USL	4.145	Data set is free of outliers. The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.
		Subsurface	Normal	95% UTL with 95% Coverage	3.76	Data set may contain outlier therefore, use of USL is not indicated. UTL selected to cover background population.
Lead	Not Similar	Surface	Non-Parametric	95% UTL with 95% Coverage	23.1	Data set may contain outlier therefore, use of USL is not indicated. UTL selected to cover background population.
		Subsurface	Normal	USL	4.242	Data set is free of outliers. The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.
Manganese	Similar	Data Combined	Lognormal	95% UTL with 95% Coverage	109.8	Data set may contain outlier therefore, use of USL is not indicated. UTL selected to cover background population.
Nickel	Not Similar	Surface	Normal	95% USL	1.924	Data sets are free of outliers. The use of USL tends to provide a balance between
		Subsurface	Normal	95% USL	2.81	false positives and false negatives provided the data represents a background data set
Zinc	Not Similar	Surface	Normal	95% USL	7.694	Data sets are free of outliers. The use of USL tends to provide a balance between
		Subsurface	Normal	95% USL	19.19	false positives and false negatives provided the data represents a background data set

mg/kg - milligrams per kilogram
USL - upper simultaneous limit
UTL - upper threshold limit

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI1-SU1-SA-REP1	AOI1-SU1-SA-REP2	AOI1-SU1-SA-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	0.17	ND	0.19	0.18	NC	NC	NC
	Copper	310	NS	310	35	mg/kg	3.00	6.00	8.40	5.80	2.71	46.65	12.61
	Lead	400	200	200	35	mg/kg	6.50	9.00	10.70	8.73	2.11	24.19	14.04
	Manganese	180	NS	180	35	mg/kg	15.50	10.50	11.50	12.50	2.65	21.17	19.16
	Nickel	150	600	150	35	mg/kg	0.89	0.68	0.94	0.84	0.14	16.49	1.18
	Zinc	2300	1,000	1,000	35	mg/kg	20.00	16.50	14.90	17.13	2.61	15.22	23.70
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	0.87	0.89	0.50	0.75	0.22	29.15	1.31

UCL results were calculated using the ITRC ISM Calculator for 1-sided
Upper Confidence Limit (UCL) for the Mean.
https://www.itrcweb.org/ISM-1/documents/Calculate_95UCL_for_ISM.xls
ND - not detected
NC - not calculated - SDs, RSDs, and UCLs are calcuated only when
there are three or more detected results.
mg/kg - milligrams per kilogram
UCL - 95% upper confidence limit of the mean (Chebychev method)
RSL - USEPA Residential Screening Level for Soil, November 2017
MCP - S-1 & GW-1 Massachusetts Contingency Plan table 2,
310 CMR 40.0975(6)(a); used for screening potential impacts to groundwater.
PSL - project screening level (lowest value of RSL and MCP)
RSD - Relative Standard Deviation (percent)
SD - Standard Deviation
Highlighted RSD values are greater than the RSD QC limit.
No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI1-SU2-SA-REP1	AOI1-SU2-SA-REP2	AOI1-SU2-SA-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	0.16	0.15	0.14	0.15	0.01	6.67	0.18
	Copper	310	NS	310	35	mg/kg	1.60	3.10	2.50	2.40	0.75	31.46	4.30
	Lead	400	200	200	35	mg/kg	5.00	6.00	8.30	6.43	1.69	26.30	10.69
	Manganese	180	NS	180	35	mg/kg	10.50	14.80	12.70	12.67	2.15	16.98	18.08
	Nickel	150	600	150	35	mg/kg	0.62	0.64	0.68	0.65	0.03	4.72	0.72
	Zinc	2300	1,000	1,000	35	mg/kg	8.60	9.90	7.70	8.73	1.11	12.66	11.52
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	ND	ND	0.71	NC	NC	NC	NC

UCL results were calculated using the ITRC ISM Calculator for 1-sided
Upper Confidence Limit (UCL) for the Mean.
https://www.itrcweb.org/ISM-1/documents/Calculate_95UCL_for_ISM.xls

ND - not detected

NC - not calculated - SDs, RSDs, and UCLs are calcuated only when there are three or more detected results.

mg/kg - milligrams per kilogram

UCL - 95% upper confidence limit of the mean (Chebychev method)

RSL - USEPA Residential Screening Level for Soil, November 2017

MCP - S-1 & GW-1 Massachusetts Contingency Plan table 2, 310 CMR 40.0975(6)(a); used for screening potential impacts to groundwater.

PSL - project screening level (lowest value of RSL and MCP)

RSD - Relative Standard Deviation (percent)

SD - Standard Deviation

Highlighted RSD values are greater than the RSD QC limit.

No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI1-SU3-SA-REP1	AOI1-SU3-SA-REP2	AOI1-SU3-SA-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	ND	0.15	0.15	NC	NC	NC	NC
	Copper	310	NS	310	35	mg/kg	0.76	0.88	0.88	0.84	0.07	8.25	1.01
	Lead	400	200	200	35	mg/kg	4.10	5.30	5.60	5.00	0.79	15.87	7.00
	Manganese	180	NS	180	35	mg/kg	13.30	13.40	13.10	13.27	0.15	1.15	13.65
	Nickel	150	600	150	35	mg/kg	0.78	0.77	0.70	0.75	0.04	5.81	0.86
	Zinc	2300	1,000	1,000	35	mg/kg	7.50	7.70	7.70	7.63	0.12	1.51	7.92
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	0.69	0.55	0.63	0.62	0.07	11.27	0.80

UCL results were calculated using the ITRC ISM Calculator for 1-sided Upper Confidence Limit (UCL) for the Mean. https://www.itrcweb.org/ISM-1/documents/Calculate_95UCL_for_ISM.xls

ND - not detected

NC - not calculated - SDs, RSDs, and UCLs are calcuated only when there are three or more detected results.

mg/kg - milligrams per kilogram

UCL - 95% upper confidence limit of the mean (Chebychev method)

RSL - USEPA Residential Screening Level for Soil, November 2017

MCP - S-1 & GW-1 Massachusetts Contingency Plan table 2, 310 CMR 40.0975(6)(a); used for screening potential impacts to groundwater.

PSL - project screening level (lowest value of RSL and MCP)

RSD - Relative Standard Deviation (percent)

SD - Standard Deviation

Highlighted RSD values are greater than the RSD QC limit.

No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI2-SU1-SA-REP1	AOI2-SU1-SA-REP2	AOI2-SU1-SA-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	ND	ND	ND	NC	NC	NC	NC
	Copper	310	NS	310	35	mg/kg	0.71	0.58	0.95	0.75	0.19	25.14	1.22
	Lead	400	200	200	35	mg/kg	3.00	2.50	2.20	2.57	0.40	15.75	3.58
	Manganese	180	NS	180	35	mg/kg	9.20	8.90	9.60	9.23	0.35	3.80	10.12
	Nickel	150	600	150	35	mg/kg	0.37	0.42	0.47	0.42	0.05	11.90	0.55
	Zinc	2300	1,000	1,000	35	mg/kg	1.90	1.70	1.50	1.70	0.20	11.76	2.50
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	ND	ND	0.46	NC	NC	NC	NC

UCL results were calculated using the ITRC ISM Calculator for 1-sided
Upper Confidence Limit (UCL) for the Mean.
https://www.itrcweb.org/ISM-1/documents/Calculate_95UCL_for_ISM.xls
ND - not detected
NC - not calculated - SDs, RSDs, and UCLs are calcuated only when
there are three or more detected results.
mg/kg - milligrams per kilogram
UCL - 95% upper confidence limit of the mean (Chebychev method)
RSL - USEPA Residential Screening Level for Soil, November 2017
MCP - S-1 & GW-1 Massachusetts Contingency Plan table 2,
310 CMR 40.0975(6)(a); used for screening potential impacts to groundwater.
PSL - project screening level (lowest value of RSL and MCP)
RSD - Relative Standard Deviation (percent)
SD - Standard Deviation
Highlighted RSD values are greater than the RSD QC limit.
No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI2-SU2-SA-REP1	AOI2-SU2-SA-REP2	AOI2-SU2-SA-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	0.23	0.25	0.16	0.21	0.05	22.15	0.33
	Copper	310	NS	310	35	mg/kg	1.90	1.80	2.10	1.93	0.15	7.90	2.32
	Lead	400	200	200	35	mg/kg	2.90	3.60	3.40	3.30	0.36	10.93	4.21
	Manganese	180	NS	180	35	mg/kg	17.50	18.00	9.40	14.97	4.83	32.25	27.12
	Nickel	150	600	150	35	mg/kg	1.20	1.30	0.45	0.98	0.46	47.25	2.15
	Zinc	2300	1,000	1,000	35	mg/kg	6.40	6.50	3.90	5.60	1.47	26.31	9.31
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	ND	ND	ND	NC	NC	NC	NC

UCL results were calculated using the ITRC ISM Calculator for 1-sided
Upper Confidence Limit (UCL) for the Mean.
https://www.itrcweb.org/ISM-1/documents/Calculate_95UCL_for_ISM.xls
ND - not detected
NC - not calculated - SDs, RSDs, and UCLs are calcuated only when
there are three or more detected results.
mg/kg - milligrams per kilogram
UCL - 95% upper confidence limit of the mean (Chebychev method)
RSL - USEPA Residential Screening Level for Soil, November 2017
MCP - S-1 & GW-1 Massachusetts Contingency Plan table 2,
310 CMR 40.0975(6)(a); used for screening potential impacts to groundwater.
PSL - project screening level (lowest value of RSL and MCP)
RSD - Relative Standard Deviation (percent)
SD - Standard Deviation
Highlighted RSD values are greater than the RSD QC limit.
No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI2-SU3-SA-REP1	AOI2-SU3-SA-REP2	AOI2-SU3-SA-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	0.15	0.27	ND	NC	NC	NC	NC
	Copper	310	NS	310	35	mg/kg	1.20	2.50	1.50	1.73	0.68	39.27	3.45
	Lead	400	200	200	35	mg/kg	3.10	5.80	3.80	4.23	1.40	33.10	7.76
	Manganese	180	NS	180	35	mg/kg	8.90	12.40	15.10	12.13	3.11	25.62	19.96
	Nickel	150	600	150	35	mg/kg	0.74	0.99	0.90	0.88	0.13	14.44	1.20
	Zinc	2300	1,000	1,000	35	mg/kg	6.00	3.80	3.00	4.27	1.55	36.41	8.18
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	ND	ND	ND	NC	NC	NC	NC

UCL results were calculated using the ITRC ISM Calculator for 1-sided
Upper Confidence Limit (UCL) for the Mean.
https://www.itrcweb.org/ISM-1/documents/Calculate_95UCL_for_ISM.xls
ND - not detected
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there are three or more detected results.
mg/kg - milligrams per kilogram
UCL - 95% upper confidence limit of the mean (Chebychev method)
RSL - USEPA Residential Screening Level for Soil, November 2017
MCP - S-1 & GW-1 Massachusetts Contingency Plan table 2,
310 CMR 40.0975(6)(a); used for screening potential impacts to groundwater.
PSL - project screening level (lowest value of RSL and MCP)
RSD - Relative Standard Deviation (percent)
SD - Standard Deviation
Highlighted RSD values are greater than the RSD QC limit.
No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI3-SU1-SA-REP1	AOI3-SU1-SA-REP2	AOI3-SU1-SA-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	0.20	0.14	0.16	0.17	0.03	18.33	0.24
	Copper	310	NS	310	35	mg/kg	1.40	1.60	1.50	1.50	0.10	6.67	1.75
	Lead	400	200	200	35	mg/kg	3.40	3.60	3.50	3.50	0.10	2.86	3.75
	Manganese	180	NS	180	35	mg/kg	20.30	28.20	21.70	23.40	4.22	18.01	34.01
	Nickel	150	600	150	35	mg/kg	0.89	0.60	0.58	0.69	0.17	25.14	1.13
	Zinc	2300	1,000	1,000	35	mg/kg	14.00	15.70	14.90	14.87	0.85	5.72	17.01
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	ND	ND	ND	NC	NC	NC	NC

UCL results were calculated using the ITRC ISM Calculator for 1-sided
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RSD - Relative Standard Deviation (percent)
SD - Standard Deviation
Highlighted RSD values are greater than the RSD QC limit.
No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI3-SU1-SB-REP1	AOI3-SU1-SB-REP2	AOI3-SU1-SB-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	ND	ND	0.16	NC	NC	NC	NC
	Copper	310	NS	310	35	mg/kg	1.40	1.40	1.60	1.47	0.12	7.87	1.76
	Lead	400	200	200	35	mg/kg	3.50	3.60	3.70	3.60	0.10	2.78	3.85
	Manganese	180	NS	180	35	mg/kg	26.10	28.90	25.80	26.93	1.71	6.35	31.24
	Nickel	150	600	150	35	mg/kg	0.98	0.97	0.94	0.96	0.02	2.16	1.02
	Zinc	2300	1,000	1,000	35	mg/kg	14.50	14.80	15.90	15.07	0.74	4.89	16.92
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	ND	ND	ND	NC	NC	NC	NC

UCL results were calculated using the ITRC ISM Calculator for 1-sided
Upper Confidence Limit (UCL) for the Mean.
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Highlighted RSD values are greater than the RSD QC limit.

No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI3-SU2-SA-REP1	AOI3-SU2-SA-REP2	AOI3-SU2-SA-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	0.16	0.23	0.14	0.18	0.05	26.75	0.30
	Copper	310	NS	310	35	mg/kg	0.69	0.78	0.70	0.72	0.05	6.82	0.85
	Lead	400	200	200	35	mg/kg	2.40	3.10	2.60	2.70	0.36	13.35	3.61
	Manganese	180	NS	180	35	mg/kg	10.10	10.40	11.70	10.73	0.85	7.92	12.87
	Nickel	150	600	150	35	mg/kg	0.68	0.66	0.55	0.63	0.07	11.11	0.81
	Zinc	2300	1,000	1,000	35	mg/kg	4.90	4.90	2.00	3.93	1.67	42.57	8.15
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	0.54	0.81	0.58	0.64	0.15	22.65	1.01

UCL results were calculated using the ITRC ISM Calculator for 1-sided Upper Confidence Limit (UCL) for the Mean. https://www.itrcweb.org/ISM-1/documents/Calculate_95UCL_for_ISM.xls

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RSD - Relative Standard Deviation (percent)

SD - Standard Deviation

Highlighted RSD values are greater than the RSD QC limit.

No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI3-SU3-SA-REP1	AOI3-SU3-SA-REP2	AOI3-SU3-SA-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	0.22	0.20	0.23	0.22	0.02	7.05	0.26
	Copper	310	NS	310	35	mg/kg	1.50	1.50	1.60	1.53	0.06	3.77	1.68
	Lead	400	200	200	35	mg/kg	3.00	3.00	3.00	3.00	0.00	0.00	3.00
	Manganese	180	NS	180	35	mg/kg	15.00	15.00	16.20	15.40	0.69	4.50	17.14
	Nickel	150	600	150	35	mg/kg	0.86	0.39	0.50	0.58	0.25	42.14	1.20
	Zinc	2300	1,000	1,000	35	mg/kg	13.40	13.30	13.70	13.47	0.21	1.55	13.99
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	ND	ND	ND	NC	NC	NC	NC

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SD - Standard Deviation

Highlighted RSD values are greater than the RSD QC limit.

No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI4-SU1-SA-REP1	AOI4-SU1-SA-REP2	AOI4-SU1-SA-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	0.17	0.22	0.21	0.20	0.03	13.23	0.27
	Copper	310	NS	310	35	mg/kg	0.84	1.50	0.98	1.11	0.35	31.42	1.98
	Lead	400	200	200	35	mg/kg	3.00	2.60	3.10	2.90	0.26	9.12	3.57
	Manganese	180	NS	180	35	mg/kg	12.20	10.90	9.70	10.93	1.25	11.44	14.08
	Nickel	150	600	150	35	mg/kg	1.00	0.93	0.87	0.93	0.07	6.97	1.10
	Zinc	2300	1,000	1,000	35	mg/kg	3.20	2.50	3.40	3.03	0.47	15.58	4.22
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	0.59	0.32	0.62	0.51	0.16522712	32.40	0.93

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RSD - Relative Standard Deviation (percent)
SD - Standard Deviation
Highlighted RSD values are greater than the RSD QC limit.
No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI4-SU2-SA-REP1	AOI4-SU2-SA-REP2	AOI4-SU2-SA-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	ND	ND	ND	NC	NC	NC	NC
	Copper	310	NS	310	35	mg/kg	0.67	0.73	0.77	0.72	0.05	6.96	0.85
	Lead	400	200	200	35	mg/kg	3.30	6.90	3.40	4.53	2.05	45.23	9.69
	Manganese	180	NS	180	35	mg/kg	37.00	32.50	42.20	37.23	4.85	13.04	49.45
	Nickel	150	600	150	35	mg/kg	1.40	0.97	1.10	1.16	0.22	19.07	1.71
	Zinc	2300	1,000	1,000	35	mg/kg	7.00	8.00	4.20	6.40	1.97	30.78	11.36
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	0.42	0.50	ND	NC	NC	NC	NC

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SD - Standard Deviation

Highlighted RSD values are greater than the RSD QC limit.

No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI4-SU2-SB-REP1	AOI4-SU2-SB-REP2	AOI4-SU2-SB-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	ND	ND	ND	NC	NC	NC	NC
	Copper	310	NS	310	35	mg/kg	0.80	0.77	0.85	0.81	0.04	5.01	0.91
	Lead	400	200	200	35	mg/kg	1.70	1.90	1.70	1.77	0.12	6.54	2.06
	Manganese	180	NS	180	35	mg/kg	71.80	68.90	63.00	67.90	4.48	6.60	79.19
	Nickel	150	600	150	35	mg/kg	1.70	2.30	1.40	1.80	0.46	25.46	2.95
	Zinc	2300	1,000	1,000	35	mg/kg	4.00	6.30	3.80	4.70	1.39	29.56	8.20
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	ND	ND	ND	NC	NC	NC	NC

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Highlighted RSD values are greater than the RSD QC limit.

No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI4-SU3-SA-REP1	AOI4-SU3-SA-REP2	AOI4-SU3-SA-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	0.22	0.22	ND	NC	NC	NC	NC
	Copper	310	NS	310	35	mg/kg	0.82	1.10	0.99	0.97	0.14	14.54	1.33
	Lead	400	200	200	35	mg/kg	3.00	4.50	4.20	3.90	0.79	20.35	5.90
	Manganese	180	NS	180	35	mg/kg	80.70	74.40	72.80	75.97	4.18	5.50	86.48
	Nickel	150	600	150	35	mg/kg	1.30	1.40	1.40	1.37	0.06	4.22	1.51
	Zinc	2300	1,000	1,000	35	mg/kg	2.90	3.60	3.20	3.23	0.35	10.86	4.12
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	0.37	0.48	0.47	0.44	0.06	13.82	0.59

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Highlighted RSD values are greater than the RSD QC limit.

No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI4-SU4-SA-REP1	AOI4-SU4-SA-REP2	AOI4-SU4-SA-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	ND	0.16	0.14	NC	NC	NC	NC
	Copper	310	NS	310	35	mg/kg	0.73	0.99	0.85	0.86	0.13	15.19	1.18
	Lead	400	200	200	35	mg/kg	3.90	6.60	5.00	5.17	1.36	26.28	8.58
	Manganese	180	NS	180	35	mg/kg	18.10	17.80	18.60	18.17	0.40	2.22	19.18
	Nickel	150	600	150	35	mg/kg	0.57	0.74	0.61	0.64	0.09	13.89	0.86
	Zinc	2300	1,000	1,000	35	mg/kg	5.50	6.10	3.20	4.93	1.53	31.03	8.79
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	ND	ND	ND	NC	NC	NC	NC

UCL results were calculated using the ITRC ISM Calculator for 1-sided Upper Confidence Limit (UCL) for the Mean.
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Highlighted RSD values are greater than the RSD QC limit.

No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI4-SU5-SA-REP1	AOI4-SU5-SA-REP2	AOI4-SU5-SA-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	ND	ND	0.15	NC	NC	NC	NC
	Copper	310	NS	310	35	mg/kg	1.40	1.50	1.40	1.43	0.06	4.03	1.58
	Lead	400	200	200	35	mg/kg	3.70	3.80	3.60	3.70	0.10	2.70	3.95
	Manganese	180	NS	180	35	mg/kg	11.60	9.70	10.10	10.47	1.00	9.57	12.99
	Nickel	150	600	150	35	mg/kg	1.30	1.20	1.40	1.30	0.10	7.69	1.55
	Zinc	2300	1,000	1,000	35	mg/kg	15.80	18.20	15.40	16.47	1.51	9.20	20.28
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	0.20	ND	ND	NC	NC	NC	NC

UCL results were calculated using the ITRC ISM Calculator for 1-sided Upper Confidence Limit (UCL) for the Mean. https://www.itrcweb.org/ISM-1/documents/Calculate_95UCL_for_ISM.xls

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No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI5-SU1-SA-REP1	AOI5-SU1-SA-REP2	AOI5-SU1-SA-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	0.24	0.28	0.19	0.24	0.05	19.05	0.35
	Copper	310	NS	310	35	mg/kg	1.70	1.60	1.30	1.53	0.21	13.58	2.06
	Lead	400	200	200	35	mg/kg	3.10	3.00	2.50	2.87	0.32	11.21	3.68
	Manganese	180	NS	180	35	mg/kg	13.20	12.60	12.40	12.73	0.42	3.27	13.78
	Nickel	150	600	150	35	mg/kg	1.10	0.75	0.75	0.87	0.20	23.32	1.38
	Zinc	2300	1,000	1,000	35	mg/kg	13.90	13.50	11.10	12.83	1.51	11.80	16.64
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	ND	ND	ND	NC	NC	NC	NC

UCL results were calculated using the ITRC ISM Calculator for 1-sided Upper Confidence Limit (UCL) for the Mean. https://www.itrcweb.org/ISM-1/documents/Calculate_95UCL_for_ISM.xls

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Highlighted RSD values are greater than the RSD QC limit.

No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI5-SU2-SA-REP1	AOI5-SU2-SA-REP2	AOI5-SU2-SA-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	0.30	0.19	0.25	0.25	0.06	22.33	0.39
	Copper	310	NS	310	35	mg/kg	1.60	1.60	1.60	1.60	0.00	0.00	1.60
	Lead	400	200	200	35	mg/kg	3.00	2.90	3.00	2.97	0.06	1.95	3.11
	Manganese	180	NS	180	35	mg/kg	15.70	20.80	17.70	18.07	2.57	14.22	24.53
	Nickel	150	600	150	35	mg/kg	1.00	1.30	0.98	1.09	0.18	16.40	1.54
	Zinc	2300	1,000	1,000	35	mg/kg	13.70	13.50	13.50	13.57	0.12	0.85	13.86
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	ND	ND	ND	NC	NC	NC	NC

UCL results were calculated using the ITRC ISM Calculator for 1-sided Upper Confidence Limit (UCL) for the Mean. https://www.itrcweb.org/ISM-1/documents/Calculate_95UCL_for_ISM.xls

ND - not detected

NC - not calculated - SDs, RSDs, and UCLs are calcuated only when there are three or more detected results.

mg/kg - milligrams per kilogram

UCL - 95% upper confidence limit of the mean (Chebychev method)

RSL - USEPA Residential Screening Level for Soil, November 2017

MCP - S-1 & GW-1 Massachusetts Contingency Plan table 2, 310 CMR 40.0975(6)(a); used for screening potential impacts to groundwater.

PSL - project screening level (lowest value of RSL and MCP)

RSD - Relative Standard Deviation (percent)

SD - Standard Deviation

Highlighted RSD values are greater than the RSD QC limit.

No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI5-SU3-SA-REP1	AOI5-SU3-SA-REP2	AOI5-SU3-SA-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	0.14	0.23	0.17	0.18	0.05	25.46	0.30
	Copper	310	NS	310	35	mg/kg	1.20	1.20	1.60	1.33	0.23	17.32	1.91
	Lead	400	200	200	35	mg/kg	1.90	1.70	2.10	1.90	0.20	10.53	2.40
	Manganese	180	NS	180	35	mg/kg	17.00	17.80	19.00	17.93	1.01	5.61	20.47
	Nickel	150	600	150	35	mg/kg	0.87	1.10	0.97	0.98	0.12	11.77	1.27
	Zinc	2300	1,000	1,000	35	mg/kg	5.60	7.90	3.20	5.57	2.35	42.22	11.48
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	ND	ND	0.21	NC	NC	NC	NC

UCL results were calculated using the ITRC ISM Calculator for 1-sided
Upper Confidence Limit (UCL) for the Mean.
https://www.itrcweb.org/ISM-1/documents/Calculate_95UCL_for_ISM.xls
ND - not detected
NC - not calculated - SDs, RSDs, and UCLs are calcuated only when
there are three or more detected results.
mg/kg - milligrams per kilogram
UCL - 95% upper confidence limit of the mean (Chebychev method)
RSL - USEPA Residential Screening Level for Soil, November 2017
MCP - S-1 & GW-1 Massachusetts Contingency Plan table 2,
310 CMR 40.0975(6)(a); used for screening potential impacts to groundwater.
PSL - project screening level (lowest value of RSL and MCP)
RSD - Relative Standard Deviation (percent)
SD - Standard Deviation
Highlighted RSD values are greater than the RSD QC limit.
No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-12. Site Data Replicate Relative Standard Deviation and Upper Confidence Limit Calculations

Method	Analyte	RSL	MCP	PSL	RSD QC Limit (%)	UNITS	AOI5-SU3-SB-REP1	AOI5-SU3-SB-REP2	AOI5-SU3-SB-REP3	Mean	Standard Deviation	RSD	UCL
SW6010	Antimony	3.1	20	3.1	35	mg/kg	ND	0.14	ND	NC	NC	NC	NC
	Copper	310	NS	310	35	mg/kg	5.90	3.90	3.60	4.47	1.25	27.99	7.61
	Lead	400	200	200	35	mg/kg	2.30	2.40	2.40	2.37	0.06	2.44	2.51
	Manganese	180	NS	180	35	mg/kg	18.10	17.70	15.10	16.97	1.63	9.60	21.07
	Nickel	150	600	150	35	mg/kg	1.10	1.20	0.96	1.09	0.12	11.09	1.39
	Zinc	2300	1,000	1,000	35	mg/kg	5.30	5.20	5.80	5.43	0.32	5.92	6.24
SW8330	Nitroguanidine	630	NS	630	35	mg/kg	ND	ND	ND	NC	NC	NC	NC

UCL results were calculated using the ITRC ISM Calculator for 1-sided
Upper Confidence Limit (UCL) for the Mean.
https://www.itrcweb.org/ISM-1/documents/Calculate_95UCL_for_ISM.xls
ND - not detected
NC - not calculated - SDs, RSDs, and UCLs are calcuated only when
there are three or more detected results.
mg/kg - milligrams per kilogram
UCL - 95% upper confidence limit of the mean (Chebychev method)
RSL - USEPA Residential Screening Level for Soil, November 2017
MCP - S-1 & GW-1 Massachusetts Contingency Plan table 2,
310 CMR 40.0975(6)(a); used for screening potential impacts to groundwater.
PSL - project screening level (lowest value of RSL and MCP)
RSD - Relative Standard Deviation (percent)
SD - Standard Deviation
Highlighted RSD values are greater than the RSD QC limit.
No individual results, mean values, or 95% UCLs were greater than the PSLs.

Table D-13. Relative Standard Deviation Calculations for Background Surface and Subsurface Soil

Method	Analyte	RSD Limit (%)	Units	BKG-SU2-SA-REP1	BKG-SU2-SA-REP2	BKG-SU2-SA-REP3	Mean	SD	RPD	BKG-SU2-SB-REP1	BKG-SU2-SB-REP2	BKG-SU2-SB-REP3	Mean	SD	RPD
SW6010	Antimony	35.00	mg/kg	0.30	0.24	0.20	0.25	0.05	20.40	0.41	0.34	0.21	0.32	0.10	31.72
	Copper	35.00	mg/kg	2.70	2.20	2.40	2.43	0.25	10.34	2.10	1.60	1.70	1.80	0.26	14.70
	Lead	35.00	mg/kg	5.90	6.40	6.60	6.30	0.36	5.72	3.60	3.50	2.90	3.33	0.38	11.36
	Manganese	35.00	mg/kg	17.60	16.60	15.50	16.57	1.05	6.34	75.90	76.80	96.90	83.20	11.87	14.27
	Nickel	35.00	mg/kg	0.95	1.30	0.76	1.00	0.27	27.30	2.40	2.30	2.70	2.47	0.21	8.44
	Zinc	35.00	mg/kg	6.80	5.80	4.50	5.70	1.15	20.23	8.20	7.90	17.20	11.10	5.28	47.61
SW8330	Nitroguanidine	35.00	mg/kg	0.73	ND	ND	NC	NC	NC	ND	ND	ND	NC	NC	NC
SW8330B	2,4,6-Trinitrotoluene	35.00	mg/kg	ND	ND	ND	NC	NC	NC	ND	ND	ND	NC	NC	NC
	2,4-Dinitrotoluene	35.00	mg/kg	ND	ND	ND	NC	NC	NC	ND	ND	ND	NC	NC	NC
	2,6-Dinitrotoluene	35.00	mg/kg	ND	ND	ND	NC	NC	NC	ND	ND	ND	NC	NC	NC
	Nitroglycerin	35.00	mg/kg	ND	ND	ND	NC	NC	NC	ND	ND	ND	NC	NC	NC
	RDX	35.00	mg/kg	ND	ND	ND	NC	NC	NC	ND	ND	ND	NC	NC	NC
	Tetryl	35.00	mg/kg	ND	ND	ND	NC	NC	NC	ND	ND	ND	NC	NC	NC

RSD results that are highlighted are greater than the RSD QC Limit.
ND - not detected
NC - not calculated - SDs and RSDs are calcuated only when
there are three or more detected results.
mg/kg - milligrams per kilogram
RSD - Relative Standard Deviation (percent)
SD - Standard Deviation

Table D-14. Relative Percent Difference Calculations for Site Subsurface Soil Discrete Method Samples

Method	Analyte Name	RPD QC Limit (%)	UNITS	AOI1-SU2-SO04-8-10	WELLFLEET-FD1	RPD
SW6010C	Antimony	20	mg/kg	ND	0.18	NC
	Copper	20	mg/kg	0.35	0.41	15.79
	Lead	20	mg/kg	1.2	1.1	8.70
	Manganese	20	mg/kg	11.9	10.7	10.62
	Nickel	20	mg/kg	0.58	0.67	14.40
	Zinc	20	mg/kg	4.8	5.1	6.06

RPD - relative percent difference
ND - not detected
NC - not calculated
FD - field duplicate
mg/kg - milligram per kilogram
% - percent

Attachment 1

ProUCL Input Data

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ProUCL Input Data for Background Threshold Value Analysis

Location	Group	Antimony	D_Antimony	Copper	D_Copper	Lead	D_Lead	Manganese	D_Manganese	Nickel	D_Nickel	Zinc	D_Zinc
BKG-SU1-SA	Surface	0.44	1	3.6	1	6.8	1	17.6	1	0.88	1	6.8	1
BKG-SU2-SA_Mean	Surface	0.25	1	2.43	1	6.30	1	16.57	1	1.00	1	5.70	1
BKG-SU3-SA	Surface	0.21	1	1.7	1	5.5	1	35	1	1.7	1	6.5	1
BKG-SU4-SA	Surface	3.4	1	3.1	1	23.1	1	13.6	1	1.5	1	6.8	1
BKG-SU5-SA	Surface	0.16	1	2.4	1	5.6	1	7.7	1	0.9	1	6.4	1
BKG-SU6-SA	Surface	0.27	1	3.2	1	5.4	1	11	1	1.5	1	7.4	1
BKG-SU7-SA	Surface	0.34	1	3.4	1	5.8	1	13.1	1	0.69	1	7	1
BKG-SU1-SB	Subsurface	0.17	1	1.7	1	3.4	1	55.6	1	2.1	1	17	1
BKG-SU2-SB_Mean	Subsurface	0.32	1	1.80	1	3.33	1	83.20	1	2.47	1	11.10	1
BKG-SU3-SB	Subsurface	0.38	1	3	1	4.1	1	18.2	1	1.7	1	7.9	1
BKG-SU4-SB	Subsurface	0.28	1	1.7	1	3.3	1	19.6	1	2	1	16.5	1
BKG-SU5-SB	Subsurface	0.15	1	1.3	1	2.7	1	21	1	2.2	1	6.7	1
BKG-SU6-SB	Subsurface	0.22	1	1.9	1	3.4	1	30.4	1	2.7	1	9	1
BKG-SU7-SB	Subsurface	0.34	1	1.3	1	3.7	1	20.6	1	2.1	1	7	1

APPENDIX D.2: DATA VALIDATION REPORTS

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Automated Data Review Report Summary for 135311EDD

Facility:	D01MA0033-04, CP Wellfleet - Art, Sm Arms, Rocket
Event:	Phase I Sampling 2018
SDG:	135311EDD
Guidance Document:	Camp Wellfleet - Art, Sm Arms, Rocket
Prime Contractor:	ERT, Inc., Laurel, MD
Project Manager:	Tom Bachovchin
Contract Laboratory:	CT Laboratories LLC, Baraboo, WI
Data Review Contractor:	HSW Engineering, Inc.
Data Review Level:	Stage 2B Review
Primary Data Reviewer:	Cindy Westergard, Senior Scientist
Second Reviewer:	Nigel Lewis, Project Scientist
Date Submitted:	July 12, 2018

Field Sample ID	Lab Sample ID	Matrix	Type/Type Code	SW6010C	SW8330	SW8330B
BKG-SU1-SA	104579	Solid	Field Sample/N	X	X	X
BKG-SU1-SA	106694	Solid	Field Sample/N	X		
BKG-SU2-SA-REP1	104578	Solid	Field Triplicate/FT	X	X	X
BKG-SU2-SA-REP1	106693	Solid	Field Triplicate/FT	X		
BKG-SU2-SA-REP2	104451	Solid	Field Triplicate/FT	X	X	X
BKG-SU2-SA-REP2	106687	Solid	Field Triplicate/FT	X		
BKG-SU2-SA-REP3	104574	Solid	Field Triplicate/FT	X	X	X
BKG-SU2-SA-REP3	106689	Solid	Field Triplicate/FT	X		
BKG-SU2-SB-REP1	104617	Solid	Field Triplicate/FT	X	X	X
BKG-SU2-SB-REP1	106701	Solid	Field Triplicate/FT	X		
BKG-SU2-SB-REP2	104614	Solid	Field Triplicate/FT	X	X	X
BKG-SU2-SB-REP2	106698	Solid	Filed Triplicate/FT	X		
BKG-SU2-SB-REP3	105388	Solid	Field Triplicate/FT	X	X	X
BKG-SU2-SB-REP3	106702	Solid	Field Triplicate/FT	X		
BKG-SU3-SA	104576	Solid	Field Sample/N	X	X	X
BKG-SU3-SA	106691	Solid	Field Sample/N	X		
BKG-SU3-SB	104577	Solid	Field Sample/N	X	X	X
BKG-SU3-SB	106692	Solid	Field Sample/N	X		
BKG-SU4-SA	104581	Solid	Field Sample/N	X	X	X
BKG-SU4-SA	106696	Solid	Field Sample/N	X		

Field Sample ID	Lab Sample ID	Matrix	Type/Type Code	SW6010C	SW8330	SW8330B
BKG-SU5-SA	104575	Solid	Field Sample/N	X	X	X
BKG-SU5-SA	106690	Solid	Field Sample/N	X		
BKG-SU5-SB	104616	Solid	Field Sample/N	X	X	X
BKG-SU5-SB	106700	Solid	Field Sample/N	X		
BKG-SU6-SA	104573	Solid	Field Sample/N	X	X	X
BKG-SU6-SA	106688	Solid	Field Sample/N	X		
BKG-SU6-SB	104615	Solid	Field Sample/N	X	X	X
BKG-SU6-SB	106699	Solid	Field Sample/N	X		
BKG-SU7-SA	104580	Solid	Field Sample/N	X	X	X
BKG-SU7-SA	106695	Solid	Field Sample/N	X		
BKG-SU7-SB	104613	Solid	Field Sample/N	X	X	X
BKG-SU7-SB	106697	Solid	Field Sample/N	X		

This report assesses the analytical data quality associated with the analyses listed on the preceding cover page. This assessment has been made through a combination of automated data review (ADR) and supplemental manual review, the details of which are described below. The approach taken in the review of this data set is consistent with the requirements contained in the Camp Wellfleet - Art, Sm Arms, Rocket and the additional guidance documents incorporated by reference to the extent possible. Where definitive guidance is not provided, results have been evaluated in a conservative manner using professional judgment.

Sample collection was managed and directed by ERT, Inc., Laurel, MD; analyses were performed by CT Laboratories LLC, Baraboo, WI and were reported under sample delivery group (SDG) 135311EDD. Data have been evaluated electronically based on electronic data deliverables (EDDs) provided by the laboratory, and hard copy data summary forms have also been reviewed during this effort and compared to the automated review output by the reviewers whose signatures appear on the following page. Findings based on the automated data submission and manual data verification processes are detailed in the ADR narrative and throughout this report.

All quality control (QC) elements associated with this SDG have been reviewed by a project chemist in accordance with the requirements defined for the project. This review is documented in the attached Data Review Checklists. The QC elements listed below were supported by the electronic deliverable and were evaluated using ADR processes.

- Blank
- Blank - Negative
- LCS Recovery
- MS Recovery
- MS RPD
- Prep Hold Time
- Surrogate
- Test Hold Time

Results of the ADR process were subsequently reviewed and updated as applicable by the data review chemists identified on the signature page. Quality control elements that were not included in the electronic deliverable were reviewed manually and findings are documented within this report. Summaries of findings and associated qualified results are documented throughout this report.

A total of 22 results (10.58%) out of the 208 results (sample and field QC samples) reported are qualified based on review and 0 results (0.00%) have been rejected. Trace values, defined as results that are qualified as estimated because they fall between the detection limit and the reporting limit/limit of quantitation, are not counted as qualified results in the above count. The qualified results are detailed throughout this report and discussed in the narrative below, where appropriate.

Narrative Comments

Sixteen ISM samples were received by CT Laboratories, Baraboo, Wisconsin, and analyzed for a select list of explosives and metals (an additional sample, BKG-SU2-SB-REP3, was received a day after the first 15 samples were received and, per the client's request, was added to this sample delivery group). The samples were received intact and at acceptable temperatures. The samples were dried, sieved, subsampled, and ground following the homogenization procedure specified for the project.

The analyses were performed in accordance with DOD QSM 5. Qualifiers applied by the laboratory are defined in each laboratory report.

Some samples were collected as three field replicates (i.e., triplicates) and identified with suffixes of -REP1, -REP2, and -REP3. As replicate samples are an intrinsic part of the ISM process and this project, the extent of variability among triplicate results will be evaluated by the project team. Triplicate results were reviewed by the validator to confirm the overall reasonableness of the results, with no issues of concern noted.

Analytical Method	Data Reviewer Comment

SW6010C	The dried/sieved fraction of each ISM was subsampled for nickel and manganese prior to undergoing grinding via the puck mill, to avoid potential contamination of the samples with these metals from the puck mill. Analyses of antimony, copper, lead, and zinc were performed with the fully-homogenized, puck-milled fractions. The samples were analyzed as part of three analytical runs (#148189, #148244, and #148423). A trace amount of copper (0.07 mg/Kg) was detected in the method blank (MDL is 0.07 mg/Kg). The concentrations of copper reported for the samples exceeded the artifact threshold value in all instances such that no qualification of the sample data, based on the detection in the method blank, was necessary. The laboratory performed MS/MSD analyses with additional volumes of samples BKG-SU3-SA, BKG-SU3-SB, and BKG-SU2-REP3 (this last sample for antimony, copper, lead, and zinc only). In the MS/MSD analyses of sample BKG-SU3-SA, the laboratory reported low recoveries of antimony and lead. In the MS/MSD analyses of sample BKG-SU3-SB, the laboratory reported elevated recoveries of manganese and low recoveries of antimony, copper, and lead. In the MS/MSD analyses of sample BKG-SU2-SB-REP3, the laboratory reported low recoveries of antimony. The results for these analytes for the parent samples were qualified in accordance with the qualification scheme specified by the eQAPP. In all instances, the results of the serial dilutions (SDs) either were not valid (because the on-instrument result for the parent sample was less than 50 times the limit of quantitation, or LOQ) or were not within acceptance limits. Post-digestion spike (PDS) recoveries were evaluated and, if acceptable, the sample results for the metals were not qualified. For example, the result for nickel reported for the SD performed with additional volumes of the digestate of sample BKG-SU3-SA was not valid due to the low concentration detected in the parent sample (1.7 mg/Kg vs. an LOQ of 0.12 mg/Kg); however, because the PDS recovery (88%) was within acceptance limits (80-120%), the result for nickel reported for sample BKG-SU3-SA did not require qualification, based on the combined evaluation of the SD and PDS results. In the SD analysis of this same sample for manganese, the SD result (18%) was valid but not within acceptance limits (+/-10%), but because the PDS recovery (114%) was within acceptance limits, the result for manganese for sample BKG-SU3-SA likewise did not require qualification, based on the combined evaluation of the SD and PDS results. Similarly, the SD result reported for manganese for sample BKG-SU3-SB (16%) was valid but not within acceptance limits (+/-10%); however, in this instance, the PDS recovery (137%) also was not acceptable. The detection of manganese reported for parent sample BKG-SU3-SB (18.2 mg/Kg) therefore was classified as less than fully quantitative and coded with a "J" validation qualifier with bias indicator of "+". This validation logic was used to evaluate all such results and qualify sample data as appropriate. The list of reason codes for data qualification for this project does not include a distinct code for indicating when PDS recoveries are not within control limits. Therefore, when the serial dilution (SD) result for a given metal was invalid or not within control limits and the subsequent PDS recovery also was not within control limits, the sample result was qualified with a validation qualifier of "J" (detections) or "UJ" (non-detections) with reason codes of "A/M" ("A" signifying an invalid or failed SD analysis and "M" indicating a spike recovery that was not within limits -- in this case, a PDS). If the MS and/or MSD recovery was not within control limits and the SD + PDS results also were not within control limits, the data were qualified with "J" or "UJ" with reason codes of "M/A" (as opposed to “A/M” or “M/A/M” as, in the case of the latter, the FUDSchem system will not allow a reason code to be entered twice). The laboratory analyzed several samples in duplicate or triplicate. The results for the parent samples were classified as less than fully quantitative when both or all three results were greater than five times the LOQ and the %RPD of the duplicate or triplicate, relative to the parent sample, exceeded 20% (limited to detections of zinc reported for samples BKG-SU5-SA, BKG-SU3-SA, BKG-SU3-SB, and BKG-SU2-SB-REP1, the results for which were coded with "J" validation qualifiers with reason codes of "D1").

SW8330	Surrogate recoveries of less than the lower recovery limit (32%) were reported for six samples (BKG-SU2-SA-REP3, BKG-SU2-SA-REP1, BKG-SU2-SB-REP2, BKG-SU1-SA, BKG-SU7-SA, and BKG-SU4-SA). The laboratory attributed the low recoveries to matrix interference. The results for nitroguanidine reported for these six samples were classified as less than fully quantitative and coded with validation qualifiers of "J" (detections) or "UJ" (non-detections) with reason code "I". No other quality issues were noted.
SW8330B	A slightly elevated recovery was reported for the surrogate in the analysis of sample BKG-SU6-SA (125% vs. a control limit of 78-119%). The absence of target analytes precluded the need for qualification of the explosives data for this sample. Surrogate recoveries for all other samples were within acceptance limits, and no other quality issues associated with the analyses for explosives by Method 8330B were noted.

Cindy Lee Westergard

July 11, 2018

Reviewed by Cindy Westergard, Senior Scientist, HSW Engineering, Inc.

As the First Reviewer, I certify that I have performed a data review process in accordance with the requirements of the project guidance document, and have compared the electronic data to the laboratory's hard copy report and have verified the consistency of a minimum of 10% of the reported sample results and method quality control data between the two deliverables.

July 11, 2018

Reviewed by Nigel Lewis, Project Scientist, HSW Engineering, Inc.

As the Second Reviewer, I certify that I have performed a quality assurance review of the report generated by the First Reviewer.

Quality Control Outliers for test method SW6010C, Blank

The purpose of laboratory blanks is to determine the existence and magnitude of cross-contamination problems resulting from laboratory activities. Reported results were evaluated to determine compliance with the required acceptance criteria. Summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and contaminants found in laboratory blanks are listed below along with any associated qualified results.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
108338 (LB)/ 108338	Copper	0.08000	< 0.07	< 0.4	mg/kg	U/None	L	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

No results associated with this QC element required qualification.

Quality Control Outliers for test method SW6010C, MS Recovery

Data for matrix spikes/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. These data alone cannot be used to evaluate the precision and accuracy of individual samples. However, when exercising professional judgment, MS/MSD data can be used in conjunction with other available QC information. Reported results were evaluated to determine compliance with the required acceptance criteria, and summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and any associated qualified results, are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
BKG-SU2-SB-REP3 (MS)/ 109659	Antimony	38.23	79 - 114	30 - 125	percent	J/UJ	M	
BKG-SU2-SB-REP3 (SD)/ 109660	Antimony	39.21	79 - 114	30 - 125	percent	J/UJ	M	
BKG-SU3-SA (MS)/ 108343	Antimony	42.59	79 - 114	30 - 125	percent	J/UJ	M	
BKG-SU3-SA (MS)/ 108343	Lead	62.15	81 - 112	30 - 125	percent	J/UJ	M	
BKG-SU3-SA (SD)/ 108344	Antimony	48.96	79 - 114	30 - 125	percent	J/UJ	M	
BKG-SU3-SA (SD)/ 108344	Lead	65.46	81 - 112	30 - 125	percent	J/UJ	M	
BKG-SU3-SB (MS)/ 107594	Manganese	146.5	84 - 114	30 - 125	percent	J/None	M	
BKG-SU3-SB (SD)/ 107595	Manganese	143.9	84 - 114	30 - 125	percent	J/None	M	
BKG-SU3-SB (MS)/ 108346	Antimony	37.33	79 - 114	30 - 125	percent	J/UJ	M	
BKG-SU3-SB (MS)/ 108346	Lead	74.51	81 - 112	30 - 125	percent	J/UJ	M	
BKG-SU3-SB (MS)/ 108346	Copper	78.13	81 - 117	30 - 117	percent	J/UJ	M	
BKG-SU3-SB (SD)/ 108347	Antimony	38.12	79 - 114	30 - 125	percent	J/UJ	M	
BKG-SU3-SB (SD)/ 108347	Lead	76.86	81 - 112	30 - 125	percent	J/UJ	M	
BKG-SU3-SB (SD)/ 108347	Copper	80.47	81 - 117	30 - 117	percent	J/UJ	M	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

Qualified Results associated with the MS Recovery for SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
BKG-SU2-SB-REP1	FT	Antimony	0.810	0.410 J	0.410 J	-	mg/kg	M/TR
BKG-SU2-SB-REP2	FT	Antimony	0.830	0.340 J	0.340 J	-	mg/kg	M/TR
BKG-SU2-SB-REP3	FT	Lead	0.240	2.90 M	2.90 J	-	mg/kg	A/M
BKG-SU2-SB-REP3	FT	Antimony	0.780	0.210 J	0.210 J	-	mg/kg	M/TR
BKG-SU3-SA	N	Lead	0.250	5.50 M	5.50 J	-	mg/kg	M/A
BKG-SU3-SA	N	Antimony	0.800	0.210 J	0.210 J	-	mg/kg	M/TR
BKG-SU3-SA	N	Copper	0.400	1.70 M	1.70 J	-	mg/kg	A/M
BKG-SU3-SB	N	Manganese	0.150	18.2 M	18.2 J	+	mg/kg	M/A
BKG-SU3-SB	N	Lead	0.260	4.10	4.10 J	-	mg/kg	M

Qualified Results associated with the MS Recovery for SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
BKG-SU3-SB	N	Antimony	0.820	0.380 J	0.380 J	-	mg/kg	M/TR
BKG-SU3-SB	N	Copper	0.410	3.00 M	3.00 J	-	mg/kg	M/A

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).

Quality Control Outliers for test method SW8330, Surrogate

Method performance for individual samples is demonstrated through spiking activities. All samples are spiked with surrogate compounds prior to sample preparation. The sample itself may produce effects due to such factors as interferences and high concentrations of analytes. Summary forms were evaluated and compared to electronic data deliverables. Surrogate results that were outside of the acceptance criteria are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
BKG-SU1-SA (N)/ 104579	1,2-Dinitrobenzene	27.00	32 - 136	10 - 136	percent	J/UJ	I	
BKG-SU2-SA-REP1 (FT)/ 104578	1,2-Dinitrobenzene	15.00	32 - 136	10 - 136	percent	J/UJ	I	
BKG-SU2-SA-REP3 (FT)/ 104574	1,2-Dinitrobenzene	20.00	32 - 136	10 - 136	percent	J/UJ	I	
BKG-SU2-SB-REP2 (FT)/ 104614	1,2-Dinitrobenzene	28.00	32 - 136	10 - 136	percent	J/UJ	I	
BKG-SU4-SA (N)/ 104581	1,2-Dinitrobenzene	27.00	32 - 136	10 - 136	percent	J/UJ	I	
BKG-SU7-SA (N)/ 104580	1,2-Dinitrobenzene	25.00	32 - 136	10 - 136	percent	J/UJ	I	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

Qualified Results associated with the Surrogate for SW8330

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
BKG-SU1-SA	N	Nitroguanidine	0.220	0.110 U	0.110 UJ	-	mg/kg	I
BKG-SU2-SA-REP1	FT	Nitroguanidine	0.240	0.730	0.730 J	-	mg/kg	I
BKG-SU2-SA-REP3	FT	Nitroguanidine	0.240	0.110 U	0.110 UJ	-	mg/kg	I
BKG-SU2-SB-REP2	FT	Nitroguanidine	0.230	0.110 U	0.110 UJ	-	mg/kg	I
BKG-SU4-SA	N	Nitroguanidine	0.250	0.120 U	0.120 UJ	-	mg/kg	I
BKG-SU7-SA	N	Nitroguanidine	0.250	0.120 U	0.120 UJ	-	mg/kg	I

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).

Table of All Qualified Results

Test Method: SW6010C Extraction Method: SW3050

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
BKG-SU2-SB-REP1	FT	Antimony	0.810	0.410 J	0.410 J	-	mg/kg	M/TR
BKG-SU2-SB-REP2	FT	Antimony	0.830	0.340 J	0.340 J	-	mg/kg	M/TR
BKG-SU2-SB-REP3	FT	Lead	0.240	2.90 M	2.90 J	-	mg/kg	A/M
BKG-SU2-SB-REP3	FT	Antimony	0.780	0.210 J	0.210 J	-	mg/kg	M/TR
BKG-SU3-SA	N	Lead	0.250	5.50 M	5.50 J	-	mg/kg	M/A
BKG-SU3-SA	N	Antimony	0.800	0.210 J	0.210 J	-	mg/kg	M/TR
BKG-SU3-SA	N	Copper	0.400	1.70 M	1.70 J	-	mg/kg	A/M
BKG-SU3-SB	N	Manganese	0.150	18.2 M	18.2 J	+	mg/kg	M/A
BKG-SU3-SB	N	Lead	0.260	4.10	4.10 J	-	mg/kg	M
BKG-SU3-SB	N	Antimony	0.820	0.380 J	0.380 J	-	mg/kg	M/TR
BKG-SU3-SB	N	Copper	0.410	3.00 M	3.00 J	-	mg/kg	M/A

Test Method: SW8330 Extraction Method: METHOD

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
BKG-SU1-SA	N	Nitroguanidine	0.220	0.110 U	0.110 UJ	-	mg/kg	I
BKG-SU2-SA-REP1	FT	Nitroguanidine	0.240	0.730	0.730 J	-	mg/kg	I
BKG-SU2-SA-REP3	FT	Nitroguanidine	0.240	0.110 U	0.110 UJ	-	mg/kg	I
BKG-SU2-SB-REP2	FT	Nitroguanidine	0.230	0.110 U	0.110 UJ	-	mg/kg	I
BKG-SU4-SA	N	Nitroguanidine	0.250	0.120 U	0.120 UJ	-	mg/kg	I
BKG-SU7-SA	N	Nitroguanidine	0.250	0.120 U	0.120 UJ	-	mg/kg	I

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).
Trace values are not included in the qualified results table unless additional reason codes are associated.

Automated Data Review Report Summary for 135311EDD

Table of All Trace Results

Test Method: SW6010C Extraction Method: SW3050

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
BKG-SU1-SA	N	Antimony	0.830	0.440 J	0.440 J		mg/kg	TR
BKG-SU2-SA-REP1	FT	Antimony	0.840	0.300 J	0.300 J		mg/kg	TR
BKG-SU2-SA-REP2	FT	Antimony	0.820	0.240 J	0.240 J		mg/kg	TR
BKG-SU2-SA-REP3	FT	Antimony	0.830	0.200 J	0.200 J		mg/kg	TR
BKG-SU2-SB-REP1	FT	Antimony	0.810	0.410 J	0.410 J	-	mg/kg	M/TR
BKG-SU2-SB-REP2	FT	Antimony	0.830	0.340 J	0.340 J	-	mg/kg	M/TR
BKG-SU2-SB-REP3	FT	Antimony	0.780	0.210 J	0.210 J	-	mg/kg	M/TR
BKG-SU3-SA	N	Antimony	0.800	0.210 J	0.210 J	-	mg/kg	M/TR
BKG-SU3-SB	N	Antimony	0.820	0.380 J	0.380 J	-	mg/kg	M/TR
BKG-SU5-SA	N	Antimony	0.810	0.160 J	0.160 J		mg/kg	TR
BKG-SU5-SB	N	Antimony	0.800	0.150 J	0.150 J		mg/kg	TR
BKG-SU6-SA	N	Antimony	0.840	0.270 J	0.270 J		mg/kg	TR
BKG-SU6-SB	N	Antimony	0.830	0.220 J	0.220 J		mg/kg	TR
BKG-SU7-SA	N	Antimony	0.790	0.340 J	0.340 J		mg/kg	TR
BKG-SU7-SB	N	Antimony	0.830	0.340 J	0.340 J		mg/kg	TR

Automated Data Review Report Summary for 135311EDD

Table of Results with Modified Qualifiers

Modified Qualifiers for test method SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	ADR Result	Modified Result	Reason
BKG-SU2-SB-REP1	FT	Zinc	0.300	8.20 Y	8.20	8.20 J	D1
BKG-SU2-SB-REP3	FT	Lead	0.240	2.90 M	2.90	2.90 J	A/M
BKG-SU2-SB-REP3	FT	Zinc	0.290	17.2 M	17.2	17.2 J	A/M
BKG-SU3-SA	N	Copper	0.400	1.70 M	1.70	1.70 J	A/M
BKG-SU3-SA	N	Lead	0.250	5.50 M	5.50 J	5.50 J	M/A
BKG-SU3-SA	N	Zinc	0.300	6.50 Y	6.50	6.50 J	D1
BKG-SU3-SB	N	Copper	0.410	3.00 M	3.00 J	3.00 J	M/A
BKG-SU3-SB	N	Zinc	0.310	7.90 Y	7.90	7.90 J	D1
BKG-SU3-SB	N	Manganese	0.150	18.2 M	18.2 J	18.2 J	M/A
BKG-SU5-SA	N	Zinc	0.300	6.40 Y	6.40	6.40 J	D1

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).
Trace values are not included in the qualified results table unless additional reason codes are associated.

Reason Code Definitions

Code	Definition
A	Serial dilution
D1	Lab Replicate RPD
I	Surrogate recovery outside project limits.
L	Lab Blank
M	MS Recovery
TR	Trace Level Detect

Flag Code and Definitions

Flag	Definition
U	Undetected: The analyte was analyzed for, but not detected.
UJ	The analyte was not detected; however, the result is estimated due to discrepancies in meeting certain analyte-specific quality control criteria.
J	Estimated: The analyte was positively identified, the quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
R	The data are rejected due to deficiencies in meeting QC criteria and may not be used for decision making.
B	Blank contamination: The analyte was found in an associated blank above one half the RL, as well as in the sample.
UB	The analyte was also detected in an associated laboratory or field blank at a concentration comparable to the concentration in the sample. The reported result has been requalified as not detected.

Review Questions

Method: SW6010C (Trace Metals by Inductively Coupled Plasma/Atomic Emission Spectrometry)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was the Calibration within acceptance criteria?	•			
Were the required minimum levels of calibration standards used in the initial calibration?	•			
Was either analysis of an ICV performed after each ICAL or a second source standard prior to sample analysis?	•			
Were all reported analytes for the ICV within the required criteria?	•			
Were CCVs run at the required frequency and within acceptance criteria?	•			
Was a method blank prepared and analyzed with each batch?	•			
Were target analytes in the method blank less than MDL?		•		A trace amount of copper (0.07 mg/Kg) was detected in the method blank (MDL is 0.07 mg/Kg). The concentrations of copper reported for the samples exceeded the artifact thresholdvalue in all instances such than no qualification of the sample data, based on the detection in the method blank, was necessary.
Were target analytes in the field blank less than MDL?			•	A field blank was not included with this sample delivery group.
Was an LCS/LCSD pair prepared and analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?	•			
Was the LCS/LCSD RPD within project acceptance limits?	•			
Was a MS/MSD pair prepared with each batch?	•			
Were MS/MSD recoveries within project acceptance limits?		•		The laboratory performed MS/MSD analyses with additional volumes of samples BKG-SU3-SA, BKG-SU3-SB, and BKG-SU2-SB-REP3 (this last sample for antimony, copper, lead, and zinc only). The recovery data met validation acceptance criteria in most instances.
Was the MS/MSD RPD within project acceptance limits?	•			
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?			•	Evaluation of field triplicates is performed by the project team, outside of the scope of this validation effort.
Were QAPP specified laboratory PQLs achieved?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			
Were DoD QSM corrective actions followed if deviations were noted?	•			
Were any data rejected during the verification process?		•		

Review Questions

Method: SW8330 (Nitroaromatics and Nitramines by HPLC)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was a blank prepared and analyzed with each batch?	•			
Were target analytes in the blank less than MDL?	•			
Were target analytes in the field blank less than MDL?			•	A field blank was not submitted.
Was an LCS or LCS/LCSD pair analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?	•			
Was the LCS/LCSD RPD within project acceptance limits?			•	An LCSD was not analyzed or reported.
Was a project specific MS or MS/MSD pair prepared with each batch?	•			Additional volumes of samples BKG-SU3-SA and -SB were used.
Were MS/MSD recoveries within project acceptance limits?	•			
Was the MS/MSD RPD within project acceptance limits?	•			
Was a project-specific duplicate analyzed, and the RPD within QAPP acceptance limits?		•		The MS/MSD analyses provided an adequate means of assessing analytical precision.
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?			•	Triplicate samples were collected at locations BKG-SU2-SA and -SB. Nitroguanidine was detected in sample BKG-SU2-SA-REP1 (0.73 mg/Kg) but not in either of the other two of these triplicate samples. Note that evaluation of field triplicates is performed by the project team, outside of the scope of this validation process.
Were QAPP specified laboratory reporting limits achieved?	•			
Were surrogate recoveries within project acceptance limits?		•		Low surrogate recoveries were reported for six of the samples. The results were classified as less than fully quantitative and coded with "J" (sample BKG-SU2-SA-REP1) or "UJ" validation qualifiers (the other five samples).
Were column comparison differences with project acceptance limits?	•			Nitroguanidine was detected only in one sample (BKG-SU2-SA-REP1).
Was the intial calibration within criteria?	•			
Was a second source check standard analyzed and within all applicable criteria?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			

Automated Data Review Report Summary for 135311EDD

Review Questions

Method: SW8330B (Nitroaromatics and Nitramines by HPLC)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was a blank prepared and analyzed with each batch?	•			
Were target analytes in the blank less than MDL?	•			
Were target analytes in the field blank less than MDL?			•	A field blank was not submitted as part of this sample delivery group.
Was an LCS or LCS/LCSD pair analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?	•			
Was the LCS/LCSD RPD within project acceptance limits?			•	LCSDs were not reported.
Was a project specific MS or MS/MSD pair prepared with each batch?	•			Additional volumes of samples BKG-SU3-SA and -SB were used.
Were MS/MSD recoveries within project acceptance limits?	•			
Was the MS/MSD RPD within project acceptance limits?	•			
Was a project-specific duplicate analyzed, and the RPD within QAPP acceptance limits?		•		The MS/MSD analyses provided an adequate means of assessing analytical precision.
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?			•	Triplicate samples were collected at locations BKG-SU2-SA and -SB. No target 8330B analytes were detected in any of these samples. Evaluation of field triplicates is performed by the project team, outside of the scope of this validation effort.
Were QAPP specified laboratory reporting limits achieved?	•			
Were surrogate recoveries within project acceptance limits?	•			A slightly elevated recovery was reported for the surrogate in the analysis of sample BKG-SU6-SA (125% vs. a control limit of 78-119%). The absence of target analytes precluded the need for qualification of the sample data.
Were column comparison differences with project acceptance limits?	•			No target explosives were detected in any of the samples by Method 8330B.
Was the intial calibration within criteria?	•			
Was a second source check standard analyzed and within all applicable criteria?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			

Summary of Qualified Data

SDG	Client Sample ID	Lab Sample ID	SACODE	LOGDATE	Test Method	EXMCODE	MATRIX	Analyte Name	PARLABEL	CAS	DB Result	UNITS	DB Reporting Limit	Limit Of Detection	Display Result	Qualifier*	Reason Code
135311EDD	108338	108338	LB	4/20/2018 11:46:00 AM	SW6010C	SW3050	SQ	Copper	CU	7440-50-8	0.08	mg/kg	0.4	0.07	0.0800	J	TR
135311EDD	BKG-SU1-SA	104579	N	4/10/2018 3:00:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.44	mg/kg	0.83	0.42	0.440	J	TR
135311EDD	BKG-SU1-SA	104579	N	4/10/2018 3:00:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0	mg/kg	0.22	0.11	0.110	UJ	I
135311EDD	BKG-SU2-SA-REP1	104578	FT	4/10/2018 4:30:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.3	mg/kg	0.84	0.42	0.300	J	TR
135311EDD	BKG-SU2-SA-REP1	104578	FT	4/10/2018 4:30:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.73	mg/kg	0.24	0.12	0.730	J	I
135311EDD	BKG-SU2-SA-REP2	104451	FT	4/10/2018 4:30:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.24	mg/kg	0.82	0.41	0.240	J	TR
135311EDD	BKG-SU2-SA-REP3	104574	FT	4/10/2018 4:30:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.2	mg/kg	0.83	0.41	0.200	J	TR
135311EDD	BKG-SU2-SA-REP3	104574	FT	4/10/2018 4:30:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0	mg/kg	0.24	0.11	0.110	UJ	I
135311EDD	BKG-SU2-SB-REP1	104617	FT	4/10/2018 3:35:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.41	mg/kg	0.81	0.4	0.410	J	M/TR
135311EDD	BKG-SU2-SB-REP1	104617	FT	4/10/2018 3:35:00 PM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	8.2	mg/kg	0.3	0.15	8.20	J	D1
135311EDD	BKG-SU2-SB-REP2	104614	FT	4/10/2018 3:35:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.34	mg/kg	0.83	0.42	0.340	J	M/TR
135311EDD	BKG-SU2-SB-REP2	104614	FT	4/10/2018 3:35:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0	mg/kg	0.23	0.11	0.110	UJ	I
135311EDD	BKG-SU2-SB-REP3	105388	FT	4/10/2018 4:50:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.21	mg/kg	0.78	0.39	0.210	J	M/TR
135311EDD	BKG-SU2-SB-REP3	105388	FT	4/10/2018 4:50:00 PM	SW6010C	SW3050	SO	Lead	PB	7439-92-1	2.9	mg/kg	0.24	0.12	2.90	J	A/M
135311EDD	BKG-SU2-SB-REP3	105388	FT	4/10/2018 4:50:00 PM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	17.2	mg/kg	0.29	0.15	17.2	J	A/M
135311EDD	BKG-SU3-SA	104576	N	4/10/2018 4:40:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.21	mg/kg	0.8	0.4	0.210	J	M/TR
135311EDD	BKG-SU3-SA	104576	N	4/10/2018 4:40:00 PM	SW6010C	SW3050	SO	Copper	CU	7440-50-8	1.7	mg/kg	0.4	0.2	1.70	J	A/M
135311EDD	BKG-SU3-SA	104576	N	4/10/2018 4:40:00 PM	SW6010C	SW3050	SO	Lead	PB	7439-92-1	5.5	mg/kg	0.25	0.12	5.50	J	M/A
135311EDD	BKG-SU3-SA	104576	N	4/10/2018 4:40:00 PM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	6.5	mg/kg	0.3	0.15	6.50	J	D1
135311EDD	BKG-SU3-SB	104577	N	4/10/2018 11:45:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.38	mg/kg	0.82	0.41	0.380	J	M/TR
135311EDD	BKG-SU3-SB	104577	N	4/10/2018 11:45:00 AM	SW6010C	SW3050	SO	Copper	CU	7440-50-8	3	mg/kg	0.41	0.21	3.00	J	M/A
135311EDD	BKG-SU3-SB	104577	N	4/10/2018 11:45:00 AM	SW6010C	SW3050	SO	Lead	PB	7439-92-1	4.1	mg/kg	0.26	0.13	4.10	J	M
135311EDD	BKG-SU3-SB	106692	N	4/10/2018 11:45:00 AM	SW6010C	SW3050	SO	Manganese	MN	7439-96-5	18.2	mg/kg	0.15	0.077	18.2	J	M/A
135311EDD	BKG-SU3-SB	104577	N	4/10/2018 11:45:00 AM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	7.9	mg/kg	0.31	0.15	7.90	J	D1
135311EDD	BKG-SU4-SA	104581	N	4/10/2018 11:30:00 AM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0	mg/kg	0.25	0.12	0.120	UJ	I
135311EDD	BKG-SU5-SA	104575	N	4/10/2018 1:30:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.16	mg/kg	0.81	0.4	0.160	J	TR
135311EDD	BKG-SU5-SA	104575	N	4/10/2018 1:30:00 PM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	6.4	mg/kg	0.3	0.15	6.40	J	D1
135311EDD	BKG-SU5-SB	104616	N	4/11/2018 1:30:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.15	mg/kg	0.8	0.4	0.150	J	TR
135311EDD	BKG-SU6-SA	104573	N	4/10/2018 3:30:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.27	mg/kg	0.84	0.42	0.270	J	TR
135311EDD	BKG-SU6-SB	104615	N	4/10/2018 11:15:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.22	mg/kg	0.83	0.41	0.220	J	TR
135311EDD	BKG-SU7-SA	104580	N	4/10/2018 1:45:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.34	mg/kg	0.79	0.4	0.340	J	TR
135311EDD	BKG-SU7-SA	104580	N	4/10/2018 1:45:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0	mg/kg	0.25	0.12	0.120	UJ	I
135311EDD	BKG-SU7-SB	104613	N	4/10/2018 1:30:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.34	mg/kg	0.83	0.41	0.340	J	TR

*Includes detections that are less than the limits of quantitation (LOQs) but otherwise unqualified as a result of the validation (i.e., validation qualifiers of "J" with reason code "TR" only).

Automated Data Review Report Summary for 135364EDD

Facility:	D01MA0033-04, CP Wellfleet - Art, Sm Arms, Rocket
Event:	Phase I Sampling 2018
SDG:	135364EDD
Guidance Document:	Camp Wellfleet - Art, Sm Arms, Rocket
Prime Contractor:	ERT, Inc., Laurel, MD
Project Manager:	Tom Bachovchin
Contract Laboratory:	CT Laboratories LLC, Baraboo, WI
Data Review Contractor:	HSW Engineering, Inc.
Data Review Level:	Stage 2B Review
Primary Data Reviewer:	Cindy Westergard, Senior Scientist
Second Reviewer:	Nigel Lewis, Project Scientist
Date Submitted:	July 12, 2018

Field Sample ID	Lab Sample ID	Matrix	Type/Type Code	SW6010C	SW8330	SW8330B
AOI3-SU3-SA-REP1	105168	Solid	Field Triplicate/FT	X	X	X
AOI3-SU3-SA-REP1	106707	Solid	Field Triplicate/FT	X		
AOI3-SU3-SA-REP2	105169	Solid	Field Triplicate/FT	X	X	X
AOI3-SU3-SA-REP2	106708	Solid	Field Triplicate/FT	X		
AOI3-SU3-SA-REP3	105170	Solid	Field Triplicate/FT	X	X	X
AOI3-SU3-SA-REP3	106709	Solid	Field Triplicate/FT	X		
AOI5-SU1-SA-REP1	105171	Solid	Field Triplicate/FT	X	X	X
AOI5-SU1-SA-REP1	106710	Solid	Field Triplicate/FT	X		
AOI5-SU1-SA-REP2	105172	Solid	Field Triplicate/FT	X	X	X
AOI5-SU1-SA-REP2	106711	Solid	Field Triplicate/FT	X		
AOI5-SU1-SA-REP3	105173	Solid	Field Triplicate/FT	X	X	X
AOI5-SU1-SA-REP3	106712	Solid	Field Triplicate/FT	X		
AOI5-SU2-SA-REP1	105174	Solid	Field Triplicate/FT	X	X	X
AOI5-SU2-SA-REP1	106713	Solid	Field Triplicate/FT	X		
AOI5-SU2-SA-REP2	105175	Solid	Field Triplicate/FT	X	X	X
AOI5-SU2-SA-REP2	106714	Solid	Field Triplicate/FT	X		
AOI5-SU2-SA-REP3	105176	Solid	Field Triplicate/FT	X	X	X
AOI5-SU2-SA-REP3	106715	Solid	Field Triplicate/FT	X		
BKG-SU1-SB	105166	Solid	Field Sample/N	X	X	X
BKG-SU1-SB	106705	Solid	Field Sample/N	X		

Field Sample ID	Lab Sample ID	Matrix	Type/Type Code	SW6010C	SW8330	SW8330B
BKG-SU4-SB	105167	Solid	Field Sample/N	X	X	X
BKG-SU4-SB	106706	Solid	Field Sample/N	X		

This report assesses the analytical data quality associated with the analyses listed on the preceding cover page. This assessment has been made through a combination of automated data review (ADR) and supplemental manual review, the details of which are described below. The approach taken in the review of this data set is consistent with the requirements contained in the Camp Wellfleet - Art, Sm Arms, Rocket and the additional guidance documents incorporated by reference to the extent possible. Where definitive guidance is not provided, results have been evaluated in a conservative manner using professional judgment.

Sample collection was managed and directed by ERT, Inc., Laurel, MD; analyses were performed by CT Laboratories LLC, Baraboo, WI and were reported under sample delivery group (SDG) 135364EDD. Data have been evaluated electronically based on electronic data deliverables (EDDs) provided by the laboratory, and hard copy data summary forms have also been reviewed during this effort and compared to the automated review output by the reviewers whose signatures appear on the following page. Findings based on the automated data submission and manual data verification processes are detailed in the ADR narrative and throughout this report.

All quality control (QC) elements associated with this SDG have been reviewed by a project chemist in accordance with the requirements defined for the project. This review is documented in the attached Data Review Checklists. The QC elements listed below were supported by the electronic deliverable and were evaluated using ADR processes.

- Blank
- Blank - Negative
- LCS Recovery
- MS Recovery
- MS RPD
- Prep Hold Time
- Surrogate
- Test Hold Time

Results of the ADR process were subsequently reviewed and updated as applicable by the data review chemists identified on the signature page. Quality control elements that were not included in the electronic deliverable were reviewed manually and findings are documented within this report. Summaries of findings and associated qualified results are documented throughout this report.

A total of 9 results (6.29%) out of the 143 results (sample and field QC samples) reported are qualified based on review and 0 results (0.00%) have been rejected. Trace values, defined as results that are qualified as estimated because they fall between the detection limit and the reporting limit/limit of quantitation, are not counted as qualified results in the above count. The qualified results are detailed throughout this report and discussed in the narrative below, where appropriate.

Narrative Comments

Eleven ISM samples were received by CT Laboratories, Baraboo, Wisconsin, and analyzed for a select list of explosives and metals. The samples were received intact and at acceptable temperatures. The samples were dried, sieved, subsampled, and ground following the homogenization procedure specified for the project. The analyses were performed in accordance with requirements given in DOD QSM 5. Qualifiers applied by the laboratory are defined in the laboratory report.

Some samples were collected as three field replicates (i.e., triplicates), identified with suffixes of -REP1, -REP2, and -REP3. As replicate samples are an intrinsic part of the ISM process and this project, the extent of variability among triplicate results will be evaluated by the project team. Triplicate results were reviewed by the validator to confirm the overall reasonableness of the results, with no issues of concern noted.

Analytical Method	Data Reviewer Comment
SW6010C	The dried/sieved fraction of each ISM was subsampled for nickel and manganese prior to undergoing grinding via a puck mill, to avoid potential contamination of the samples with these metals from the puck mill. Analyses for antimony, copper, lead, and zinc were performed with the fully-homogenized, puck-milled fractions. The samples were analyzed as part of two analytical runs (#148190 and #148401). The laboratory performed MS/MSD analyses with additional volumes of sample BKG-SU1-SB. The laboratory reported low MS/MSD recoveries of antimony (38% / 43%) and a slightly low MS recovery of zinc (80%). The detections of antimony and zinc reported for parent sample BKG-SU1-SB were classified as less than fully quantitative and coded with "J" validation qualifiers with reason codes of “M”. The laboratory reported the MS recovery of manganese as 114% in the laboratory report and as 114.3% in the electronic data deliverable (EDD). The automated data review module flagged this recovery as an outlier; however, after rounding to three significant digits, the recovery was equal to the control limit (114%). Therefore, the “J” qualifier, bias indicator of “+”, and reason code “M” applied to the detection of manganese reported for parent sample BKG-SU1-SB (55.6 mg/Kg) by the FUDSchem automated data review (ADR) module were removed by the validator. The laboratory performed serial dilution (SD) and post-digestion spike (PDS) analyses of sample BKG-SU1-SB. SD results for all target metals excluding zinc were either invalid (i.e., the concentration of the analyte in the parent sample was less than 50 times the limit of quantitation, or LOQ) or deemed to have failed (i.e., not within +/-10% difference as compared to the instrument reading obtained for the parent sample). PDS recoveries reported for lead (76%), manganese (76%), and zinc (50%) also failed (i.e., each was less than the acceptance range of 80-120%). The detections of these three metals were classified as less than fully quantitative and coded with "J" validation qualifiers. The list of reason codes for data qualification for this project does not include a distinct code for indicating when PDS recoveries are not within control limits. Therefore, when the SD result for a given metal was invalid or not within control limits and the subsequent PDS recovery also was not within control limits, the sample result was qualified with a validation qualifier of "J" (detections) or "UJ" (non-detections) with reason codes of "A/M" ("A" signifying an invalid or failed SD analysis and "M" indicating a spike recovery that was not within limits -- in this case, a PDS). If the MS and/or MSD recovery was not within control limits and the SD + PDS results also were not within control limits, the data were qualified with "J" or "UJ" with reason codes of "M/A" (rather than "M/A/M", as the FUDSchem system will not allow a reason code to be entered twice). The laboratory performed unspiked laboratory triplicate analyses of samples BKG-SU1-SB, AOI3-SU3-SA-REP2, and AOI5-SU2-SA-REP2. The results met validation acceptance criteria for analytical precision, with no qualification of the sample data necessary, based on this particular quality control element.
SW8330	As noted in the laboratory case narrative and confirmed by the validation, low surrogate recoveries were reported for samples AOI3-SU3-SA-REP2, AOI3-SU3-SA-REP3, AOI5-SU1-SA-REP1, AOI5-SU2-SA-REP1, and AOI5-SU2-SA-REP3. The low recoveries were attributed by the laboratory to matrix interferences. The results for nitroguanidine reported for these five samples (all of which were findings of non-detect) were classified as less than fully quantitative and coded with “UJ” validation qualifiers with reason codes of “I”. No other quality issues were noted.
SW8330B	No analytical issues requiring qualification of sample data were noted.

Cindy Lee Westergard

July 11, 2018

Reviewed by Cindy Westergard, Senior Scientist, HSW Engineering, Inc.

As the First Reviewer, I certify that I have performed a data review process in accordance with the requirements of the project guidance document, and have compared the electronic data to the laboratory's hard copy report and have verified the consistency of a minimum of 10% of the reported sample results and method quality control data between the two deliverables.

July 11, 2018

Reviewed by Nigel Lewis, Project Scientist, HSW Engineering, Inc.

As the Second Reviewer, I certify that I have performed a quality assurance review of the report generated by the First Reviewer.

HSW Engineering, Inc.

Quality Control Outliers for test method SW6010C, MS Recovery

Data for matrix spikes/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. These data alone cannot be used to evaluate the precision and accuracy of individual samples. However, when exercising professional judgment, MS/MSD data can be used in conjunction with other available QC information. Reported results were evaluated to determine compliance with the required acceptance criteria, and summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and any associated qualified results, are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
BKG-SU1-SB (SD)/ 107611	Manganese	114.3	84 - 114	30 - 125	percent	J/None	M	
BKG-SU1-SB (MS)/ 109652	Antimony	37.99	79 - 114	30 - 125	percent	J/UJ	M	
BKG-SU1-SB (MS)/ 109652	Zinc	79.92	82 - 113	30 - 125	percent	J/UJ	M	
BKG-SU1-SB (SD)/ 109653	Antimony	43.30	79 - 114	30 - 125	percent	J/UJ	M	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

Qualified Results associated with the MS Recovery for SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
BKG-SU1-SB	N	Manganese	0.150	55.6 M	55.6 J	-	mg/kg	A/M
BKG-SU1-SB	N	Antimony	0.850	0.170 J	0.170 J	-	mg/kg	M/TR
BKG-SU1-SB	N	Zinc	0.320	17.0 M	17.0 J	-	mg/kg	M/A

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).

Quality Control Outliers for test method SW8330, Surrogate

Method performance for individual samples is demonstrated through spiking activities. All samples are spiked with surrogate compounds prior to sample preparation. The sample itself may produce effects due to such factors as interferences and high concentrations of analytes. Summary forms were evaluated and compared to electronic data deliverables. Surrogate results that were outside of the acceptance criteria are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
AOI3-SU3-SA-REP2 (FT)/ 105169	1,2-Dinitrobenzene	11.00	32 - 136	10 - 136	percent	J/UJ	I	
AOI3-SU3-SA-REP3 (FT)/ 105170	1,2-Dinitrobenzene	20.00	32 - 136	10 - 136	percent	J/UJ	I	
AOI5-SU1-SA-REP1 (FT)/ 105171	1,2-Dinitrobenzene	16.00	32 - 136	10 - 136	percent	J/UJ	I	
AOI5-SU2-SA-REP1 (FT)/ 105174	1,2-Dinitrobenzene	30.00	32 - 136	10 - 136	percent	J/UJ	I	
AOI5-SU2-SA-REP3 (FT)/ 105176	1,2-Dinitrobenzene	12.00	32 - 136	10 - 136	percent	J/UJ	I	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

Qualified Results associated with the Surrogate for SW8330

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI3-SU3-SA-REP2	FT	Nitroguanidine	0.230	0.110 U	0.110 UJ	-	mg/kg	I
AOI3-SU3-SA-REP3	FT	Nitroguanidine	0.240	0.120 U	0.120 UJ	-	mg/kg	I
AOI5-SU1-SA-REP1	FT	Nitroguanidine	0.240	0.120 U	0.120 UJ	-	mg/kg	I
AOI5-SU2-SA-REP1	FT	Nitroguanidine	0.240	0.110 U	0.110 UJ	-	mg/kg	I
AOI5-SU2-SA-REP3	FT	Nitroguanidine	0.240	0.120 U	0.120 UJ	-	mg/kg	I

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).

Engineering, Inc.

Table of All Qualified Results

Test Method: SW6010C Extraction Method: SW3050

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
BKG-SU1-SB	N	Manganese	0.150	55.6 M	55.6 J	-	mg/kg	A/M
BKG-SU1-SB	N	Antimony	0.850	0.170 J	0.170 J	-	mg/kg	M/TR
BKG-SU1-SB	N	Zinc	0.320	17.0 M	17.0 J	-	mg/kg	M/A

Test Method: SW8330 Extraction Method: METHOD

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI3-SU3-SA-REP2	FT	Nitroguanidine	0.230	0.110 U	0.110 UJ	-	mg/kg	I
AOI3-SU3-SA-REP3	FT	Nitroguanidine	0.240	0.120 U	0.120 UJ	-	mg/kg	I
AOI5-SU1-SA-REP1	FT	Nitroguanidine	0.240	0.120 U	0.120 UJ	-	mg/kg	I
AOI5-SU2-SA-REP1	FT	Nitroguanidine	0.240	0.110 U	0.110 UJ	-	mg/kg	I
AOI5-SU2-SA-REP3	FT	Nitroguanidine	0.240	0.120 U	0.120 UJ	-	mg/kg	I

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).
Trace values are not included in the qualified results table unless additional reason codes are associated.

Automated Data Review Report Summary for 135364EDD

Table of All Trace Results

Test Method: SW6010C   Extraction Method: SW3050

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI3-SU3-SA-REP1	FT	Antimony	0.780	0.220 J	0.220 J		mg/kg	TR
AOI3-SU3-SA-REP2	FT	Antimony	0.780	0.200 J	0.200 J		mg/kg	TR
AOI3-SU3-SA-REP3	FT	Antimony	0.800	0.230 J	0.230 J		mg/kg	TR
AOI5-SU1-SA-REP1	FT	Antimony	0.850	0.240 J	0.240 J		mg/kg	TR
AOI5-SU1-SA-REP2	FT	Antimony	0.840	0.280 J	0.280 J		mg/kg	TR
AOI5-SU1-SA-REP3	FT	Antimony	0.800	0.190 J	0.190 J		mg/kg	TR
AOI5-SU2-SA-REP1	FT	Antimony	0.820	0.300 J	0.300 J		mg/kg	TR
AOI5-SU2-SA-REP2	FT	Antimony	0.790	0.190 J	0.190 J		mg/kg	TR
AOI5-SU2-SA-REP3	FT	Antimony	0.790	0.250 J	0.250 J		mg/kg	TR
BKG-SU1-SB	N	Antimony	0.850	0.170 J	0.170 J	-	mg/kg	M/TR
BKG-SU4-SB	N	Antimony	0.800	0.280 J	0.280 J		mg/kg	TR

Automated Data Review Report Summary for 135364EDD

Table of Results with Modified Qualifiers

Modified Qualifiers for test method SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	ADR Result	Modified Result	Reason
BKG-SU1-SB	N	Lead	0.260	3.40 M	3.40	3.40 J	A/M
BKG-SU1-SB	N	Zinc	0.320	17.0 M	17.0 J	17.0 J	M/A
BKG-SU1-SB	N	Manganese	0.150	55.6 M	55.6 J	55.6 J	A/M

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).
Trace values are not included in the qualified results table unless additional reason codes are associated.

Reason Code Definitions

Code	Definition
A	Serial dilution
I	Surrogate recovery outside project limits.
M	MS Recovery
TR	Trace Level Detect

Flag Code and Definitions

Flag	Definition
U	Undetected: The analyte was analyzed for, but not detected.
UJ	The analyte was not detected; however, the result is estimated due to discrepancies in meeting certain analyte-specific quality control criteria.
J	Estimated: The analyte was positively identified, the quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
R	The data are rejected due to deficiencies in meeting QC criteria and may not be used for decision making.
B	Blank contamination: The analyte was found in an associated blank above one half the RL, as well as in the sample.
UB	The analyte was also detected in an associated laboratory or field blank at a concentration comparable to the concentration in the sample. The reported result has been requalified as not detected.

HSW Engineering, Inc.

Review Questions

Method: SW6010C (Trace Metals by Inductively Coupled Plasma/Atomic Emission Spectrometry)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was the Calibration within acceptance criteria?	•			
Were the required minimum levels of calibration standards used in the initial calibration?	•			
Was either analysis of an ICV performed after each ICAL or a second source standard prior to sample analysis?	•			
Were all reported analytes for the ICV within the required criteria?	•			
Were CCVs run at the required frequency and within acceptance criteria?	•			
Was a method blank prepared and analyzed with each batch?	•			
Were target analytes in the method blank less than MDL?	•			
Were target analytes in the field blank less than MDL?			•	A field blank was not included with the samples comprising this sample delivery group.
Was an LCS/LCSD pair prepared and analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?	•			
Was the LCS/LCSD RPD within project acceptance limits?			•	
Was a MS/MSD pair prepared with each batch?	•			Additional volumes of sample BKG-SU1-SB were used.
Were MS/MSD recoveries within project acceptance limits?		•		
Was the MS/MSD RPD within project acceptance limits?	•			
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?			•	Field triplicates were collected at three sampling locations. Evaluation of field triplicates is performed by the project team, outside of the scope of this validation effort.
Were QAPP specified laboratory PQLs achieved?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			
Were DoD QSM corrective actions followed if deviations were noted?	•			
Were any data rejected during the verification process?		•		

Review Questions

Method: SW8330 (Nitroaromatics and Nitramines by HPLC)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was a blank prepared and analyzed with each batch?	•			
Were target analytes in the blank less than MDL?	•			
Were target analytes in the field blank less than MDL?			•	A field blank was not submitted.
Was an LCS or LCS/LCSD pair analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?	•			
Was the LCS/LCSD RPD within project acceptance limits?			•	An LCSD was not analyzed.
Was a project specific MS or MS/MSD pair prepared with each batch?	•			Additional volumes of sample BKG-SU1-SB were used.
Were MS/MSD recoveries within project acceptance limits?	•			
Was the MS/MSD RPD within project acceptance limits?	•			
Was a project-specific duplicate analyzed, and the RPD within QAPP acceptance limits?		•		Not reported.
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?			•	The sampling team collected triplicate samples at three locations. No nitroguanidine was detected in any of these samples, nor in any other samples comprising this sample delivery group. Note that evaluation of field triplicates is performed by the project team, outside of the scope of this validation effort.
Were QAPP specified laboratory reporting limits achieved?	•			
Were surrogate recoveries within project acceptance limits?		•		Low surrogate recoveries were reported for five samples; these findings of non-detect were qualified with UJ validation qualifiers.
Were column comparison differences with project acceptance limits?	•			The target analyte was not detected in any of the samples.
Was the intial calibration within criteria?	•			
Was a second source check standard analyzed and within all applicable criteria?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			

Review Questions

Method: SW8330B (Nitroaromatics and Nitramines by HPLC)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was a blank prepared and analyzed with each batch?	•			
Were target analytes in the blank less than MDL?	•			
Were target analytes in the field blank less than MDL?			•	A field blank was not included with this sample delivery group.
Was an LCS or LCS/LCSD pair analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?	•			
Was the LCS/LCSD RPD within project acceptance limits?			•	An LCSD was not reported.
Was a project specific MS or MS/MSD pair prepared with each batch?	•			Additional volumes of sample BKG-SU1-SB were used.
Were MS/MSD recoveries within project acceptance limits?	•			
Was the MS/MSD RPD within project acceptance limits?	•			
Was a project-specific duplicate analyzed, and the RPD within QAPP acceptance limits?		•		Not reported.
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?			•	Samples were collected in triplicate at three locations; no target explosives were detected in any of these samples. Note that evaluation of field triplicates is performed by the project team, outside of the scope of this validation effort.
Were QAPP specified laboratory reporting limits achieved?	•			
Were surrogate recoveries within project acceptance limits?	•			
Were column comparison differences with project acceptance limits?	•			No target analytes were detected.
Was the intial calibration within criteria?	•			
Was a second source check standard analyzed and within all applicable criteria?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			

Summary of Qualified Data

SDG	Client Sample ID	Lab Sample ID	SACODE	LOGDATE	Test Method	EXMCODE	MATRIX	Analyte Name	PARLABEL	CAS	DB Result	UNITS	DB Reporting Limit	Limit Of Detection	Display Result	Qualifier*	Reason Code
135364EDD	AOI3-SU3-SA-REP1	105168	FT	4/12/2018 12:15:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.22	mg/kg	0.78	0.39	0.220	J	TR
135364EDD	AOI3-SU3-SA-REP2	105169	FT	4/12/2018 12:15:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.2	mg/kg	0.78	0.39	0.200	J	TR
135364EDD	AOI3-SU3-SA-REP2	105169	FT	4/12/2018 12:15:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0	mg/kg	0.23	0.11	0.110	UJ	I
135364EDD	AOI3-SU3-SA-REP3	105170	FT	4/12/2018 12:15:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.23	mg/kg	0.8	0.4	0.230	J	TR
135364EDD	AOI3-SU3-SA-REP3	105170	FT	4/12/2018 12:15:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0	mg/kg	0.24	0.12	0.120	UJ	I
135364EDD	AOI5-SU1-SA-REP1	105171	FT	4/12/2018 2:00:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.24	mg/kg	0.85	0.42	0.240	J	TR
135364EDD	AOI5-SU1-SA-REP1	105171	FT	4/12/2018 2:00:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0	mg/kg	0.24	0.12	0.120	UJ	I
135364EDD	AOI5-SU1-SA-REP2	105172	FT	4/12/2018 2:00:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.28	mg/kg	0.84	0.42	0.280	J	TR
135364EDD	AOI5-SU1-SA-REP3	105173	FT	4/12/2018 2:00:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.19	mg/kg	0.8	0.4	0.190	J	TR
135364EDD	AOI5-SU2-SA-REP1	105174	FT	4/12/2018 3:00:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.3	mg/kg	0.82	0.41	0.300	J	TR
135364EDD	AOI5-SU2-SA-REP1	105174	FT	4/12/2018 3:00:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0	mg/kg	0.24	0.11	0.110	UJ	I
135364EDD	AOI5-SU2-SA-REP2	105175	FT	4/12/2018 3:00:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.19	mg/kg	0.79	0.39	0.190	J	TR
135364EDD	AOI5-SU2-SA-REP3	105176	FT	4/12/2018 3:00:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.25	mg/kg	0.79	0.4	0.250	J	TR
135364EDD	AOI5-SU2-SA-REP3	105176	FT	4/12/2018 3:00:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0	mg/kg	0.24	0.12	0.120	UJ	I
135364EDD	BKG-SU1-SB	105166	N	4/12/2018 9:45:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.17	mg/kg	0.85	0.42	0.170	J	M/TR
135364EDD	BKG-SU1-SB	105166	N	4/12/2018 9:45:00 AM	SW6010C	SW3050	SO	Lead	PB	7439-92-1	3.4	mg/kg	0.26	0.13	3.40	J	A/M
135364EDD	BKG-SU1-SB	106705	N	4/12/2018 9:45:00 AM	SW6010C	SW3050	SO	Manganese	MN	7439-96-5	55.6	mg/kg	0.15	0.075	55.6	J	A/M
135364EDD	BKG-SU1-SB	105166	N	4/12/2018 9:45:00 AM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	17	mg/kg	0.32	0.16	17.0	J	M/A
135364EDD	BKG-SU4-SB	105167	N	4/12/2018 9:45:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.28	mg/kg	0.8	0.4	0.280	J	TR

*Includes detections that are less than the limits of quantitation (LOQs) but otherwise unqualified as a result of the validation (i.e., validation qualifiers of "J" with reason code "TR" only).

Automated Data Review Report Summary for 135399EDD

Facility:	D01MA0033-04, CP Wellfleet - Art, Sm Arms, Rocket
Event:	Phase I Sampling 2018
SDG:	135399EDD
Guidance Document:	Camp Wellfleet - Art, Sm Arms, Rocket
Prime Contractor:	ERT, Inc., Laurel, MD
Project Manager:	Tom Bachovchin
Contract Laboratory:	CT Laboratories LLC, Baraboo, WI
Data Review Contractor:	HSW Engineering, Inc.
Data Review Level:	Stage 2B Review
Primary Data Reviewer:	Cindy Westergard, Senior Scientist
Second Reviewer:	Nigel Lewis, Project Scientist
Date Submitted:	July 12, 2018

Field Sample ID	Lab Sample ID	Matrix	Type/Type Code	SW6010C	SW8330	SW8330B
AOI3-SU1-SA-REP1	105949	Solid	Field Triplicate/FT	X	X	X
AOI3-SU1-SA-REP1	106739	Solid	Field Triplicate/FT	X		
AOI3-SU1-SA-REP2	105950	Solid	Field Triplicate/FT	X	X	X
AOI3-SU1-SA-REP2	106740	Solid	Field Triplicate/FT	X		
AOI3-SU1-SA-REP3	105951	Solid	Field Triplicate/FT	X	X	X
AOI3-SU1-SA-REP3	106741	Solid	Field Triplicate/FT	X		
AOI3-SU1-SB-REP1	105952	Solid	Field Triplicate/FT	X	X	X
AOI3-SU1-SB-REP1	106742	Solid	Field Triplicate/FT	X		
AOI3-SU1-SB-REP2	105953	Solid	Field Triplicate/FT	X	X	X
AOI3-SU1-SB-REP2	106743	Solid	Field Triplicate/FT	X		
AOI3-SU1-SB-REP3	105954	Solid	Field Triplicate/FT	X	X	X
AOI3-SU1-SB-REP3	106744	Solid	Field Triplicate/FT	X		
AOI4-SU5-SA-REP1	105946	Solid	Field Triplicate/FT	X	X	X
AOI4-SU5-SA-REP1	106736	Solid	Field Triplicate/FT	X		
AOI4-SU5-SA-REP2	105947	Solid	Field Triplicate/FT	X	X	X
AOI4-SU5-SA-REP2	106737	Solid	Field Triplicate/FT	X		
AOI4-SU5-SA-REP3	105948	Solid	Field Triplicate/FT	X	X	X
AOI4-SU5-SA-REP3	106738	Solid	Field Triplicate/FT	X		
WELLB-GW-1	105955	Water	Field Sample/N	X	X	X

This report assesses the analytical data quality associated with the analyses listed on the preceding cover page. This assessment has been made through a combination of automated data review (ADR) and supplemental manual review, the details of which are described below. The approach taken in the review of this data set is consistent with the requirements contained in the Camp Wellfleet - Art, Sm Arms, Rocket and the additional guidance documents incorporated by reference to the extent possible. Where definitive guidance is not provided, results have been evaluated in a conservative manner using professional judgment.

Sample collection was managed and directed by ERT, Inc., Laurel, MD; analyses were performed by CT Laboratories LLC, Baraboo, WI and were reported under sample delivery group (SDG) 135399EDD. Data have been evaluated electronically based on electronic data deliverables (EDDs) provided by the laboratory, and hard copy data summary forms have also been reviewed during this effort and compared to the automated review output by the reviewers whose signatures appear on the following page. Findings based on the automated data submission and manual data verification processes are detailed in the ADR narrative and throughout this report.

All quality control (QC) elements associated with this SDG have been reviewed by a project chemist in accordance with the requirements defined for the project. This review is documented in the attached Data Review Checklists. The QC elements listed below were supported by the electronic deliverable and were evaluated using ADR processes.

Blank

Blank - Negative

LCS Recovery LCS

RPD

MS Recovery

MS RPD

Prep Hold Time

Surrogate

Test Hold Time

Results of the ADR process were subsequently reviewed and updated as applicable by the data review chemists identified on the signature page. Quality control elements that were not included in the electronic deliverable were reviewed manually and findings are documented within this report. Summaries of findings and associated qualified results are documented throughout this report.

A total of 12 results (9.23%) out of the 130 results (sample and field QC samples) reported are qualified based on review and 0 results (0.00%) have been rejected. Trace values, defined as results that are qualified as estimated because they fall between the detection limit and the reporting limit/limit of quantitation, are not counted as qualified results in the above count. The qualified results are detailed throughout this report and discussed in the narrative below, where appropriate.

Narrative Comments

Nine ISM samples and one groundwater sample were received by CT Laboratories, Baraboo, Wisconsin, and analyzed for a select list of explosives and metals. The samples were received intact and at acceptable temperatures. The ISM samples were dried, sieved, subsampled, and ground following the homogenization procedure specified for the project. All analyses were performed in accordance with requirements given in DOD QSM 5. Qualifiers used by the laboratory are defined in the laboratory report.

All of the ISM samples were collected as three field replicates (i.e., triplicates), identified with suffixes of -REP1, -REP2, and -REP3. As replicate samples are an intrinsic part of the ISM process and this project, the extent of variability among triplicate results will be evaluated by the project team. Triplicate results were reviewed by the validator to confirm the overall reasonableness of the results, with no issues of concern noted.

Analytical Method	Data Reviewer Comment
SW6010C	The dried/sieved fraction of each ISM sample was subsampled for nickel and manganese prior to undergoing grinding via a puck mill, to avoid potential contamination of the samples with these metals from the puck mill. Analyses for antimony, copper, lead, and zinc were performed with the fully-homogenized, puck-milled fractions. The ISM samples were analyzed as part of two analytical runs (#148191 and #148402); the groundwater sample was analyzed as part of analytical run #148087. A low level of lead was detected in the method blank for soil; however, the concentration was less than one-tenth the concentrations detected in the soil samples. No qualification of the sample data was necessary. The laboratory performed MS/MSD analyses with additional volumes of water sample WELLB-GW-1, with a slightly low recovery reported for copper in the analysis of the MSD (85.2% vs. a lower acceptance limit of 86%). The detection of copper reported for the parent sample (20.8 ug/L) was classified as less than fully quantitative and coded with a “J” validation qualifier. The laboratory performed MS/MSD analyses with additional volumes of soil sample AOI4-SU5-SA-REP1. The laboratory reported low MS/MSD recoveries of antimony (39% / 37%) and lead (77% / 74%); all other recoveries were within acceptance limits. The %RPDs for antimony and lead and the four other target metals were within acceptance limits. The finding of non-detect for antimony and detection of lead reported for parent sample AOI4-SU5-SA-REP1 were classified as less than fully quantitative and coded with “J” and “UJ” validation qualifiers, respectively. The FUDSchem automated data review (ADR) module also applied these qualifiers to the other two field replicates collected at this location (AOI4-SU5-SA-REP2 and -REP3). The laboratory performed serial dilution (SD) and post-digestion spike (PDS) analyses of sample AOI4-SU5-SA-REP1. With the exception of the SD result reported for manganese, all SD results were indicated with as being either invalid (due to the concentration of the analyte in the parent sample being less than 50 times the limit of quantitation, or LOQ) or not within the acceptance limit (+/-10%D). The PDS analyses of these sample digestates yielded recoveries of copper, lead, and zinc that also were not within acceptance limits (80-120%). The detections of copper, lead, and zinc reported for sample AOI4-SU5-SA-REP1 were classified as less than fully quantitative and coded with “J” validation qualifiers. As the SD result for antimony was invalid but the PDS recovery was acceptable, additional qualification of the result for antimony reported for the parent sample (previously qualified due to low MS/MSD recoveries), based on the combined SD + PDS findings, was not necessary. The list of reason codes for data qualification for this project does not include a distinct code for indicating when PDS recoveries are not within control limits. Therefore, when the serial dilution (SD) result for a given metal was invalid or not within control limits and the subsequent PDS recovery also was not within control limits, the sample result was qualified with a validation qualifier of "J" (detections) or "UJ" (non-detections) with reason codes of "A/M" ("A" signifying an invalid or failed SD analysis and "M" indicating a spike recovery that was not within limits -- in this case, a PDS). If the MS and/or MSD recovery was not within control limits and the SD + PDS results also were not within control limits, the data were qualified with "J" or "UJ" with reason codes of "M/A" (rather than "M/A/M", as the FUDSchem system will not allow a reason code to be entered twice).

SW8330	The laboratory reported low surrogate recoveries in the analysis of samples AOI4-SU5-SA-REP1, AOI4-SU5-SA-REP2, and AOI3-SU1-SA-REP3, attributing the low recoveries to matrix interference. The detection of nitroguanidine reported for sample AO14-SU5-SA-REP1 and findings of non-detect reported for samples AOI4-SU5-SA-REP2 and AOI3-SU1-SA-REP3 were classified as less than fully quantitative and coded with "J" or "UJ" validation qualifiers with reason codes of "I". Nitroguanidine was detected in both the primary and confirmation analyses of sample AOI4-SU5-SA-REP1, but the values yielded a relative percent difference (%RPD) of greater than 40%. The detection of nitroguanidine reported for the parent sample, previously qualified due to a low surrogate recovery (as well as due to its detection at less than the LOQ), was additionally qualified based on the discrepancy between detections on the two analytical columns (i.e., reason code "P1"). No additional quality issues were noted.
SW8330B	A detection of 2,6-dinitrotoluene was reported for the method blank associated with the soil samples. As the analyte was not detected in any of the soil samples, no qualification of the sample data for 2,6-dinitrotoluene was necessary. No other quality issues requiring qualification of sample data were noted. An LCS/LCSD was analyzed for the water matrix as insufficient volumes were available for aqueous MS/MSD analyses. The recoveries of tetryl exceeded control limits; however, as the analyte was not detected in the water sample, no qualification of the sample data for this analyte was necessary. One instance in which a surrogate was elevated slightly above the acceptance limit was reported (sample WELLB-GW-1). This minor quality control excursion was not relevant as no target analytes were detected in the sample.

Cindy Lee Westergard

July 11, 2018

Reviewed by Cindy Westergard, Senior Scientist, HSW Engineering, Inc.

As the First Reviewer, I certify that I have performed a data review process in accordance with the requirements of the project guidance document, and have compared the electronic data to the laboratory's hard copy report and have verified the consistency of a minimum of 10% of the reported sample results and method quality control data between the two deliverables.

July 11, 2018

Reviewed by Nigel Lewis, Project Scientist, HSW Engineering, Inc.

As the Second Reviewer, I certify that I have performed a quality assurance review of the report generated by the First Reviewer.

Quality Control Outliers for test method SW6010C, Blank

The purpose of laboratory blanks is to determine the existence and magnitude of cross-contamination problems resulting from laboratory activities. Reported results were evaluated to determine compliance with the required acceptance criteria. Summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and contaminants found in laboratory blanks are listed below along with any associated qualified results.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
109643 (LB)/ 109643	Lead	0.09600	< 0.04	< 0.25	mg/kg	U/None	L	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

No results associated with this QC element required qualification.

Quality Control Outliers for test method SW6010C, MS Recovery

Data for matrix spikes/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. These data alone cannot be used to evaluate the precision and accuracy of individual samples. However, when exercising professional judgment, MS/MSD data can be used in conjunction with other available QC information. Reported results were evaluated to determine compliance with the required acceptance criteria, and summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and any associated qualified results, are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
AOI4-SU5-SA-REP1 (MS)/ 109647	Antimony	38.87	79 - 114	30 - 125	percent	J/UJ	M	
AOI4-SU5-SA-REP1 (MS)/ 109647	Lead	76.52	81 - 112	30 - 125	percent	J/UJ	M	
AOI4-SU5-SA-REP1 (SD)/ 109648	Antimony	36.69	79 - 114	30 - 125	percent	J/UJ	M	
AOI4-SU5-SA-REP1 (SD)/ 109648	Lead	74.19	81 - 112	30 - 125	percent	J/UJ	M	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

Qualified Results associated with the MS Recovery for SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI4-SU5-SA-REP1	FT	Antimony	0.790	0.390 U	0.390 UJ	-	mg/kg	M
AOI4-SU5-SA-REP1	FT	Lead	0.250	3.70 M	3.70 J	-	mg/kg	M/A
AOI4-SU5-SA-REP2	FT	Antimony	0.800	0.400 U	0.400 UJ	-	mg/kg	M
AOI4-SU5-SA-REP2	FT	Lead	0.250	3.80	3.80 J	-	mg/kg	M
AOI4-SU5-SA-REP3	FT	Antimony	0.790	0.150 J	0.150 J	-	mg/kg	M/TR
AOI4-SU5-SA-REP3	FT	Lead	0.250	3.60	3.60 J	-	mg/kg	M

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).

Quality Control Outliers for test method SW6010C, MS Recovery

Data for matrix spikes/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. These data alone cannot be used to evaluate the precision and accuracy of individual samples. However, when exercising professional judgment, MS/MSD data can be used in conjunction with other available QC information. Reported results were evaluated to determine compliance with the required acceptance criteria, and summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and any associated qualified results, are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
WELLB-GW-1 (SD)/ 106282	Copper	85.20	86 - 114	30 - 125	percent	J/UJ	M	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

Qualified Results associated with the MS Recovery for SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
WELLB-GW-1	N	Copper	7.00	20.8	20.8 J	-	ug/l	M

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).

Quality Control Outliers for test method SW8330, Surrogate

Method performance for individual samples is demonstrated through spiking activities. All samples are spiked with surrogate compounds prior to sample preparation. The sample itself may produce effects due to such factors as interferences and high concentrations of analytes. Summary forms were evaluated and compared to electronic data deliverables. Surrogate results that were outside of the acceptance criteria are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
AOI3-SU1-SA-REP3 (FT)/ 105951	1,2-Dinitrobenzene	31.00	32 - 136	10 - 136	percent	J/UJ	I	
AOI4-SU5-SA-REP1 (FT)/ 105946	1,2-Dinitrobenzene	17.00	32 - 136	10 - 136	percent	J/UJ	I	
AOI4-SU5-SA-REP1 (MS)/ 109240	1,2-Dinitrobenzene	18.20	32 - 136	10 - 136	percent	J/UJ	I	
AOI4-SU5-SA-REP1 (SD)/ 109241	1,2-Dinitrobenzene	18.00	32 - 136	10 - 136	percent	J/UJ	I	
AOI4-SU5-SA-REP2 (FT)/ 105947	1,2-Dinitrobenzene	18.00	32 - 136	10 - 136	percent	J/UJ	I	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

Qualified Results associated with the Surrogate for SW8330

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI3-SU1-SA-REP3	FT	Nitroguanidine	0.250	0.120 U	0.120 UJ	-	mg/kg	I
AOI4-SU5-SA-REP1	FT	Nitroguanidine	0.240	0.200 JP,Y	0.200 J	-	mg/kg	I/TR/P1
AOI4-SU5-SA-REP2	FT	Nitroguanidine	0.230	0.110 U	0.110 UJ	-	mg/kg	I

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).

Quality Control Outliers for test method SW8330B, Blank

The purpose of laboratory blanks is to determine the existence and magnitude of cross-contamination problems resulting from laboratory activities. Reported results were evaluated to determine compliance with the required acceptance criteria. Summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and contaminants found in laboratory blanks are listed below along with any associated qualified results.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
109181 (LB)/ 109181	2,6-Dinitrotoluene	0.1580	< 0.06	< 0.3	mg/kg	U/None	L	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

No results associated with this QC element required qualification.

Quality Control Outliers for test method SW8330B, LCS Recovery

The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. Reported results were evaluated to determine compliance with the required acceptance criteria, and summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and any associated qualified results, are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
107530 (BS)/ 107530	Tetryl	129.2	64 - 128	20 - 128	percent	J/None	C	
107531 (BD)/ 107531	2,6-Dinitrotoluene	127.2	77 - 127	20 - 127	percent	J/None	C	
107531 (BD)/ 107531	Tetryl	135.4	64 - 128	20 - 128	percent	J/None	C	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

No results associated with this QC element required qualification.

Automated Data Review Report Summary for 135399EDD

Table of All Qualified Results

Test Method: SW6010C   Extraction Method: SW3010

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
WELLB-GW-1	N	Copper	7.00	20.8	20.8 J	-	ug/l	M

Test Method: SW6010C   Extraction Method: SW3050

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI4-SU5-SA-REP1	FT	Antimony	0.790	0.390 U	0.390 UJ	-	mg/kg	M
AOI4-SU5-SA-REP1	FT	Lead	0.250	3.70 M	3.70 J	-	mg/kg	M/A
AOI4-SU5-SA-REP2	FT	Antimony	0.800	0.400 U	0.400 UJ	-	mg/kg	M
AOI4-SU5-SA-REP2	FT	Lead	0.250	3.80	3.80 J	-	mg/kg	M
AOI4-SU5-SA-REP3	FT	Antimony	0.790	0.150 J	0.150 J	-	mg/kg	M/TR
AOI4-SU5-SA-REP3	FT	Lead	0.250	3.60	3.60 J	-	mg/kg	M

Test Method: SW8330   Extraction Method: METHOD

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI3-SU1-SA-REP3	FT	Nitroguanidine	0.250	0.120 U	0.120 UJ	-	mg/kg	I
AOI4-SU5-SA-REP1	FT	Nitroguanidine	0.240	0.200 JP,Y	0.200 J	-	mg/kg	I/TR/P1
AOI4-SU5-SA-REP2	FT	Nitroguanidine	0.230	0.110 U	0.110 UJ	-	mg/kg	I

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).
Trace values are not included in the qualified results table unless additional reason codes are associated.

Automated Data Review Report Summary for 135399EDD

Table of All Trace Results

Test Method: SW6010C   Extraction Method: SW3010

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
WELLB-GW-1	N	Antimony	12.0	3.80 J	3.80 J		ug/L	TR
WELLB-GW-1	N	Lead	4.00	3.30 J	3.30 J		ug/L	TR

Test Method: SW6010C   Extraction Method: SW3050

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI3-SU1-SA-REP1	FT	Antimony	0.780	0.200 J	0.200 J		mg/kg	TR
AOI3-SU1-SA-REP2	FT	Antimony	0.790	0.140 J	0.140 J		mg/kg	TR
AOI3-SU1-SA-REP3	FT	Antimony	0.780	0.160 J	0.160 J		mg/kg	TR
AOI3-SU1-SB-REP3	FT	Antimony	0.800	0.160 J	0.160 J		mg/kg	TR
AOI4-SU5-SA-REP3	FT	Antimony	0.790	0.150 J	0.150 J	-	mg/kg	M/TR

Test Method: SW8330   Extraction Method: METHOD

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI4-SU5-SA-REP1	FT	Nitroguanidine	0.240	0.200 JP,Y	0.200 J	-	mg/kg	I/TR/P1

Table of Results with Modified Qualifiers

Modified Qualifiers for test method SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	ADR Result	Modified Result	Reason
AOI4-SU5-SA-REP1	FT	Copper	0.390	1.40 M	1.40	1.40 J	A/M
AOI4-SU5-SA-REP1	FT	Lead	0.250	3.70 M	3.70 J	3.70 J	M/A
AOI4-SU5-SA-REP1	FT	Zinc	0.300	15.8 M	15.8	15.8 J	A/M

Modified Qualifiers for test method SW8330

FieldSample ID	Type	Analyte	LOQ	Lab Result	ADR Result	Modified Result	Reason
AOI4-SU5-SA-REP1	FT	Nitroguanidine	0.240	0.200 JP,Y	0.200 J	0.200 J	I/TR/P1

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).
Trace values are not included in the qualified results table unless additional reason codes are associated.

Reason Code Definitions

Code	Definition
A	Serial dilution
C	LCS Recovery
I	Surrogate recovery outside project limits.
L	Lab Blank
M	MS Recovery
P1	Column RPD
TR	Trace Level Detect

Flag Code and Definitions

Flag	Definition
U	Undetected: The analyte was analyzed for, but not detected.
UJ	The analyte was not detected; however, the result is estimated due to discrepancies in meeting certain analyte-specific quality control criteria.
J	Estimated: The analyte was positively identified, the quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
R	The data are rejected due to deficiencies in meeting QC criteria and may not be used for decision making.
B	Blank contamination: The analyte was found in an associated blank above one half the RL, as well as in the sample.
UB	The analyte was also detected in an associated laboratory or field blank at a concentration comparable to the concentration in the sample. The reported result has been requalified as not detected.

Review Questions

Method: SW6010C (Trace Metals by Inductively Coupled Plasma/Atomic Emission Spectrometry)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was the Calibration within acceptance criteria?	•			
Were the required minimum levels of calibration standards used in the initial calibration?	•			
Was either analysis of an ICV performed after each ICAL or a second source standard prior to sample analysis?	•			
Were all reported analytes for the ICV within the required criteria?	•			
Were CCVs run at the required frequency and within acceptance criteria?	•			
Was a method blank prepared and analyzed with each batch?	•			
Were target analytes in the method blank less than MDL?		•		A low level of lead was detected in the method blank for soil; however, the concentration was less than one-tenth the concentrations detected in the soil samples.
Were target analytes in the field blank less than MDL?			•	
Was an LCS/LCSD pair prepared and analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?	•			
Was the LCS/LCSD RPD within project acceptance limits?			•	
Was a MS/MSD pair prepared with each batch?	•			Additional volumes of samples AOI4-SU5-SA-REP1 and WELLB-GW-1 were used.
Were MS/MSD recoveries within project acceptance limits?		•		Refer to the Test Method comments for details.
Was the MS/MSD RPD within project acceptance limits?	•			
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?			•	Evaluation of field triplicates is performed by the project team, outside of the scope of this validation effort.
Were QAPP specified laboratory PQLs achieved?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			
Were DoD QSM corrective actions followed if deviations were noted?	•			
Were any data rejected during the verification process?		•		

Automated Data Review Report Summary for 135399EDD

Review Questions

Method: SW8330 (Nitroaromatics and Nitramines by HPLC)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was a blank prepared and analyzed with each batch?	•			
Were target analytes in the blank less than MDL?	•			No nitroguanidine was detected in the method blanks.
Were target analytes in the field blank less than MDL?			•	
Was an LCS or LCS/LCSD pair analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?	•			
Was the LCS/LCSD RPD within project acceptance limits?	•			Reported for the water matrix only.
Was a project specific MS or MS/MSD pair prepared with each batch?	•			Insufficient sample volumes were available for project-specific MS/MSD analyses of the aqueous sample. MS/MSD data were provided in association with the soil samples.
Were MS/MSD recoveries within project acceptance limits?	•			
Was the MS/MSD RPD within project acceptance limits?	•			
Was a project-specific duplicate analyzed, and the RPD within QAPP acceptance limits?		•		Unspiked laboratory duplicate or triplicate analyses were not reported.
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?			•	Field triplicates were collected at three sampling locations. Evaluation of field triplicates is performed by the project team, outside of the scope of this validation effort.
Were QAPP specified laboratory reporting limits achieved?	•			
Were surrogate recoveries within project acceptance limits?		•		Low surrogates were reported for three samples.
Were column comparison differences with project acceptance limits?		•		A discrepancy was noted for sample AO14-SU5-SA-REP1.
Was the intial calibration within criteria?	•			
Was a second source check standard analyzed and within all applicable criteria?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			

Automated Data Review Report Summary for 135399EDD

Review Questions

Method: SW8330B (Nitroaromatics and Nitramines by HPLC)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was a blank prepared and analyzed with each batch?	•			
Were target analytes in the blank less than MDL?		•		A detection of 2,6-dinitrotoluene was reported for the method blank associated with the soil samples. As this analyte was not detected in any of the soil samples, no qualification of the sample data was necessary.
Were target analytes in the field blank less than MDL?			•	
Was an LCS or LCS/LCSD pair analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?	•			An LCS/LCSD was analyzed for the water matrix as insufficient volumes were available for aqueous MS/MSD analyses. The recoveries of tetryl exceeded control limits; however, as the analyte was not detected in the water sample, no qualification of the sample data for this analyte was necessary.
Was the LCS/LCSD RPD within project acceptance limits?	•			Aqueous LCS/LCSD only.
Was a project specific MS or MS/MSD pair prepared with each batch?	•			Performed for soil only. Additional volumes of sample AO14-SU5-SA-REP1 were used.
Were MS/MSD recoveries within project acceptance limits?	•			
Was the MS/MSD RPD within project acceptance limits?	•			
Was a project-specific duplicate analyzed, and the RPD within QAPP acceptance limits?		•		Not required.
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?			•	Field triplicates were collected at three locations. Evaluation of field triplicates is performed by the project team, outside of the scope of this validation effort.
Were QAPP specified laboratory reporting limits achieved?	•			
Were surrogate recoveries within project acceptance limits?	•			One instance in which a surrogate was elevated slightly above the acceptance limit (sample WELLB-GW-1) was not relevant as no target analytes were detected in the sample.
Were column comparison differences with project acceptance limits?	•			
Was the intial calibration within criteria?	•			
Was a second source check standard analyzed and within all applicable criteria?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			

Summary of Qualified Data

SDG	Client Sample ID	Lab Sample ID	SACODE	LOGDATE	Test Method	EXMCODE	MATRIX	Analyte Name	PARLABEL	CAS	DB Result	UNITS	DB Reporting Limit	Limit Of Detection	Display Result	Qualifier*	Reason Code
135399EDD	109181	109181	LB	4/24/2018 3:30:00 PM	SW8330B	METHOD	SQ	2,6-Dinitrotoluene	DNT26	606-20-2	0.158	mg/kg	0.3	0.06	0.158	J	TR
135399EDD	109643	109643	LB	4/25/2018 9:47:00 AM	SW6010C	SW3050	SQ	Lead	PB	7439-92-1	0.096	mg/kg	0.25	0.04	0.0960	J	TR
135399EDD	AOI3-SU1-SA-REP1	105949	FT	4/13/2018 2:15:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.2	mg/kg	0.78	0.39	0.200	J	TR
135399EDD	AOI3-SU1-SA-REP2	105950	FT	4/13/2018 2:15:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.14	mg/kg	0.79	0.4	0.140	J	TR
135399EDD	AOI3-SU1-SA-REP3	105951	FT	4/13/2018 2:15:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.16	mg/kg	0.78	0.39	0.160	J	TR
135399EDD	AOI3-SU1-SA-REP3	105951	FT	4/13/2018 2:15:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0	mg/kg	0.25	0.12	0.120	UJ	I
135399EDD	AOI3-SU1-SB-REP3	105954	FT	4/13/2018 3:45:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.16	mg/kg	0.8	0.4	0.160	J	TR
135399EDD	AOI4-SU5-SA-REP1	105946	FT	4/13/2018 12:20:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0	mg/kg	0.79	0.39	0.390	UJ	M
135399EDD	AOI4-SU5-SA-REP1	105946	FT	4/13/2018 12:20:00 PM	SW6010C	SW3050	SO	Copper	CU	7440-50-8	1.4	mg/kg	0.39	0.2	1.40	J	A/M
135399EDD	AOI4-SU5-SA-REP1	105946	FT	4/13/2018 12:20:00 PM	SW6010C	SW3050	SO	Lead	PB	7439-92-1	3.7	mg/kg	0.25	0.12	3.70	J	M/A
135399EDD	AOI4-SU5-SA-REP1	105946	FT	4/13/2018 12:20:00 PM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	15.8	mg/kg	0.3	0.15	15.8	J	A/M
135399EDD	AOI4-SU5-SA-REP1	105946	FT	4/13/2018 12:20:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.2	mg/kg	0.24	0.11	0.200	J	I/TR/P1
135399EDD	AOI4-SU5-SA-REP1	109240	MS	4/13/2018 12:20:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	1.83	mg/kg	0.251	0.12	1.83	J	I
135399EDD	AOI4-SU5-SA-REP1	109241	SD	4/13/2018 12:20:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	1.85	mg/kg	0.248	0.119	1.85	J	I
135399EDD	AOI4-SU5-SA-REP2	105947	FT	4/13/2018 12:20:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0	mg/kg	0.8	0.4	0.400	UJ	M
135399EDD	AOI4-SU5-SA-REP2	105947	FT	4/13/2018 12:20:00 PM	SW6010C	SW3050	SO	Lead	PB	7439-92-1	3.8	mg/kg	0.25	0.12	3.80	J	M
135399EDD	AOI4-SU5-SA-REP2	105947	FT	4/13/2018 12:20:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0	mg/kg	0.23	0.11	0.110	UJ	I
135399EDD	AOI4-SU5-SA-REP3	105948	FT	4/13/2018 12:20:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.15	mg/kg	0.79	0.39	0.150	J	M/TR
135399EDD	AOI4-SU5-SA-REP3	105948	FT	4/13/2018 12:20:00 PM	SW6010C	SW3050	SO	Lead	PB	7439-92-1	3.6	mg/kg	0.25	0.12	3.60	J	M
135399EDD	WELLB-GW-1	105955	N	4/13/2018 8:05:00 AM	SW6010C	SW3010	WP	Antimony	SB	7440-36-0	3.8	ug/L	12	6	3.80	J	TR
135399EDD	WELLB-GW-1	105955	N	4/13/2018 8:05:00 AM	SW6010C	SW3010	WP	Copper	CU	7440-50-8	20.8	ug/L	7	3.5	20.8	J	M
135399EDD	WELLB-GW-1	105955	N	4/13/2018 8:05:00 AM	SW6010C	SW3010	WP	Lead	PB	7439-92-1	3.3	ug/L	4	2	3.30	J	TR

*Includes detections that are less than the limits of quantitation (LOQs) but otherwise unqualified as a result of the validation (i.e., validation qualifiers of "J" with reason code "TR" only).

Automated Data Review Report Summary for 135443EDD

Facility:	D01MA0033-04, CP Wellfleet - Art, Sm Arms, Rocket
Event:	Phase I Sampling 2018
SDG:	135443EDD
Guidance Document:	Camp Wellfleet - Art, Sm Arms, Rocket
Prime Contractor:	ERT, Inc., Laurel, MD
Project Manager:	Tom Bachovchin
Contract Laboratory:	CT Laboratories LLC, Baraboo, WI
Data Review Contractor:	HSW Engineering, Inc.
Data Review Level:	Stage 2B Review
Primary Data Reviewer:	Cindy Westergard, Senior Scientist
Second Reviewer:	Nigel Lewis, Project Scientist
Date Submitted:	July 12, 2018

Field Sample ID	Lab Sample ID	Matrix	Type/Type Code	SW6010C	SW8330	SW8330B
AOI3-SU2-SA-REP1	107218	Solid	Field Triplicate/FT	X	X	X
AOI3-SU2-SA-REP1	107219	Solid	Field Triplicate/FT	X		
AOI3-SU2-SA-REP2	107220	Solid	Field Triplicate/FT	X	X	X
AOI3-SU2-SA-REP2	107221	Solid	Field Triplicate/FT	X		
AOI3-SU2-SA-REP3	107222	Solid	Field Triplicate/FT	X	X	X
AOI3-SU2-SA-REP3	107223	Solid	Field Triplicate/FT	X		
AOI4-SU1-SA-REP1	107196	Solid	Field Triplicate/FT	X	X	X
AOI4-SU1-SA-REP1	107197	Solid	Field Triplicate/FT	X		
AOI4-SU1-SA-REP2	107198	Solid	Field Triplicate/FT	X	X	X
AOI4-SU1-SA-REP2	107199	Solid	Field Triplicate/FT	X		
AOI4-SU1-SA-REP3	107200	Solid	Field Triplicate/FT	X	X	X
AOI4-SU1-SA-REP3	107201	Solid	Field Triplicate/FT	X		
AOI4-SU2-SA-REP1	107095	Solid	Field Triplicate/FT	X	X	X
AOI4-SU2-SA-REP1	107096	Solid	Field Triplicate/FT	X		
AOI4-SU2-SA-REP2	107097	Solid	Field Triplicate/FT	X	X	X
AOI4-SU2-SA-REP2	107098	Solid	Field Triplicate/FT	X		
AOI4-SU2-SA-REP3	107099	Solid	Field Triplicate/FT	X	X	X
AOI4-SU2-SA-REP3	107100	Solid	Field Triplicate/FT	X		
AOI4-SU2-SB-REP1	107101	Solid	Field Triplicate/FT	X	X	X
AOI4-SU2-SB-REP1	107102	Solid	Field Triplicate/FT	X		

Field Sample ID	Lab Sample ID	Matrix	Type/Type Code	SW6010C	SW8330	SW8330B
AOI4-SU2-SB-REP2	107103	Solid	Field Triplicate/FT	X	X	X
AOI4-SU2-SB-REP2	107104	Solid	Field Triplicate/FT	X		
AOI4-SU2-SB-REP3	107105	Solid	Field Triplicate/FT	X	X	X
AOI4-SU2-SB-REP3	107106	Solid	Field Triplicate/FT	X		
AOI4-SU3-SA-REP1	107202	Solid	Field Triplicate/FT	X	X	X
AOI4-SU3-SA-REP1	107203	Solid	Field Triplicate/FT	X		
AOI4-SU3-SA-REP2	107204	Solid	Field Triplicate/FT	X	X	X
AOI4-SU3-SA-REP2	107205	Solid	Field Triplicate/FT	X		
AOI4-SU3-SA-REP3	107216	Solid	Field Triplicate/FT	X	X	X
AOI4-SU3-SA-REP3	107217	Solid	Field Triplicate/FT	X		
AOI4-SU4-SA-REP1	107188	Solid	Field Triplicate/FT	X	X	X
AOI4-SU4-SA-REP1	107190	Solid	Field Triplicate/FT	X		
AOI4-SU4-SA-REP2	107191	Solid	Field Triplicate/FT	X	X	X
AOI4-SU4-SA-REP2	107192	Solid	Field Triplicate/FT	X		
AOI4-SU4-SA-REP3	107194	Solid	Field Triplicate/FT	X	X	X
AOI4-SU4-SA-REP3	107195	Solid	Field Triplicate/FT	X		

This report assesses the analytical data quality associated with the analyses listed on the preceding cover page. This assessment has been made through a combination of automated data review (ADR) and supplemental manual review, the details of which are described below. The approach taken in the review of this data set is consistent with the requirements contained in the Camp Wellfleet - Art, Sm Arms, Rocket and the additional guidance documents incorporated by reference to the extent possible. Where definitive guidance is not provided, results have been evaluated in a conservative manner using professional judgment.

Sample collection was managed and directed by ERT, Inc., Laurel, MD; analyses were performed by CT Laboratories LLC, Baraboo, WI and were reported under sample delivery group (SDG) 135443EDD. Data have been evaluated electronically based on electronic data deliverables (EDDs) provided by the laboratory, and hard copy data summary forms have also been reviewed during this effort and compared to the automated review output by the reviewers whose signatures appear on the following page. Findings based on the automated data submission and manual data verification processes are detailed in the ADR narrative and throughout this report.

All quality control (QC) elements associated with this SDG have been reviewed by a project chemist in accordance with the requirements defined for the project. This review is documented in the attached Data Review Checklists. The QC elements listed below were supported by the electronic deliverable and were evaluated using ADR processes.

Blank

Blank - Negative

LCS Recovery

MS Recovery

MS RPD

Prep Hold Time

Surrogate

Test Hold Time

Results of the ADR process were subsequently reviewed and updated as applicable by the data review chemists identified on the signature page. Quality control elements that were not included in the electronic deliverable were reviewed manually and findings are documented within this report. Summaries of findings and associated qualified results are documented throughout this report.

A total of 38 results (16.24%) out of the 234 results (sample and field QC samples) reported are qualified based on review and 0 results (0.00%) have been rejected. Trace values, defined as results that are qualified as estimated because they fall between the detection limit and the reporting limit/limit of quantitation, are not counted as qualified results in the above count. The qualified results are detailed throughout this report and discussed in the narrative below, where appropriate.

Narrative Comments

Eighteen ISM samples were received by CT Laboratories, Baraboo, Wisconsin, and analyzed for a select list of explosives and metals. The samples were received intact and at acceptable temperatures. The ISM samples were dried, sieved, subsampled, and ground following the homogenization procedure specified for the project. All analyses were performed in accordance with requirements given in DOD QSM 5. Qualifiers used by the laboratory are defined in the laboratory report.

This laboratory deliverable was selected by the validator for validation of Stage 4 deliverables. No errors were detected by the validator as a result of this in-depth review. Documentation of the Stage 4 validation is included as an attachment to this data validation report.

The samples were collected as three field replicates (i.e., triplicates) from each of six sampling locations and identified with suffixes of -REP1, -REP2, and -REP3. As replicate samples are an intrinsic part of the ISM process and this project, the extent of variability among triplicate results will be evaluated by the project team. Triplicate results were reviewed by the validator to confirm the overall reasonableness of the results, with no issues of concern noted.

Analytical Method	Data Reviewer Comment

SW6010C	The dried/sieved fraction of each ISM sample was subsampled for nickel and manganese prior to undergoing grinding via a puck mill, to avoid potential contamination of the samples with these metals from the puck mill. Analyses for antimony, copper, lead, and zinc were performed with the fully-homogenized, puck-milled fractions. The ISM samples were analyzed as part of four analytical runs (#148366, #148403, #148405, and #148405). A low level of lead was detected in one of the two method blanks associated with the fully-homogenized, puck-milled fractions; however, the concentration was less than one-tenth the concentrations detected in the associated soil samples. No qualification of the sample data was necessary. The laboratory performed MS/MSD analyses with additional volumes of samples AOI3-SU2-SA-REP1, AOI4-SU2-SB-REP1, and AOI4-SU2-SA-REP1 (this last MS/MSD pair, for antimony, copper, lead, and zinc only; the first two MS/MSD pairs for all six target metals). The laboratory reported low MS/MSD recoveries of antimony in the analysis of all three of these MS/MSD pairs, ranging from 51% (MS of sample AOI3-SU2-SA-REP1) to 68% (MSD of sample AOI4-SU2-SB-REP1) vs. a lower acceptance limit of 79%. A low recovery of manganese was reported for the MS of sample AOI4-SU2-SB-REP1 (74% vs. a lower limit of 84%), while low recoveries of zinc were reported for the MS/MSD of sample AOI3-SU2-SA-REP1 (80% and 81%) and MS of sample AOI4-SU2-SA-REP1 (72%); the lower acceptance limit for zinc is 82%. The %RPD reported for the MS/MSD analyses of sample AOI4-SU2-SA-REP1 (29%) also was not within acceptance limits (20%). The results for these analytes in the parent samples and corresponding field triplicates were coded with validation qualifiers of “UJ” (non-detections of antimony reported for four of the nine samples) or “J” (detections of antimony, manganese, and zinc reported in all other instances for the nine samples) by the FUDSchem automated data review (ADR) module. The laboratory performed serial dilution (SD) and post-digestion spike (PDS) analyses of samples AOI3-SU2-SA-REP1, AOI4-SU2-SB-REP1, and AOI4-SU2-SA-REP1 (this last sample, for antimony, copper, lead, and zinc only; the first two samples for all six target metals). In all instances, the SD results either were invalid (i.e., the concentration of the analyte in the parent sample was less than 50 times the limit of quantitation, or LOQ) or were not within the acceptance limit (+/-10%D). Subsequent analyses of PDS samples yielded acceptable results in several instances such that qualification of the sample data was not necessary. The laboratory reported low recoveries of manganese in the PDS analyses of samples AOI3-SU2-SA-REP1 (61%) and AOI4-SU2-SB-REP1 (54%), copper in the PDS analysis of sample AOI4-SU2-SA-REP1 (76%), and lead and zinc in the PDS analysis of sample AOI3-SU2-SA-REP1 (both 78%). The results for these analytes in the affected parent samples were classified as less than fully quantitative and coded with “J” validation qualifiers (all were detections). The list of reason codes for data qualification for this project does not include a distinct code for indicating when PDS recoveries are not within control limits. Therefore, when the SD result for a given metal was invalid or not within control limits and the subsequent PDS recovery also was not within control limits, the sample result was qualified with a validation qualifier of "J" (detections) or "UJ" (non-detections) with reason codes of "A/M" ("A" signifying an invalid or failed SD analysis and "M" indicating a spike recovery that was not within limits -- in this case, a PDS). If the MS and/or MSD recovery was not within control limits and the SD + PDS results also were not within control limits, the data were qualified with "J" or "UJ" with reason codes of "M/A" (and not “M/A/M”, as the FUDSchem system will not allow a reason code to be entered twice). The laboratory performed duplicate or triplicate analyses of samples AOI3-SU2-SA-REP1, AOI4-SU1-SA-REP3, AOI4-SU2-SA-REP1, AOI4-SU2-SB-REP1, and AOI4-SU4-SA-REP1. Sample results were qualified when the detection of the analyte was at least five times as great as the LOQ and the %RPD exceeded 20%. Following this logic, qualification was limited to detections of lead and zinc reported for sample AOI3-SU2-SA-REP1 and for zinc reported for samples AOI4-SU2-SA-REP1 and AOI4-SU4-SA-REP1.

SW8330	The ISM samples were analyzed for nitroguanidine as part of two analytical runs. Eleven of these ISM samples had positive detections of nitroguanidine. In each case, the detection of nitroguanidine in the primary analysis differed by greater than 40% relative percent difference (%RPD) from the amount of nitroguanidine detected in the confirmation analysis. The laboratory attributed the discrepancies to interferences occurring in the confirmation analyses. The detections of nitroguanidine reported for these samples were classified as less than fully quantitative and coded with "J" validation qualifiers with reason codes of "P1". No other quality issues were noted.
SW8330B	The ISM samples were analyzed for explosives by Method 8330B as part of two preparation batches and two analytical runs (batch #66551 / run #148897 and batch #66553 / run #148966). The laboratory control sample (LCS) prepared in batch #66551 yielded a low recovery of tetryl (42% vs. an acceptance range of 68-135%). The recovery of tetryl was acceptable in the analysis of the LCS prepared in batch #66553. Tetryl is known to be problematic as it decomposes upon exposure to heat, light, and moisture. The findings of non-detect reported for the six ISM samples included in preparation batch #66551 (AOI4-SU2-SA-REP1, AOI4-SU2-SA-REP2, AOI4-SU2-SA-REP3, AOI4-SU2-SB-REP1, AOI4-SU2-SB-REP2, and AOI4-SU2-SB-REP3) were classified as less than fully quantitative, based on the LCS recovery, and coded with "UJ" validation qualifiers with reason code "C". The laboratory performed MS/MSD analyses with additional volumes of samples AOI4-SU2-SA-REP1, AOI4-SU2-SB-REP1, and AOI3-SU2-SA-REP1. The MS performed with sample AOI3-SU2-SA-REP1 had low recoveries (about 50%) for all analytes on the initial analysis. This MS was re-analyzed on the confirmation column with more acceptable recoveries. The laboratory concluded that the primary analysis had a mis-injection due to the cap septum having been pushed into the vial; therefore, the confirmation analysis results were reported. Using these data, the laboratory reported elevated recoveries of tetryl in the MS analysis of sample AOI4-SU2-SB-REP1 (145% vs. an upper limit of 135%) and of 2,4-dinitrotoluene in the MS analysis of sample AOI3-SU2-SA-REP1 (125% vs. an upper limit of 117%); an elevated %RPD also was reported for 2,4-dinitrotoluene in the MS/MSD analysis of sample AOI3-SU2-SA-REP1. The MS of sample AOI3-SU2-SA-REP1 also had a high recovery for 26-dinitrotoluene (26-DNT). The absence of tetryl in parent sample AOI4-SU2-SB-REP1 precluded the need for qualification of the sample result. While the absence of 2,4-dinitrotoluene reported for parent sample AOI3-SU2-SA-REP1 likewise precluded qualification of the sample result based on the slightly elevated MS recovery, the finding of non-detect was qualified with a "UJ" validation qualifier with reason code "D", due to evidence of diminished analytical precision. No other quality issues were noted.

Cindy Lee Westergard

July 11, 2018

Reviewed by Cindy Westergard, Senior Scientist, HSW Engineering, Inc.

As the First Reviewer, I certify that I have performed a data review process in accordance with the requirements of the project guidance document, and have compared the electronic data to the laboratory's hard copy report and have verified the consistency of a minimum of 10% of the reported sample results and method quality control data between the two deliverables.

July 11, 2018

Reviewed by Nigel Lewis, Project Scientist, HSW Engineering, Inc.

As the Second Reviewer, I certify that I have performed a quality assurance review of the report generated by the First Reviewer.

Quality Control Outliers for test method SW6010C, Blank

The purpose of laboratory blanks is to determine the existence and magnitude of cross-contamination problems resulting from laboratory activities. Reported results were evaluated to determine compliance with the required acceptance criteria. Summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and contaminants found in laboratory blanks are listed below along with any associated qualified results.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
109697 (LB)/ 109697	Lead	0.06700	< 0.04	< 0.25	mg/kg	U/None	L	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

No results associated with this QC element required qualification.

Quality Control Outliers for test method SW6010C, MS Recovery

Data for matrix spikes/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. These data alone cannot be used to evaluate the precision and accuracy of individual samples. However, when exercising professional judgment, MS/MSD data can be used in conjunction with other available QC information. Reported results were evaluated to determine compliance with the required acceptance criteria, and summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and any associated qualified results, are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
AOI3-SU2-SA-REP1 (MS)/ 109693	Antimony	50.73	79 - 114	30 - 125	percent	J/UJ	M	
AOI3-SU2-SA-REP1 (MS)/ 109693	Zinc	80.31	82 - 113	30 - 125	percent	J/UJ	M	
AOI3-SU2-SA-REP1 (SD)/ 109694	Antimony	54.38	79 - 114	30 - 125	percent	J/UJ	M	
AOI3-SU2-SA-REP1 (SD)/ 109694	Zinc	81.15	82 - 113	30 - 125	percent	J/UJ	M	
AOI4-SU2-SA-REP1 (MS)/ 109663	Antimony	56.40	79 - 114	30 - 125	percent	J/UJ	M	
AOI4-SU2-SA-REP1 (MS)/ 109663	Zinc	72.33	82 - 113	30 - 125	percent	J/UJ	M	
AOI4-SU2-SA-REP1 (SD)/ 109664	Antimony	64.64	79 - 114	30 - 125	percent	J/UJ	M	
AOI4-SU2-SB-REP1 (MS)/ 109086	Manganese	74.33	84 - 114	30 - 125	percent	J/UJ	M	
AOI4-SU2-SB-REP1 (MS)/ 109673	Antimony	66.40	79 - 114	30 - 125	percent	J/UJ	M	
AOI4-SU2-SB-REP1 (SD)/ 109674	Antimony	68.40	79 - 114	30 - 125	percent	J/UJ	M	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

Qualified Results associated with the MS Recovery for SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI3-SU2-SA-REP1	FT	Manganese	0.160	10.1 M	10.1 J	-	mg/kg	A/M
AOI3-SU2-SA-REP1	FT	Zinc	0.310	4.90 Y,M	4.90 J	-	mg/kg	M/A/D1
AOI3-SU2-SA-REP1	FT	Antimony	0.830	0.160 J	0.160 J	-	mg/kg	M/TR
AOI3-SU2-SA-REP2	FT	Zinc	0.310	4.90	4.90 J	-	mg/kg	M
AOI3-SU2-SA-REP2	FT	Antimony	0.840	0.230 J	0.230 J	-	mg/kg	M/TR
AOI3-SU2-SA-REP3	FT	Zinc	0.310	2.00	2.00 J	-	mg/kg	M
AOI3-SU2-SA-REP3	FT	Antimony	0.830	0.140 J	0.140 J	-	mg/kg	M/TR
AOI4-SU2-SA-REP1	FT	Zinc	0.300	7.00 Y	7.00 J	-	mg/kg	M/D1
AOI4-SU2-SA-REP1	FT	Antimony	0.800	0.130 J	0.130 J	-	mg/kg	M/TR
AOI4-SU2-SA-REP2	FT	Zinc	0.310	8.00	8.00 J	-	mg/kg	M/D1
AOI4-SU2-SA-REP2	FT	Antimony	0.840	0.420 U	0.420 UJ	-	mg/kg	M
AOI4-SU2-SA-REP3	FT	Zinc	0.310	4.20	4.20 J	-	mg/kg	M/D1
AOI4-SU2-SA-REP3	FT	Antimony	0.840	0.420 U	0.420 UJ	-	mg/kg	M
AOI4-SU2-SB-REP1	FT	Manganese	0.160	71.8 M	71.8 J	-	mg/kg	M/A
AOI4-SU2-SB-REP1	FT	Antimony	0.810	0.400 U	0.400 UJ	-	mg/kg	M

Qualified Results associated with the MS Recovery for SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI4-SU2-SB-REP2	FT	Manganese	0.150	68.9	68.9 J	-	mg/kg	M
AOI4-SU2-SB-REP2	FT	Antimony	0.830	0.130 J	0.130 J	-	mg/kg	M/TR
AOI4-SU2-SB-REP3	FT	Manganese	0.150	63.0	63.0 J	-	mg/kg	M
AOI4-SU2-SB-REP3	FT	Antimony	0.820	0.410 U	0.410 UJ	-	mg/kg	M

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).

Quality Control Outliers for test method SW6010C, MS RPD

The objective of matrix spikes/matrix spike duplicates (MS/MSD) RPD analysis is to demonstrate acceptable method precision by the laboratory at the time of analysis. MS/MSD analyses are also performed to generate data that determines the long-term precision of the analytical method on various matrices. Non-homogenous samples can impact the apparent method precision. Summary forms were evaluated and compared to electronic data deliverables. Matrix spikes/matrix spike duplicates results that were outside of the acceptance criteria are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
AOI4-SU2-SA-REP1 (SD)/ 109664	Zinc	29.05	< 20	< 20	rpd	J/UJ	D	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

No results associated with this QC element required qualification.

Quality Control Outliers for test method SW8330B, LCS Recovery

The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. Reported results were evaluated to determine compliance with the required acceptance criteria, and summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and any associated qualified results, are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
109209 (BS)/ 109209	Tetryl	41.73	68 - 135	20 - 135	percent	J/UJ	C	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

Qualified Results associated with the LCS Recovery for SW8330B

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI4-SU2-SA-REP1	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI4-SU2-SA-REP2	FT	Tetryl	0.290	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI4-SU2-SA-REP3	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI4-SU2-SB-REP1	FT	Tetryl	0.300	0.150 UQ,M	0.150 UJ		mg/kg	C
AOI4-SU2-SB-REP2	FT	Tetryl	0.300	0.150 UQ	0.150 UJ		mg/kg	C
AOI4-SU2-SB-REP3	FT	Tetryl	0.290	0.150 UQ	0.150 UJ		mg/kg	C

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).

Quality Control Outliers for test method SW8330B, MS Recovery

Data for matrix spikes/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. These data alone cannot be used to evaluate the precision and accuracy of individual samples. However, when exercising professional judgment, MS/MSD data can be used in conjunction with other available QC information. Reported results were evaluated to determine compliance with the required acceptance criteria, and summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and any associated qualified results, are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
AOI3-SU2-SA-REP1 (MS)/ 109233	2,6-Dinitrotoluene	125.0	79 - 117	20 - 117	percent	J/None	M	
AOI4-SU2-SB-REP1 (MS)/ 109215	Tetryl	144.9	68 - 135	20 - 135	percent	J/None	M	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

No results associated with this QC element required qualification.

Quality Control Outliers for test method SW8330B, MS RPD

The objective of matrix spikes/matrix spike duplicates (MS/MSD) RPD analysis is to demonstrate acceptable method precision by the laboratory at the time of analysis. MS/MSD analyses are also performed to generate data that determines the long-term precision of the analytical method on various matrices. Non-homogenous samples can impact the apparent method precision. Summary forms were evaluated and compared to electronic data deliverables. Matrix spikes/matrix spike duplicates results that were outside of the acceptance criteria are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
AOI3-SU2-SA-REP1 (SD)/ 109234	2,6-Dinitrotoluene	39.23	< 20	< 20	rpd	J/None	D	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

No results associated with this QC element required qualification.

Automated Data Review Report Summary for 135443EDD

HSW Engineering, Inc.

Table of All Qualified Results

Test Method: SW6010C Extraction Method: SW3050

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI3-SU2-SA-REP1	FT	Manganese	0.160	10.1 M	10.1 J	-	mg/kg	A/M
AOI3-SU2-SA-REP1	FT	Zinc	0.310	4.90 Y,M	4.90 J	-	mg/kg	M/A/D1
AOI3-SU2-SA-REP1	FT	Antimony	0.830	0.160 J	0.160 J	-	mg/kg	M/TR
AOI3-SU2-SA-REP2	FT	Zinc	0.310	4.90	4.90 J	-	mg/kg	M
AOI3-SU2-SA-REP2	FT	Antimony	0.840	0.230 J	0.230 J	-	mg/kg	M/TR
AOI3-SU2-SA-REP3	FT	Zinc	0.310	2.00	2.00 J	-	mg/kg	M
AOI3-SU2-SA-REP3	FT	Antimony	0.830	0.140 J	0.140 J	-	mg/kg	M/TR
AOI4-SU2-SA-REP1	FT	Zinc	0.300	7.00 Y	7.00 J	-	mg/kg	M/D1
AOI4-SU2-SA-REP1	FT	Antimony	0.800	0.130 J	0.130 J	-	mg/kg	M/TR
AOI4-SU2-SA-REP2	FT	Zinc	0.310	8.00	8.00 J	-	mg/kg	M/D1
AOI4-SU2-SA-REP2	FT	Antimony	0.840	0.420 U	0.420 UJ	-	mg/kg	M
AOI4-SU2-SA-REP3	FT	Zinc	0.310	4.20	4.20 J	-	mg/kg	M/D1
AOI4-SU2-SA-REP3	FT	Antimony	0.840	0.420 U	0.420 UJ	-	mg/kg	M
AOI4-SU2-SB-REP1	FT	Manganese	0.160	71.8 M	71.8 J	-	mg/kg	M/A
AOI4-SU2-SB-REP1	FT	Antimony	0.810	0.400 U	0.400 UJ	-	mg/kg	M
AOI4-SU2-SB-REP2	FT	Manganese	0.150	68.9	68.9 J	-	mg/kg	M
AOI4-SU2-SB-REP2	FT	Antimony	0.830	0.130 J	0.130 J	-	mg/kg	M/TR
AOI4-SU2-SB-REP3	FT	Manganese	0.150	63.0	63.0 J	-	mg/kg	M
AOI4-SU2-SB-REP3	FT	Antimony	0.820	0.410 U	0.410 UJ	-	mg/kg	M

Test Method: SW8330B Extraction Method: METHOD

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI4-SU2-SA-REP1	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI4-SU2-SA-REP2	FT	Tetryl	0.290	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI4-SU2-SA-REP3	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI4-SU2-SB-REP1	FT	Tetryl	0.300	0.150 UQ,M	0.150 UJ		mg/kg	C
AOI4-SU2-SB-REP2	FT	Tetryl	0.300	0.150 UQ	0.150 UJ		mg/kg	C
AOI4-SU2-SB-REP3	FT	Tetryl	0.290	0.150 UQ	0.150 UJ		mg/kg	C

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).
Trace values are not included in the qualified results table unless additional reason codes are associated.

Automated Data Review Report Summary for 135443EDD

Table of All Trace Results

Test Method: SW6010C   Extraction Method: SW3050

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI3-SU2-SA-REP1	FT	Antimony	0.830	0.160 J	0.160 J	-	mg/kg	M/TR
AOI3-SU2-SA-REP2	FT	Antimony	0.840	0.230 J	0.230 J	-	mg/kg	M/TR
AOI3-SU2-SA-REP3	FT	Antimony	0.830	0.140 J	0.140 J	-	mg/kg	M/TR
AOI4-SU1-SA-REP1	FT	Antimony	0.810	0.170 J	0.170 J		mg/kg	TR
AOI4-SU1-SA-REP2	FT	Antimony	0.800	0.220 J	0.220 J		mg/kg	TR
AOI4-SU1-SA-REP3	FT	Antimony	0.820	0.210 J	0.210 J		mg/kg	TR
AOI4-SU2-SA-REP1	FT	Antimony	0.800	0.130 J	0.130 J	-	mg/kg	M/TR
AOI4-SU2-SB-REP2	FT	Antimony	0.830	0.130 J	0.130 J	-	mg/kg	M/TR
AOI4-SU3-SA-REP1	FT	Antimony	0.830	0.220 J	0.220 J		mg/kg	TR
AOI4-SU3-SA-REP2	FT	Antimony	0.810	0.220 J	0.220 J		mg/kg	TR
AOI4-SU3-SA-REP3	FT	Antimony	0.830	0.130 J	0.130 J		mg/kg	TR
AOI4-SU4-SA-REP1	FT	Antimony	0.820	0.130 J	0.130 J		mg/kg	TR
AOI4-SU4-SA-REP2	FT	Antimony	0.770	0.160 J	0.160 J		mg/kg	TR
AOI4-SU4-SA-REP3	FT	Antimony	0.840	0.140 J	0.140 J		mg/kg	TR

Automated Data Review Report Summary for 135443EDD

Table of Results with Modified Qualifiers

Modified Qualifiers for test method SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	ADR Result	Modified Result	Reason
AOI3-SU2-SA-REP1	FT	Lead	0.260	2.40 Y,M	2.40	2.40 J	A/M/D1
AOI3-SU2-SA-REP1	FT	Zinc	0.310	4.90 Y,M	4.90 J	4.90 J	M/A/D1
AOI3-SU2-SA-REP1	FT	Manganese	0.160	10.1 M	10.1	10.1 J	A/M
AOI4-SU2-SA-REP1	FT	Copper	0.400	0.670 M	0.670	0.670 J	A/M
AOI4-SU2-SA-REP1	FT	Zinc	0.300	7.00 Y	7.00 J	7.00 J	M/D1
AOI4-SU2-SA-REP2	FT	Zinc	0.310	8.00	8.00 J	8.00 J	M/D1
AOI4-SU2-SA-REP3	FT	Zinc	0.310	4.20	4.20 J	4.20 J	M/D1
AOI4-SU2-SB-REP1	FT	Manganese	0.160	71.8 M	71.8 J	71.8 J	M/A

Modified Qualifiers for test method SW8330

FieldSample ID	Type	Analyte	LOQ	Lab Result	ADR Result	Modified Result	Reason
AOI3-SU2-SA-REP1	FT	Nitroguanidine	0.240	0.540 P	0.540	0.540 J	P1
AOI3-SU2-SA-REP2	FT	Nitroguanidine	0.240	0.810 P	0.810	0.810 J	P1
AOI3-SU2-SA-REP3	FT	Nitroguanidine	0.240	0.580 P	0.580	0.580 J	P1
AOI4-SU1-SA-REP1	FT	Nitroguanidine	0.250	0.590 P	0.590	0.590 J	P1
AOI4-SU1-SA-REP2	FT	Nitroguanidine	0.240	0.320 P	0.320	0.320 J	P1
AOI4-SU1-SA-REP3	FT	Nitroguanidine	0.240	0.620 P	0.620	0.620 J	P1
AOI4-SU2-SA-REP1	FT	Nitroguanidine	0.250	0.420 P	0.420	0.420 J	P1
AOI4-SU2-SA-REP2	FT	Nitroguanidine	0.250	0.500 P	0.500	0.500 J	P1
AOI4-SU3-SA-REP1	FT	Nitroguanidine	0.240	0.370 P	0.370	0.370 J	P1
AOI4-SU3-SA-REP2	FT	Nitroguanidine	0.240	0.480 P	0.480	0.480 J	P1
AOI4-SU3-SA-REP3	FT	Nitroguanidine	0.250	0.470 P	0.470	0.470 J	P1

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).
Trace values are not included in the qualified results table unless additional reason codes are associated.

Automated Data Review Report Summary for 135443EDD

Reason Code Definitions

Code	Definition
A	Serial dilution
C	LCS Recovery
D	MS RPD
D1	Lab Replicate RPD
L	Lab Blank
M	MS Recovery
P1	Column RPD
TR	Trace Level Detect

Flag Code and Definitions

Flag	Definition
U	Undetected: The analyte was analyzed for, but not detected.
UJ	The analyte was not detected; however, the result is estimated due to discrepancies in meeting certain analyte-specific quality control criteria.
J	Estimated: The analyte was positively identified, the quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
R	The data are rejected due to deficiencies in meeting QC criteria and may not be used for decision making.
B	Blank contamination: The analyte was found in an associated blank above one half the RL, as well as in the sample.
UB	The analyte was also detected in an associated laboratory or field blank at a concentration comparable to the concentration in the sample. The reported result has been requalified as not detected.

Review Questions

Method: SW6010C (Trace Metals by Inductively Coupled Plasma/Atomic Emission Spectrometry)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was the Calibration within acceptance criteria?	•			
Were the required minimum levels of calibration standards used in the initial calibration?	•			
Was either analysis of an ICV performed after each ICAL or a second source standard prior to sample analysis?	•			
Were all reported analytes for the ICV within the required criteria?	•			
Were CCVs run at the required frequency and within acceptance criteria?	•			
Was a method blank prepared and analyzed with each batch?	•			
Were target analytes in the method blank less than MDL?		•		Lead was detected above the MDL in one method blank sample (0.06700 mg/kg). Detections of lead in the samples associated with this blank exceeded the artifact threshold value such that no qualification of any sample data, based on the blank detection, was necessary.
Were target analytes in the field blank less than MDL?			•	
Was an LCS/LCSD pair prepared and analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?	•			
Was the LCS/LCSD RPD within project acceptance limits?			•	
Was a MS/MSD pair prepared with each batch?	•			Additional volumes of samples AO13-SU2-SA-REP1, AO14-SU2-SB-REP1, and AO14-SU2-SA-REP1 were used (this last sample, for antimony, copper, lead, and zinc only).
Were MS/MSD recoveries within project acceptance limits?		•		Data for the parent samples were classified as less than fully quantitative and coded with validation qualifiers of "J" (detections) or "UJ" (non-detections).
Was the MS/MSD RPD within project acceptance limits?		•		Elevated %RPDs were reported for zinc in the MS/MSD analyses of sample AO14-SU2-SA-REP1 and for antimony in the MS/MSD analyses of sample AO14-SU2-SB-REP1.
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?			•	Evaluation of field triplicates is performed by the project team, outside of the scope of this validation effort.
Were QAPP specified laboratory PQLs achieved?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			
Were DoD QSM corrective actions followed if deviations were noted?	•			
Were any data rejected during the verification process?		•		

Review Questions

Method: SW8330 (Nitroaromatics and Nitramines by HPLC)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was a blank prepared and analyzed with each batch?	•			
Were target analytes in the blank less than MDL?	•			
Were target analytes in the field blank less than MDL?			•	
Was an LCS or LCS/LCSD pair analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?	•			
Was the LCS/LCSD RPD within project acceptance limits?			•	
Was a project specific MS or MS/MSD pair prepared with each batch?	•			
Were MS/MSD recoveries within project acceptance limits?	•			
Was the MS/MSD RPD within project acceptance limits?	•			
Was a project-specific duplicate analyzed, and the RPD within QAPP acceptance limits?		•		MS/MSD data allowed an adequate means of assessing analytical precision.
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?			•	Field triplicates were collected at three locations. In general, the results for each of these sets of triplicates were in agreement. This quality element will be reviewed by the project team outside of this validation process.
Were QAPP specified laboratory reporting limits achieved?	•			
Were surrogate recoveries within project acceptance limits?	•			
Were column comparison differences with project acceptance limits?		•		Eleven of the ISM samples had positive detections of nitroguanidine. In each case, the detection of the analyte in the primary analysis differed by greater than 40% from the amount of nitroguanidine detected in each of these samples in the confirmation analyses (%RPDs >40%). The laboratory attributed the discrepancies to interferences occurring in the confirmation analyses. The detections of nitroguanidine reported for these eleven samples were classified as less than fully quantitative and coded with “J” validation qualifiers with reason codes of “P1”.
Was the intial calibration within criteria?	•			
Was a second source check standard analyzed and within all applicable criteria?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			

Automated Data Review Report Summary for 135443EDD

Review Questions

Method: SW8330B (Nitroaromatics and Nitramines by HPLC)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was a blank prepared and analyzed with each batch?	•			
Were target analytes in the blank less than MDL?	•			
Were target analytes in the field blank less than MDL?	•			
Was an LCS or LCS/LCSD pair analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?		•		The recovery of tetryl reported for the LCS for one of the two analytical batches (42%) was less than the lower control limit (68%). The findings of non-detect reported for the six ISM samples included in this batch were qualified with "UJ" validation qualifiers.
Was the LCS/LCSD RPD within project acceptance limits?			•	
Was a project specific MS or MS/MSD pair prepared with each batch?	•			
Were MS/MSD recoveries within project acceptance limits?		•		
Was the MS/MSD RPD within project acceptance limits?		•		An elevated %RPD (39% vs. 20%) was reported for 2,6-DNT for the MS/MSD analyses performed with sample AOI3-SU2-SA-REP1.
Was a project-specific duplicate analyzed, and the RPD within QAPP acceptance limits?		•		MS/MSD analyses allowed an assessment of analytical precision.
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?			•	Field duplicates and triplicates are evaluated outside of the scope of this analytical data validation effort.
Were QAPP specified laboratory reporting limits achieved?	•			
Were surrogate recoveries within project acceptance limits?	•			
Were column comparison differences with project acceptance limits?	•			No target analytes reported by Method 8330B were detected.
Was the intial calibration within criteria?	•			
Was a second source check standard analyzed and within all applicable criteria?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			

Summary of Qualified Data

SDG	Client Sample ID	Lab Sample ID	SACODE	LOGDATE	Test Method	EXMCODE	MATRIX	Analyte Name	PARLABEL	CAS	DB Result	UNITS	DB Reporting Limit	Limit Of Detection	Display Result	Qualifier*	Reason Code
135443EDD	AOI3-SU2-SA-REP1	107218	FT	4/14/2018 11:40:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.16	mg/kg	0.83	0.41	0.160	J	M/TR
135443EDD	AOI3-SU2-SA-REP1	107218	FT	4/14/2018 11:40:00 AM	SW6010C	SW3050	SO	Lead	PB	7439-92-1	2.4	mg/kg	0.26	0.13	2.40	J	A/M/D1
135443EDD	AOI3-SU2-SA-REP1	107219	FT	4/14/2018 11:40:00 AM	SW6010C	SW3050	SO	Manganese	MN	7439-96-5	10.1	mg/kg	0.16	0.078	10.1	J	A/M
135443EDD	AOI3-SU2-SA-REP1	107218	FT	4/14/2018 11:40:00 AM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	4.9	mg/kg	0.31	0.16	4.90	J	M/A/D1
135443EDD	AOI3-SU2-SA-REP1	107218	FT	4/14/2018 11:40:00 AM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.54	mg/kg	0.24	0.12	0.540	J	P1
135443EDD	AOI3-SU2-SA-REP2	107220	FT	4/14/2018 11:40:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.23	mg/kg	0.84	0.42	0.230	J	M/TR
135443EDD	AOI3-SU2-SA-REP2	107220	FT	4/14/2018 11:40:00 AM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	4.9	mg/kg	0.31	0.16	4.90	J	M
135443EDD	AOI3-SU2-SA-REP2	107220	FT	4/14/2018 11:40:00 AM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.81	mg/kg	0.24	0.12	0.810	J	P1
135443EDD	AOI3-SU2-SA-REP3	107222	FT	4/14/2018 11:40:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.14	mg/kg	0.83	0.42	0.140	J	M/TR
135443EDD	AOI3-SU2-SA-REP3	107222	FT	4/14/2018 11:40:00 AM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	2	mg/kg	0.31	0.16	2.00	J	M
135443EDD	AOI3-SU2-SA-REP3	107222	FT	4/14/2018 11:40:00 AM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.58	mg/kg	0.24	0.12	0.580	J	P1
135443EDD	AOI4-SU1-SA-REP1	107196	FT	4/14/2018 1:00:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.17	mg/kg	0.81	0.4	0.170	J	TR
135443EDD	AOI4-SU1-SA-REP1	107196	FT	4/14/2018 1:00:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.59	mg/kg	0.25	0.12	0.590	J	P1
135443EDD	AOI4-SU1-SA-REP2	107198	FT	4/14/2018 1:00:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.22	mg/kg	0.8	0.4	0.220	J	TR
135443EDD	AOI4-SU1-SA-REP2	107198	FT	4/14/2018 1:00:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.32	mg/kg	0.24	0.12	0.320	J	P1
135443EDD	AOI4-SU1-SA-REP3	107200	FT	4/14/2018 1:00:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.21	mg/kg	0.82	0.41	0.210	J	TR
135443EDD	AOI4-SU1-SA-REP3	107200	FT	4/14/2018 1:00:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.62	mg/kg	0.24	0.11	0.620	J	P1
135443EDD	AOI4-SU2-SA-REP1	107095	FT	4/14/2018 8:35:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.13	mg/kg	0.8	0.4	0.130	J	M/TR
135443EDD	AOI4-SU2-SA-REP1	107095	FT	4/14/2018 8:35:00 AM	SW6010C	SW3050	SO	Copper	CU	7440-50-8	0.67	mg/kg	0.4	0.2	0.670	J	A/M
135443EDD	AOI4-SU2-SA-REP1	107095	FT	4/14/2018 8:35:00 AM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	7	mg/kg	0.3	0.15	7.00	J	M/D1
135443EDD	AOI4-SU2-SA-REP1	107095	FT	4/14/2018 8:35:00 AM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.42	mg/kg	0.25	0.12	0.420	J	P1
135443EDD	AOI4-SU2-SA-REP1	107095	FT	4/14/2018 8:35:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135443EDD	AOI4-SU2-SA-REP2	107097	FT	4/14/2018 8:35:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0	mg/kg	0.84	0.42	0.420	UJ	M
135443EDD	AOI4-SU2-SA-REP2	107097	FT	4/14/2018 8:35:00 AM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	8	mg/kg	0.31	0.16	8.00	J	M/D1
135443EDD	AOI4-SU2-SA-REP2	107097	FT	4/14/2018 8:35:00 AM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.5	mg/kg	0.25	0.12	0.500	J	P1
135443EDD	AOI4-SU2-SA-REP2	107097	FT	4/14/2018 8:35:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.29	0.15	0.150	UJ	C
135443EDD	AOI4-SU2-SA-REP3	107099	FT	4/14/2018 8:35:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0	mg/kg	0.84	0.42	0.420	UJ	M
135443EDD	AOI4-SU2-SA-REP3	107099	FT	4/14/2018 8:35:00 AM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	4.2	mg/kg	0.31	0.16	4.20	J	M/D1
135443EDD	AOI4-SU2-SA-REP3	107099	FT	4/14/2018 8:35:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135443EDD	AOI4-SU2-SB-REP1	107101	FT	4/14/2018 10:00:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0	mg/kg	0.81	0.4	0.400	UJ	M
135443EDD	AOI4-SU2-SB-REP1	107102	FT	4/14/2018 10:00:00 AM	SW6010C	SW3050	SO	Manganese	MN	7439-96-5	71.8	mg/kg	0.16	0.078	71.8	J	M/A
135443EDD	AOI4-SU2-SB-REP1	107101	FT	4/14/2018 10:00:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135443EDD	AOI4-SU2-SB-REP2	107103	FT	4/14/2018 10:00:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.13	mg/kg	0.83	0.41	0.130	J	M/TR
135443EDD	AOI4-SU2-SB-REP2	107104	FT	4/14/2018 10:00:00 AM	SW6010C	SW3050	SO	Manganese	MN	7439-96-5	68.9	mg/kg	0.15	0.075	68.9	J	M
135443EDD	AOI4-SU2-SB-REP2	107103	FT	4/14/2018 10:00:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135443EDD	AOI4-SU2-SB-REP3	107105	FT	4/14/2018 10:00:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0	mg/kg	0.82	0.41	0.410	UJ	M
135443EDD	AOI4-SU2-SB-REP3	107106	FT	4/14/2018 10:00:00 AM	SW6010C	SW3050	SO	Manganese	MN	7439-96-5	63	mg/kg	0.15	0.075	63.0	J	M
135443EDD	AOI4-SU2-SB-REP3	107105	FT	4/14/2018 10:00:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.29	0.15	0.150	UJ	C
135443EDD	AOI4-SU3-SA-REP1	107202	FT	4/14/2018 2:20:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.22	mg/kg	0.83	0.42	0.220	J	TR
135443EDD	AOI4-SU3-SA-REP1	107202	FT	4/14/2018 2:20:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.37	mg/kg	0.24	0.11	0.370	J	P1
135443EDD	AOI4-SU3-SA-REP2	107204	FT	4/14/2018 2:20:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.22	mg/kg	0.81	0.41	0.220	J	TR
135443EDD	AOI4-SU3-SA-REP2	107204	FT	4/14/2018 2:20:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.48	mg/kg	0.24	0.12	0.480	J	P1
135443EDD	AOI4-SU3-SA-REP3	107216	FT	4/14/2018 2:20:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.13	mg/kg	0.83	0.41	0.130	J	TR
135443EDD	AOI4-SU3-SA-REP3	107216	FT	4/14/2018 2:20:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.47	mg/kg	0.25	0.12	0.470	J	P1
135443EDD	AOI4-SU4-SA-REP1	107188	FT	4/14/2018 3:30:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.13	mg/kg	0.82	0.41	0.130	J	TR
135443EDD	AOI4-SU4-SA-REP2	107191	FT	4/14/2018 3:30:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.16	mg/kg	0.77	0.39	0.160	J	TR
135443EDD	AOI4-SU4-SA-REP3	107194	FT	4/14/2018 3:30:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.14	mg/kg	0.84	0.42	0.140	J	TR

*Includes detections that are less than the limits of quantitation (LOQs) but otherwise unqualified as a result of the validation (i.e., validation qualifiers of "J" with reason code "TR" only).

Stage 4 Validation
Nitroguanidine by EPA Method 8330
Laboratory Deliverable 135443

				Initial Calibration (ICAL)			Slope (m)	Intercept (b)	Slope m when forced through zero	Intercept (b) when forced through zero	Regression Equation (ug/mL)					
Nitroguanidine (NQ)	12/14/2017 14:40:14	NQ	(Target analyte)	Amount (ug/mL)	Area Counts	Response Factor (RF)	378514.23	10812.63	389326.86	0	y = (389327 * x) + b					
(Primary Column)		(RT ~ 2.4 min)		0.000	0	0										
p. 236				0.040	27675	691875										
				0.080	52755	659437.5										
				0.200	96004	480020										
				0.500	193654	387308										
				1.00	381630	381630										
				2.00	762099	381049.5										
				2.50	964894	385957.6										
Sample Results (Primary Column)	ERT Sample ID	Lab Sample ID	Chromatogram Used	Known concentration (ug/mL)	Area Counts	Mass (g)	Extract Volume (mL)	Percent Solids	Dilution Volume (mL)							
		ICV		0.500	176194						0.453	--				
	AOI4-SU4-SA-REP1	107188	After manual integ.		89348	5.20	10.0	0.998	20.0		0.229	(Not reported; BDL on confirmation column)				
	AOI4-SU4-SA-REP2	107191	After manual integ.		90551	5.07	10.0	0.998	20.0		0.233	(Not reported; BDL on confirmation column)				
	AOI4-SU4-SA-REP3	107194	After manual integ.		113785	5.19	10.0	0.998	20.0		0.292	(Not reported; BDL on confirmation column)				
	AOI4-SU1-SA-REP1	107196	After manual integ.		58355	5.05	10.0	0.998	20.0		0.150	0.59				
	AOI4-SU1-SA-REP2	107198	After manual integ.		32357	5.12	10.0	0.998	20.0		0.083	0.33				
	AOI4-SU1-SA-REP3	107200	After manual integ.		64240	5.31	10.0	0.997	20.0		0.165	0.62				
	AOI4-SU3-SA-REP1	107202	After manual integ.		37328	5.22	10.0	0.998	20.0		0.096	0.37				
	AOI4-SU3-SA-REP2	107204	After manual integ.		48801	5.16	10.0	0.998	20.0		0.125	0.49				
				Initial Calibration (ICAL)			Slope (m)	Intercept (b)	(NA)	(NA)	Regression Equation (ug/mL)					
Nitroguanidine (NQ)	5/7/2018 11:11:50	NQ	(Target analyte)	Amount (ug/mL)	Area	RF	368205.03	4895.53			y = (368205.03 * x) + 4895.53					
(Confirmation Column)		(RT ~2.7 min)		0.000	0	0										
p. 249				0.040	18335	458375										
				0.080	31285	391062.5										
				0.200	82431	412155										
				0.500	184371	368742										
				1.00	379812	379812										
				2.00	767427	383713.5										
				2.50	902559	361023.6										
						Mass (g)	Extract Volume (mL)	Percent Solids	Dilution Volume (mL)							
		ICV		0.500	207020						0.549					
	AOI4-SU4-SA-REP1	107188	(No reinteg. nec.)		(ND)						(ND)		Confirmed ND from chromatogram; no peak at 2.70 min.			
	AOI4-SU4-SA-REP2	107191	After manual integ.		(ND)						(ND)		Confirmed ND from chromatogram; no peak at 2.70 min.			
	AOI4-SU4-SA-REP3	107194	After manual integ.		(ND)						(ND)		Confirmed ND from chromatogram; no peak at 2.70 min.			
	AOI4-SU1-SA-REP1	107196	After manual integ.		16209	5.05	10.0	0.998	20.0		0.031	0.12	Least-squares weighting used; confirmation is approximate.			
	AOI4-SU1-SA-REP2	107198	After manual integ.		10506	5.12	10.0	0.998	20.0		0.015	0.06	Least-squares weighting used; confirmation is approximate.			
	AOI4-SU1-SA-REP3	107200	After manual integ.		22068	5.31	10.0	0.997	20.0		0.047	0.18	Least-squares weighting used; confirmation is approximate.			
	AOI4-SU3-SA-REP1	107202	After manual integ.		9919	5.22	10.0	0.998	20.0		0.014	0.05	Least-squares weighting used; confirmation is approximate.			
	AOI4-SU3-SA-REP2	107204	After manual integ.		15391	5.16	10.0	0.998	20.0		0.029	0.11	Least-squares weighting used; confirmation is approximate.			

Results highlighed in green were calculated by the validator and are confirmed in the laboratory report.

Note that the regression equation for the confirmation column could not be precisely replicated by either the validator or the laboratory as the instrument software employed a weighted linear regression for this particular calibration.

Stage 4 Validation
Metals by EPA Method 6010
Laboratory Deliverable 135443

Analysis Run #		A0	A1	For each metal, the first row is the standard (ug/L) and the second is the instrument response.											Regression Equation
148405 (p. 1181)	Sb 206.833			0	1000	10	50	10000							
		-0.000065	0.000030	-0.00007	0.02997	0.00020	0.00152	0.29712							0.00002971
	Sb 217.581			0	1000	20	10	100	5	10000					
		0.000022	0.000023	0.00002	0.02359	0.00053	0.00024	0.00235	0.00025	0.23420					0.00002341
	Cu 2247			0	1000	50	100	10	10000	5	20	1	100000		
		0.000008	0.000136	0.00001	0.12945	0.00682	0.01324	0.00137	1.2366	0.00109	0.00278	0.00024	13.809		0.00013812
	Cu 3247			0	1000	100	10000	100000							
		0.000285	0.000003	0.00031	0.00333	0.00060	0.03045	0.33765							0.00000338
	Pb 2169			0	1000	10000	100	10	100000						
			0.000026	0.00008	0.0266	0.25367	0.00283	0.0030	2.8781						0.00002882
	Pb 2203			0	10	100	5	1000	10000						
			0.000040	0.00014	0.00052	0.00427	0.00041	0.0403	0.37970						0.00003792
	Zn 2062			10000	0	1000	100000	10	100						
			0.000190	1.8907	-0.00007	0.19605	18.652	0.00200	0.01995						0.00018647
	Zn 2138			10000	0	1000	10	100							
			0.000006	0.0545	0.0000	0.00580	0.00006	0.00060							0.00000544
148308 (p. 771)	Mn 257.610			0	10	50	20	100	5	1000	10000				
			0.000009	0	0.001	0.0048	0.002	0.0096	0.0008	0.00929	0.08715				0.00000845
	Mn 259.373			0	10000	1000	100000								
			0.000008	0.00001	0.08339	0.00851	0.88945								0.00000891
	Ni 221.647			0	10000	100	1000								
			0.000122	-0.00007	1.2154	0.01297	0.12608								0.00012140
	Ni 231.604			0	50	10	100	5	1000	1	10000				
		-0.000018	0.000168	-0.00002	0.00892	0.00173	0.01791	0.00141	0.1744	0.00016	1.671				0.00016703
148366 (p. 920)	Mn 257.610		0	10	50	20	100	5	1000	10000					
		0.00001	0	0.0001	0.0005	0.00021	0.00097	0.00009	0.00949	0.08873					0.00000887
	Mn 259.373		0	10000	1000	100000									
		0.000006	0.00001	0.06374	0.0065	0.69024									0.00000692
	Ni 221.647		0	10000	100	1000									
		0.000202	0.00017	2.0078	0.02141	0.20998									0.00020049
	Ni 231.604		0	50	10	100	5	1000	1	10000					
		0.000204	0.00001	0.01048	0.00205	0.02066	0.00166	0.20315	0.00025	1.949					0.00019482
				Sb, Cu, Pb, Zn				Instrument Readings (ug/L)				Results (mg/Kg)			
ERT Sample ID	Lab Sample ID	Percent Solids	Prep Batch #	Analytical Run #	Page No.	Sb2175	Cu2247	Pb2203	Zn2138	Mass (g)	F.V. (mL)	Sb	Cu	Pb	Zn
AOI4-SU4-SA-REP1	107188	0.998	66568	148405	1290	4.99	28.6	150	215	1.95	50	0.13	0.73	3.85	5.52
AOI4-SU4-SA-REP2	107191	0.998	66568	148405	1293	6.65	41.1	272	252	2.08	50	0.16	0.99	6.55	6.07
AOI4-SU4-SA-REP3	107194	0.998	66568	148405	1294	5.21	32.5	193	123	1.92	50	0.14	0.85	5.04	3.21
AOI4-SU1-SA-REP1	107196	0.998	66568	148405	1295	6.83	33.2	121	126	1.99	50	0.17	0.84	3.05	3.17
AOI4-SU1-SA-REP2	107198	0.998	66568	148405	1296	8.66	58.3	104	99.0	2.00	50	0.22	1.46	2.61	2.48
AOI4-SU1-SA-REP3	107200	0.997	66568	148405	1297	8.11	38.4	120	134	1.96	50	0.21	0.98	3.07	3.43
AOI4-SU3-SA-REP1	107202	0.998	66568	148405	1298	8.63	31.7	116	110	1.93	50	0.22	0.82	3.01	2.86
AOI4-SU3-SA-REP2	107204	0.998	66568	148405	1299	8.84	45.0	175	141	1.97	50	0.22	1.14	4.45	3.59
				Mn, Zn			Instrument Readings (ug/L)					Results (mg/Kg)			
ERT Sample ID	Lab Sample ID	Percent Solids	Prep Batch #	Analytical Run #	Page No.	Mn2576	Mn2593	Ni2316		Mass (g)	F.V. (mL)	Mn	Ni		
AOI4-SU4-SA-REP1	107190	0.993	66534	148308	907	707	815	22.2		1.97	50	18.1	0.57		
AOI4-SU4-SA-REP2	107192	0.994	66534	148308	908	688	797	28.7		1.94	50	17.8	0.74		
AOI4-SU4-SA-REP3	107195	0.994	66534	148308	913	721	799	23.8		1.95	50	18.6	0.61		
AOI4-SU1-SA-REP1	107197	0.995	66534	148308	914	467	656	38.9		1.93	50	12.2	1.01		
AOI4-SU1-SA-REP2	107199	0.995	66534	148308	915	413	605	35.4		1.91	50	10.9	0.93		
AOI4-SU1-SA-REP3	107201	0.998	66538	148366	1029	380	396	34.1		1.97	50	9.7	0.87		
AOI4-SU3-SA-REP1	107203	0.996	66538	148366	1032	--	3070	50.6		1.91	50	80.69	1.33		
AOI4-SU3-SA-REP2	107205	0.996	66538	148366	1033	--	2890	55.5		1.95	50	74.40	1.43		
Results highlighed in green were calculated by the validator and are confirmed in the laboratory report.															

Automated Data Review Report Summary for 135444EDD

Facility:	D01MA0033-04, CP Wellfleet - Art, Sm Arms, Rocket
Event:	Phase I Sampling 2018
SDG:	135444EDD
Guidance Document:	Camp Wellfleet - Art, Sm Arms, Rocket
Prime Contractor:	ERT, Inc., Laurel, MD
Project Manager:	Tom Bachovchin
Contract Laboratory:	CT Laboratories LLC, Baraboo, WI
Data Review Contractor:	HSW Engineering, Inc.
Data Review Level:	Stage 2B Review
Primary Data Reviewer:	Cindy Westergard, Senior Scientist
Second Reviewer:	Nigel Lewis, Project Scientist
Date Submitted:	July 12, 2018

Field Sample ID	Lab Sample ID	Matrix	Type/Type Code	SW6010C	SW8330	SW8330B
AOI1-SU1-SA-REP1	107143	Solid	Field Triplicate/FT	X	X	X
AOI1-SU1-SA-REP1	107144	Solid	Field Triplicate/FT	X		
AOI1-SU1-SA-REP2	107147	Solid	Field Triplicate/FT	X	X	X
AOI1-SU1-SA-REP2	107148	Solid	Field Triplicate/FT	X		
AOI1-SU1-SA-REP3	107149	Solid	Field Triplicate/FT	X	X	X
AOI1-SU1-SA-REP3	107151	Solid	Field Triplicate/FT	X		
AOI1-SU2-SA-REP1	107128	Solid	Field Triplicate/FT	X	X	X
AOI1-SU2-SA-REP1	107132	Solid	Field Triplicate/FT	X		
AOI1-SU2-SA-REP2	107133	Solid	Field Triplicate/FT	X	X	X
AOI1-SU2-SA-REP2	107134	Solid	Field Triplicate/FT	X		
AOI1-SU2-SA-REP3	107135	Solid	Field Triplicate/FT	X	X	X
AOI1-SU2-SA-REP3	107136	Solid	Field Triplicate/FT	X		
AOI1-SU2-SO01-8-10	107124	Solid	Field Sample/N	X	X	X
AOI1-SU2-SO02-8-10	107125	Solid	Field Sample/N	X	X	X
AOI1-SU2-SO03-8-10	107126	Solid	Field Sample/N	X	X	X
AOI1-SU2-SO04-8-10	107127	Solid	Field Sample/N	X	X	X
AOI1-SU3-SA-REP1	107137	Solid	Field Triplicate/FT	X	X	X
AOI1-SU3-SA-REP1	107138	Solid	Field Triplicate/FT	X		
AOI1-SU3-SA-REP2	107139	Solid	Field Triplicate/FT	X	X	X
AOI1-SU3-SA-REP2	107140	Solid	Field Triplicate/FT	X		

Field Sample ID	Lab Sample ID	Matrix	Type/Type Code	SW6010C	SW8330	SW8330B
AOI1-SU3-SA-REP3	107141	Solid	Field Triplicate/FT	X	X	X
AOI1-SU3-SA-REP3	107142	Solid	Field Triplicate/FT	X		
AOI1-SU3-SO01-8-10	107123	Solid	Field Sample/N	X	X	X
AOI1-SU3-SO02-8-10	107122	Solid	Field Sample/N	X	X	X
AOI1-SU3-SO03-8-10	107121	Solid	Field Sample/N	X	X	X
AOI1-SU3-SO04-8-10	107120	Solid	Field Sample/N	X	X	X
WELLFLEET-FD1	107154	Solid	Field Duplicate/FD	X	X	X

This report assesses the analytical data quality associated with the analyses listed on the preceding cover page. This assessment has been made through a combination of automated data review (ADR) and supplemental manual review, the details of which are described below. The approach taken in the review of this data set is consistent with the requirements contained in the Camp Wellfleet - Art, Sm Arms, Rocket and the additional guidance documents incorporated by reference to the extent possible. Where definitive guidance is not provided, results have been evaluated in a conservative manner using professional judgment.

Sample collection was managed and directed by ERT, Inc., Laurel, MD; analyses were performed by CT Laboratories LLC, Baraboo, WI and were reported under sample delivery group (SDG) 135444EDD. Data have been evaluated electronically based on electronic data deliverables (EDDs) provided by the laboratory, and hard copy data summary forms have also been reviewed during this effort and compared to the automated review output by the reviewers whose signatures appear on the following page. Findings based on the automated data submission and manual data verification processes are detailed in the ADR narrative and throughout this report.

All quality control (QC) elements associated with this SDG have been reviewed by a project chemist in accordance with the requirements defined for the project. This review is documented in the attached Data Review Checklists. The QC elements listed below were supported by the electronic deliverable and were evaluated using ADR processes.

- Blank
- Blank - Negative
- Field Duplicate RPD
- LCS Recovery
- MS Recovery
- MS RPD
- Prep Hold Time
- Surrogate
- Test Hold Time

Results of the ADR process were subsequently reviewed and updated as applicable by the data review chemists identified on the signature page. Quality control elements that were not included in the electronic deliverable were reviewed manually and findings are documented within this report. Summaries of findings and associated qualified results are documented throughout this report.

A total of 22 results (9.40%) out of the 234 results (sample and field QC samples) reported are qualified based on review and 0 results (0.00%) have been rejected. Trace values, defined as results that are qualified as estimated because they fall between the detection limit and the reporting limit/limit of quantitation, are not counted as qualified results in the above count. The qualified results are detailed throughout this report and discussed in the narrative below, where appropriate.

Narrative Comments

Nine ISM soil samples and nine discrete soil samples were received by CT Laboratories, Baraboo, Wisconsin, and analyzed for a select list of explosives and metals. The samples were received intact and at a temperature within method specified acceptance limits. The ISM samples were dried, sieved, subsampled, and ground following the homogenization procedure specified for the project. The analyses were performed in accordance with requirements given in DOD QSM 5. Qualifiers used by the laboratory are defined in the laboratory report.

The ISM samples were collected as three field replicates (i.e., triplicates) from each of three locations and identified with suffixes of -REP1, -REP2, and -REP3. As replicate samples are an intrinsic part of the ISM process and this project, the extent of variability among triplicate results will be evaluated by the project team. Triplicate results were reviewed by the validator to confirm the overall reasonableness of the results, with no issues of concern noted.

Analytical Method	Data Reviewer Comment
SW6010C	The dried/sieved fraction of each ISM sample was subsampled for nickel and manganese before the sample underwent grinding via a puck mill, to avoid potential contamination of the samples with these metals from the puck mill. Analyses for antimony, copper, lead, and zinc were performed with the fully-homogenized, puck-milled fractions. The ISM samples were analyzed as part of two analytical runs (#148308 and #148444). The recovery of nickel reported for the laboratory control sample (LCS) associated with the nine discrete soil samples was 113.2% and, after rounding to three significant digits, was equal to the control limit of 113%. The recovery was indicated as acceptable in the laboratory report; however, the ADR review module interpreted the recovery as having exceeded the control limit and applied “J” validation qualifiers with reason code “C” to the detections of this analyte reported for all nine discrete soil samples. The qualifiers were deemed unwarranted by the validator and were removed. The laboratory performed MS/MSD, serial dilution (SD), and post-digestion spike (PDS) analyses with additional volumes of sample AOI1-SU3-SO01-8-10. With the exception of an elevated MSD recovery of manganese (127% vs. an upper control limit of 114%), all recoveries were within project control limits for analytical accuracy and analytical precision. The detection of manganese reported for the parent sample was classified as less than fully quantitative and coded with a “J” validation qualifier with reason code “M”. While all results reported for the SD were indicated either to have been invalid or to have failed, all recoveries reported for the PDS were within acceptance limits, precluding the need for additional qualification. A field duplicate was collected at location AOI1-SU2-S004-8-10 and identified as WELLFLEET-FD1. The detections of target metals reported for these two soil samples met validation acceptance criteria for cumulative precision. The laboratory performed triplicate analyses of samples AOI1-SU3-SA-REP2, AOI1-SU3-SO01-8-10, and WELLFLEET-FD1. Sample results were qualified when the detection of the analyte was at least five times as great as the limit of quantitation (LOQ) and the %RPD exceeded 20%. Following this logic, qualification was limited to detections of manganese and nickel reported for sample AOI1-SU3-SA-REP2, manganese and zinc reported for samples AOI1-SU3-SO01-8-10 and WELLFLEET-FD1.

SW8330	The ISM samples were analyzed for nitroguanidine as part of two analytical runs (#148455 and #148749). Nitroguanidine was detected in seven of these samples, with the results produced by the primary and confirmation analyses differing by more than 40% in each case (i.e., %RPD >40%). The laboratory attributed the discrepancies to interferences occurring in the confirmation analyses. The detections of nitroguanidine reported for these seven samples were classified as less than fully quantitative and coded with “J” validation qualifiers with reason codes of “P1”. Low surrogate recoveries reported for the MS/MSD analyses of sample AOI1-SU2-SA-REP1 did not warrant qualification of sample data as the recoveries of the target analyte (nitroguanidine) met validation acceptance criteria for analytical accuracy and analytical precision. No other quality issues requiring qualification of sample data for nitroguanidine were noted.
SW8330B	The samples were analyzed for explosives by Method 8330B as part of two preparation batches and two analytical runs (batch #66453 / run #148964 and batch #66552 / run #148898). The laboratory control sample (LCS) prepared in batch #66552 yielded a low recovery of tetryl (37% vs. an acceptance range of 68-135%). The recovery of tetryl was acceptable in the analysis of the LCS prepared in batch #66453. Tetryl is known to be problematic as it decomposes upon exposure to heat, light, and moisture. The findings of non-detect reported for the nine ISM samples, all of which were included in preparation batch #66552, were classified as less than fully quantitative, based on the LCS recovery, and coded with “UJ” validation qualifiers with reason code “C”. The laboratory performed MS/MSD analyses with additional volumes of discrete sample AOI1-SU3-SO01-8-10 and ISM sample AOI1-SU2-SA-REP1. Slightly elevated recoveries of tetryl were reported for the MS/MSD analyses of sample AOI1-SU3-SO01-8-10 (both 136% vs. an upper control limit of 135%). The absence of the analyte in the parent sample precluded the need for qualification of the result. Similarly, an elevated surrogate reported for sample WELLFLEET-FD1 (142% vs. an upper control limit of 119%) did not result in qualification of any of the explosives data for this sample as no target explosives were detected.

Cindy Lee Westergard

July 11, 2018

Reviewed by Cindy Westergard, Senior Scientist, HSW Engineering, Inc.

As the First Reviewer, I certify that I have performed a data review process in accordance with the requirements of the project guidance document, and have compared the electronic data to the laboratory's hard copy report and have verified the consistency of a minimum of 10% of the reported sample results and method quality control data between the two deliverables.

July 11, 2018

Reviewed by Nigel Lewis, Project Scientist, HSW Engineering, Inc.

As the Second Reviewer, I certify that I have performed a quality assurance review of the report generated by the First Reviewer.

Quality Control Outliers for test method SW6010C, LCS Recovery

The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. Reported results were evaluated to determine compliance with the required acceptance criteria, and summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and any associated qualified results, are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
109682 (BS)/ 109682	Nickel	113.2	83 - 113	40 - 150	percent	J/None	C	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

No results associated with this QC element required qualification.

Quality Control Outliers for test method SW6010C, MS Recovery

Data for matrix spikes/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. These data alone cannot be used to evaluate the precision and accuracy of individual samples. However, when exercising professional judgment, MS/MSD data can be used in conjunction with other available QC information. Reported results were evaluated to determine compliance with the required acceptance criteria, and summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and any associated qualified results, are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
AOI1-SU3-SO01-8-10 (SD)/ 109678	Manganese	127.4	84 - 114	30 - 125	percent	J/None	M	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

Qualified Results associated with the MS Recovery for SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI1-SU3-SO01-8-10	N	Manganese	0.150	8.70 Y	8.70 J		mg/kg	M/D1

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).

Quality Control Outliers for test method SW8330, Surrogate

Method performance for individual samples is demonstrated through spiking activities. All samples are spiked with surrogate compounds prior to sample preparation. The sample itself may produce effects due to such factors as interferences and high concentrations of analytes. Summary forms were evaluated and compared to electronic data deliverables. Surrogate results that were outside of the acceptance criteria are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
AOI1-SU2-SA-REP1 (MS)/ 109256	1,2-Dinitrobenzene	29.60	32 - 136	10 - 136	percent	J/UJ	I	
AOI1-SU2-SA-REP1 (SD)/ 109257	1,2-Dinitrobenzene	29.00	32 - 136	10 - 136	percent	J/UJ	I	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

No results associated with this QC element required qualification.

Quality Control Outliers for test method SW8330B, LCS Recovery

The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. Reported results were evaluated to determine compliance with the required acceptance criteria, and summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and any associated qualified results, are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
109222 (BS)/ 109222	Tetryl	36.83	68 - 135	20 - 135	percent	J/UJ	C	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

Qualified Results associated with the LCS Recovery for SW8330B

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI1-SU1-SA-REP1	FT	Tetryl	0.290	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI1-SU1-SA-REP2	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI1-SU1-SA-REP3	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI1-SU2-SA-REP1	FT	Tetryl	0.290	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI1-SU2-SA-REP2	FT	Tetryl	0.290	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI1-SU2-SA-REP3	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI1-SU3-SA-REP1	FT	Tetryl	0.290	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI1-SU3-SA-REP2	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI1-SU3-SA-REP3	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).

Automated Data Review Report Summary for 135444EDD

HSW Engineering, Inc.

Quality Control Outliers for test method SW8330B, MS Recovery

Data for matrix spikes/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. These data alone cannot be used to evaluate the precision and accuracy of individual samples. However, when exercising professional judgment, MS/MSD data can be used in conjunction with other available QC information. Reported results were evaluated to determine compliance with the required acceptance criteria, and summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and any associated qualified results, are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
AOI1-SU3-SO01-8-10 (MS)/ 107265	Tetryl	136.3	68 - 135	20 - 135	percent	J/None	M	
AOI1-SU3-SO01-8-10 (SD)/ 107266	Tetryl	135.7	68 - 135	20 - 135	percent	J/None	M	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

No results associated with this QC element required qualification.

Table of All Qualified Results

Test Method: SW6010C Extraction Method: SW3050

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI1-SU3-SO01-8-10	N	Manganese	0.150	8.70 Y	8.70 J		mg/kg	M/D1

Test Method: SW8330B Extraction Method: METHOD

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI1-SU1-SA-REP1	FT	Tetryl	0.290	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI1-SU1-SA-REP2	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI1-SU1-SA-REP3	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI1-SU2-SA-REP1	FT	Tetryl	0.290	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI1-SU2-SA-REP2	FT	Tetryl	0.290	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI1-SU2-SA-REP3	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI1-SU3-SA-REP1	FT	Tetryl	0.290	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI1-SU3-SA-REP2	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI1-SU3-SA-REP3	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).
Trace values are not included in the qualified results table unless additional reason codes are associated.

Table of All Trace Results

Test Method: SW6010C Extraction Method: SW3050

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI1-SU1-SA-REP1	FT	Antimony	0.840	0.170 J	0.170 J		mg/kg	TR
AOI1-SU1-SA-REP2	FT	Antimony	0.800	0.130 J	0.130 J		mg/kg	TR
AOI1-SU1-SA-REP3	FT	Antimony	0.810	0.190 J	0.190 J		mg/kg	TR
AOI1-SU2-SA-REP1	FT	Antimony	0.800	0.160 J	0.160 J		mg/kg	TR
AOI1-SU2-SA-REP2	FT	Antimony	0.820	0.150 J	0.150 J		mg/kg	TR
AOI1-SU2-SA-REP3	FT	Antimony	0.820	0.140 J	0.140 J		mg/kg	TR
AOI1-SU2-SO01-8-10	N	Antimony	0.800	0.220 J	0.220 J		mg/kg	TR
AOI1-SU2-SO02-8-10	N	Copper	0.430	0.320 J	0.320 J		mg/kg	TR
AOI1-SU2-SO03-8-10	N	Copper	0.410	0.340 J	0.340 J		mg/kg	TR
AOI1-SU2-SO04-8-10	N	Copper	0.410	0.350 J	0.350 J		mg/kg	TR
AOI1-SU3-SA-REP2	FT	Antimony	0.800	0.150 J	0.150 J		mg/kg	TR
AOI1-SU3-SA-REP3	FT	Antimony	0.830	0.150 J	0.150 J		mg/kg	TR
AOI1-SU3-SO01-8-10	N	Copper	0.400	0.270 J	0.270 J		mg/kg	TR
WELLFLEET-FD1	FD	Antimony	0.800	0.180 J	0.180 J		mg/kg	TR

Table of Results with Modified Qualifiers

Modified Qualifiers for test method SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	ADR Result	Modified Result	Reason
AOI1-SU2-SO01-8-10	N	Nickel	0.120	0.710	0.710 J	0.710	
AOI1-SU2-SO02-8-10	N	Nickel	0.130	0.550	0.550 J	0.550	
AOI1-SU2-SO03-8-10	N	Nickel	0.120	0.530	0.530 J	0.530	
AOI1-SU2-SO04-8-10	N	Nickel	0.120	0.580	0.580 J	0.580	
AOI1-SU3-SA-REP2	FT	Manganese	0.160	13.4 Y	13.4	13.4 J	D1
AOI1-SU3-SA-REP2	FT	Nickel	0.130	0.770 Y	0.770	0.770 J	D1
AOI1-SU3-SO01-8-10	N	Manganese	0.150	8.70 Y	8.70 J	8.70 J	M/D1
AOI1-SU3-SO01-8-10	N	Nickel	0.120	0.510	0.510 J	0.510	
AOI1-SU3-SO01-8-10	N	Zinc	0.300	4.80 Y	4.80	4.80 J	D1
AOI1-SU3-SO02-8-10	N	Nickel	0.120	0.820	0.820 J	0.820	
AOI1-SU3-SO03-8-10	N	Nickel	0.120	0.840	0.840 J	0.840	
AOI1-SU3-SO04-8-10	N	Nickel	0.120	0.840	0.840 J	0.840	
WELLFLEET-FD1	FD	Manganese	0.150	10.7 Y	10.7	10.7 J	D1
WELLFLEET-FD1	FD	Nickel	0.120	0.670	0.670 J	0.670	
WELLFLEET-FD1	FD	Zinc	0.300	5.10 Y	5.10	5.10 J	D1

Modified Qualifiers for test method SW8330

FieldSample ID	Type	Analyte	LOQ	Lab Result	ADR Result	Modified Result	Reason
AOI1-SU1-SA-REP1	FT	Nitroguanidine	0.250	0.870 P	0.870	0.870 J	P1
AOI1-SU1-SA-REP2	FT	Nitroguanidine	0.250	0.890 P	0.890	0.890 J	P1
AOI1-SU1-SA-REP3	FT	Nitroguanidine	0.240	0.500 P	0.500	0.500 J	P1
AOI1-SU2-SA-REP3	FT	Nitroguanidine	0.240	0.710 P	0.710	0.710 J	P1
AOI1-SU3-SA-REP1	FT	Nitroguanidine	0.250	0.690 P	0.690	0.690 J	P1
AOI1-SU3-SA-REP2	FT	Nitroguanidine	0.240	0.550 P	0.550	0.550 J	P1
AOI1-SU3-SA-REP3	FT	Nitroguanidine	0.250	0.630 P	0.630	0.630 J	P1

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).
Trace values are not included in the qualified results table unless additional reason codes are associated.

Reason Code Definitions

Code	Definition
C	LCS Recovery
D1	Lab Replicate RPD
I	Surrogate recovery outside project limits.
M	MS Recovery
P1	Column RPD
TR	Trace Level Detect

Flag Code and Definitions

Flag	Definition
U	Undetected: The analyte was analyzed for, but not detected.
UJ	The analyte was not detected; however, the result is estimated due to discrepancies in meeting certain analyte-specific quality control criteria.
J	Estimated: The analyte was positively identified, the quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
R	The data are rejected due to deficiencies in meeting QC criteria and may not be used for decision making.
B	Blank contamination: The analyte was found in an associated blank above one half the RL, as well as in the sample.
UB	The analyte was also detected in an associated laboratory or field blank at a concentration comparable to the concentration in the sample. The reported result has been requalified as not detected.

Review Questions

Method: SW6010C (Trace Metals by Inductively Coupled Plasma/Atomic Emission Spectrometry)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was the Calibration within acceptance criteria?	•			
Were the required minimum levels of calibration standards used in the initial calibration?	•			
Was either analysis of an ICV performed after each ICAL or a second source standard prior to sample analysis?	•			
Were all reported analytes for the ICV within the required criteria?	•			
Were CCVs run at the required frequency and within acceptance criteria?	•			
Was a method blank prepared and analyzed with each batch?	•			
Were target analytes in the method blank less than MDL?	•			
Were target analytes in the field blank less than MDL?			•	
Was an LCS/LCSD pair prepared and analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?	•			
Was the LCS/LCSD RPD within project acceptance limits?			•	
Was a MS/MSD pair prepared with each batch?	•			
Were MS/MSD recoveries within project acceptance limits?		•		An elevated MSD recovery was reported for manganese (sample AOI1-SU3-SO01-8-10 was used).
Was the MS/MSD RPD within project acceptance limits?	•			
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?	•			A field duplicate, identified as WELLFLEET-FD1, was collected at location AOI1-SU2-S004-8-10.
Were QAPP specified laboratory PQLs achieved?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			
Were DoD QSM corrective actions followed if deviations were noted?	•			
Were any data rejected during the verification process?		•		

Review Questions

Method: SW8330 (Nitroaromatics and Nitramines by HPLC)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was a blank prepared and analyzed with each batch?	•			
Were target analytes in the blank less than MDL?	•			
Were target analytes in the field blank less than MDL?	•			
Was an LCS or LCS/LCSD pair analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?	•			
Was the LCS/LCSD RPD within project acceptance limits?			•	
Was a project specific MS or MS/MSD pair prepared with each batch?	•			
Were MS/MSD recoveries within project acceptance limits?	•			
Was the MS/MSD RPD within project acceptance limits?	•			
Was a project-specific duplicate analyzed, and the RPD within QAPP acceptance limits?		•		
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?	•			A field duplicate was collected at location AOI1-SU2-SO04-8-10 and identified as sample WELLFLEET-FD1. No nitroguanidine was detected in either of these samples. Data for field triplicates are evaluated outside of the scope of this validation process.
Were QAPP specified laboratory reporting limits achieved?	•			
Were surrogate recoveries within project acceptance limits?	•			
Were column comparison differences with project acceptance limits?		•		In all seven instances in which nitroguanidine was detected, the %RPD for the concentrations detected on the primary and confirmatory columns exceeded 40%.
Was the intial calibration within criteria?	•			
Was a second source check standard analyzed and within all applicable criteria?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			

Review Questions

Method: SW8330B (Nitroaromatics and Nitramines by HPLC)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was a blank prepared and analyzed with each batch?	•			
Were target analytes in the blank less than MDL?	•			
Were target analytes in the field blank less than MDL?			•	
Was an LCS or LCS/LCSD pair analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?		•		
Was the LCS/LCSD RPD within project acceptance limits?			•	
Was a project specific MS or MS/MSD pair prepared with each batch?	•			
Were MS/MSD recoveries within project acceptance limits?		•		The recoveries of tetryl in the MS/MSD analyses of sample AOI1-SU3-SO01-8-10 slightly exceeded the upper control limit; however, the absence of the analyte in the parent sample precluded the need for qualification of the result.
Was the MS/MSD RPD within project acceptance limits?	•			
Was a project-specific duplicate analyzed, and the RPD within QAPP acceptance limits?	•			A field duplicate was collected at location AOI1-SU2-S004-8-10 and identified as sample WELLFLEET-FD1. No target explosives were detected in either of these two samples. Field triplicates are evaluated outside of the scope of this validation process.
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?		•		
Were QAPP specified laboratory reporting limits achieved?	•			
Were surrogate recoveries within project acceptance limits?		•		The recovery of the surrogate in the analysis of sample WELLFLEET-FD1 was slightly greater than the upper control limit; however, no target explosives were detected in this sample.
Were column comparison differences with project acceptance limits?	•			
Was the intial calibration within criteria?	•			
Was a second source check standard analyzed and within all applicable criteria?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			

Summary of Qualified Data

SDG	Client Sample ID	Lab Sample ID	SACODE	LOGDATE	Test Method	EXMCODE	MATRIX	Analyte Name	PARLABEL	CAS	DB Result	UNITS	DB Reporting Limit	Limit Of Detection	Display Result	Qualifier*	Reason Code
135444EDD	AOI1-SU1-SA-REP1	107143	FT	4/17/2018 2:45:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.17	mg/kg	0.84	0.42	0.170	J	TR
135444EDD	AOI1-SU1-SA-REP1	107143	FT	4/17/2018 2:45:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.87	mg/kg	0.25	0.12	0.870	J	P1
135444EDD	AOI1-SU1-SA-REP1	107143	FT	4/17/2018 2:45:00 PM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.29	0.15	0.150	UJ	C
135444EDD	AOI1-SU1-SA-REP2	107147	FT	4/17/2018 2:45:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.13	mg/kg	0.8	0.4	0.130	J	TR
135444EDD	AOI1-SU1-SA-REP2	107147	FT	4/17/2018 2:45:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.89	mg/kg	0.25	0.12	0.890	J	P1
135444EDD	AOI1-SU1-SA-REP2	107147	FT	4/17/2018 2:45:00 PM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135444EDD	AOI1-SU1-SA-REP3	107149	FT	4/17/2018 2:45:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.19	mg/kg	0.81	0.4	0.190	J	TR
135444EDD	AOI1-SU1-SA-REP3	107149	FT	4/17/2018 2:45:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.5	mg/kg	0.24	0.11	0.500	J	P1
135444EDD	AOI1-SU1-SA-REP3	107149	FT	4/17/2018 2:45:00 PM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135444EDD	AOI1-SU2-SA-REP1	107128	FT	4/17/2018 11:20:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.16	mg/kg	0.8	0.4	0.160	J	TR
135444EDD	AOI1-SU2-SA-REP1	107128	FT	4/17/2018 11:20:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.29	0.15	0.150	UJ	C
135444EDD	AOI1-SU2-SA-REP2	107133	FT	4/17/2018 11:20:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.15	mg/kg	0.82	0.41	0.150	J	TR
135444EDD	AOI1-SU2-SA-REP2	107133	FT	4/17/2018 11:20:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.29	0.15	0.150	UJ	C
135444EDD	AOI1-SU2-SA-REP3	107135	FT	4/17/2018 11:20:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.14	mg/kg	0.82	0.41	0.140	J	TR
135444EDD	AOI1-SU2-SA-REP3	107135	FT	4/17/2018 11:20:00 AM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.71	mg/kg	0.24	0.12	0.710	J	P1
135444EDD	AOI1-SU2-SA-REP3	107135	FT	4/17/2018 11:20:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135444EDD	AOI1-SU2-SO01-8-10	107124	N	4/17/2018 9:45:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.22	mg/kg	0.8	0.4	0.220	J	TR
135444EDD	AOI1-SU2-SO02-8-10	107125	N	4/17/2018 10:15:00 AM	SW6010C	SW3050	SO	Copper	CU	7440-50-8	0.32	mg/kg	0.43	0.21	0.320	J	TR
135444EDD	AOI1-SU2-SO03-8-10	107126	N	4/17/2018 10:40:00 AM	SW6010C	SW3050	SO	Copper	CU	7440-50-8	0.34	mg/kg	0.41	0.21	0.340	J	TR
135444EDD	AOI1-SU2-SO04-8-10	107127	N	4/17/2018 11:05:00 AM	SW6010C	SW3050	SO	Copper	CU	7440-50-8	0.35	mg/kg	0.41	0.2	0.350	J	TR
135444EDD	AOI1-SU3-SA-REP1	107137	FT	4/17/2018 12:50:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.69	mg/kg	0.25	0.12	0.690	J	P1
135444EDD	AOI1-SU3-SA-REP1	107137	FT	4/17/2018 12:50:00 PM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.29	0.15	0.150	UJ	C
135444EDD	AOI1-SU3-SA-REP2	107139	FT	4/17/2018 12:50:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.15	mg/kg	0.8	0.4	0.150	J	TR
135444EDD	AOI1-SU3-SA-REP2	107140	FT	4/17/2018 12:50:00 PM	SW6010C	SW3050	SO	Manganese	MN	7439-96-5	13.4	mg/kg	0.16	0.078	13.4	J	D1
135444EDD	AOI1-SU3-SA-REP2	107140	FT	4/17/2018 12:50:00 PM	SW6010C	SW3050	SO	Nickel	NI	7440-02-0	0.77	mg/kg	0.13	0.063	0.770	J	D1
135444EDD	AOI1-SU3-SA-REP2	107139	FT	4/17/2018 12:50:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.55	mg/kg	0.24	0.12	0.550	J	P1
135444EDD	AOI1-SU3-SA-REP2	107139	FT	4/17/2018 12:50:00 PM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135444EDD	AOI1-SU3-SA-REP3	107141	FT	4/17/2018 12:50:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.15	mg/kg	0.83	0.41	0.150	J	TR
135444EDD	AOI1-SU3-SA-REP3	107141	FT	4/17/2018 12:50:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.63	mg/kg	0.25	0.12	0.630	J	P1
135444EDD	AOI1-SU3-SA-REP3	107141	FT	4/17/2018 12:50:00 PM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135444EDD	AOI1-SU3-SO01-8-10	107123	N	4/17/2018 11:30:00 AM	SW6010C	SW3050	SO	Copper	CU	7440-50-8	0.27	mg/kg	0.4	0.2	0.270	J	TR
135444EDD	AOI1-SU3-SO01-8-10	107123	N	4/17/2018 11:30:00 AM	SW6010C	SW3050	SO	Manganese	MN	7439-96-5	8.7	mg/kg	0.15	0.075	8.70	J	M/D1
135444EDD	AOI1-SU3-SO01-8-10	107123	N	4/17/2018 11:30:00 AM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	4.8	mg/kg	0.3	0.15	4.80	J	D1
135444EDD	WELLFLEET-FD1	107154	FD	4/17/2018 11:05:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.18	mg/kg	0.8	0.4	0.180	J	TR
135444EDD	WELLFLEET-FD1	107154	FD	4/17/2018 11:05:00 AM	SW6010C	SW3050	SO	Manganese	MN	7439-96-5	10.7	mg/kg	0.15	0.075	10.7	J	D1
135444EDD	WELLFLEET-FD1	107154	FD	4/17/2018 11:05:00 AM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	5.1	mg/kg	0.3	0.15	5.10	J	D1

*Includes detections that are less than the limits of quantitation (LOQs) but otherwise unqualified as a result of the validation (i.e., validation qualifiers of "J" with reason code "TR" only).

Automated Data Review Report Summary for 135478EDD

Facility:	D01MA0033-04, CP Wellfleet - Art, Sm Arms, Rocket
Event:	Phase I Sampling 2018
SDG:	135478EDD
Guidance Document:	Camp Wellfleet - Art, Sm Arms, Rocket
Prime Contractor:	ERT, Inc., Laurel, MD
Project Manager:	Tom Bachovchin
Contract Laboratory:	CT Laboratories LLC, Baraboo, WI
Data Review Contractor:	HSW Engineering Inc.
Data Review Level:	Stage 2B Review
Primary Data Reviewer:	Cindy Westergard, Senior Scientist
Second Reviewer:	Nigel Lewis, Project Scientist
Date Submitted:	July 12, 2018

Field Sample ID	Lab Sample ID	Matrix	Type/Type Code	SW6010C	SW8330	SW8330B
AOI2-SU1-SA-REP1	107797	Solid	Field Triplicate/FT	X	X	X
AOI2-SU1-SA-REP1	107798	Solid	Field Triplicate/FT	X		
AOI2-SU1-SA-REP2	107799	Solid	Field Triplicate/FT	X	X	X
AOI2-SU1-SA-REP2	107800	Solid	Field Triplicate/FT	X		
AOI2-SU1-SA-REP3	107801	Solid	Field Triplicate/FT	X	X	X
AOI2-SU1-SA-REP3	107802	Solid	Field Triplicate/FT	X		
AOI2-SU2-SA-REP1	107791	Solid	Field Triplicate/FT	X	X	X
AOI2-SU2-SA-REP1	107792	Solid	Field Triplicate/FT	X		
AOI2-SU2-SA-REP2	107793	Solid	Field Triplicate/FT	X	X	X
AOI2-SU2-SA-REP2	107794	Solid	Field Triplicate/FT	X		
AOI2-SU2-SA-REP3	107795	Solid	Field Triplicate/FT	X	X	X
AOI2-SU2-SA-REP3	107796	Solid	Field Triplicate/FT	X		
AOI2-SU3-SA-REP1	107785	Solid	Field Triplicate/FT	X	X	X
AOI2-SU3-SA-REP1	107786	Solid	Field Triplicate/FT	X		
AOI2-SU3-SA-REP2	107787	Solid	Field Triplicate/FT	X	X	X
AOI2-SU3-SA-REP2	107788	Solid	Field Triplicate/FT	X		
AOI2-SU3-SA-REP3	107789	Solid	Field Triplicate/FT	X	X	X
AOI2-SU3-SA-REP3	107790	Solid	Field Triplicate/FT	X		
AOI5-SU3-SA-REP1	107803	Solid	Field Triplicate/FT	X	X	X
AOI5-SU3-SA-REP1	107804	Solid	Field Triplicate/FT	X		

Field Sample ID	Lab Sample ID	Matrix	Type/Type Code	SW6010C	SW8330	SW8330B
AOI5-SU3-SA-REP2	107805	Solid	Field Triplicate/FT	X	X	X
AOI5-SU3-SA-REP2	107806	Solid	Field Triplicate/FT	X		
AOI5-SU3-SA-REP3	107807	Solid	Field Triplicate/FT	X	X	X
AOI5-SU3-SA-REP3	107808	Solid	Field Triplicate/FT	X		

This report assesses the analytical data quality associated with the analyses listed on the preceding cover page. This assessment has been made through a combination of automated data review (ADR) and supplemental manual review, the details of which are described below. The approach taken in the review of this data set is consistent with the requirements contained in the Camp Wellfleet - Art, Sm Arms, Rocket and the additional guidance documents incorporated by reference to the extent possible. Where definitive guidance is not provided, results have been evaluated in a conservative manner using professional judgment.

Sample collection was managed and directed by ERT, Inc., Laurel, MD; analyses were performed by CT Laboratories LLC, Baraboo, WI and were reported under sample delivery group (SDG) 135478EDD. Data have been evaluated electronically based on electronic data deliverables (EDDs) provided by the laboratory, and hard copy data summary forms have also been reviewed during this effort and compared to the automated review output by the reviewers whose signatures appear on the following page. Findings based on the automated data submission and manual data verification processes are detailed in the ADR narrative and throughout this report.

All quality control (QC) elements associated with this SDG have been reviewed by a project chemist in accordance with the requirements defined for the project. This review is documented in the attached Data Review Checklists. The QC elements listed below were supported by the electronic deliverable and were evaluated using ADR processes.

- Blank
- Blank - Negative
- LCS Recovery
- MS Recovery
- MS RPD
- Prep Hold Time
- Surrogate
- Test Hold Time

Results of the ADR process were subsequently reviewed and updated as applicable by the data review chemists identified on the signature page. Quality control elements that were not included in the electronic deliverable were reviewed manually and findings are documented within this report. Summaries of findings and associated qualified results are documented throughout this report.

A total of 43 results (27.56%) out of the 156 results (sample and field QC samples) reported are qualified based on review and 0 results (0.00%) have been rejected. Trace values, defined as results that are qualified as estimated because they fall between the detection limit and the reporting limit/limit of quantitation, are not counted as qualified results in the above count. The qualified results are detailed throughout this report and discussed in the narrative below, where appropriate.

Narrative Comments

Twelve ISM samples were received by CT Laboratories, Baraboo, Wisconsin, and analyzed for a select list of explosives and metals. The samples were received intact and at a temperature within method specified acceptance limits. The ISM samples were dried, sieved, subsampled, and ground following the homogenization procedure specified for the project. The analyses were performed in accordance with requirements given in DOD QSM 5. Qualifiers used by the laboratory are defined in the laboratory report.

The ISM samples were collected as three field replicates (i.e., triplicates) from each of four locations and identified with suffixes of -REP1, -REP2, and -REP3. As replicate samples are an intrinsic part of the ISM process and this project, the extent of variability among triplicate results will be evaluated by the project team. Triplicate results were reviewed by the validator to confirm the overall reasonableness of the results, with no issues of concern noted.

Analytical Method	Data Reviewer Comment
SW6010C	The dried/sieved fraction of each ISM sample was subsampled for nickel and manganese prior to the sample undergoing grinding via a puck mill, to avoid potential contamination of the samples with these metals from the puck mill. Analyses for antimony, copper, lead, and zinc were performed with the fully-homogenized, puck-milled fractions. The ISM samples were analyzed as part of two analytical runs (#148308 and #148444). The laboratory performed MS/MSD, serial dilution(SD), and post-digestion spike (PDS) analyses with additional volumes of samples AOI2-SU2-SA-REP1 and AOI5-SU3-SA-REP1. Low recoveries were reported for antimony in the MS and MSD (52% and 51%) and for copper in the MS (80%) of sample AOI2-SU2-SA-REP1; all other recoveries reported for the MS/MSD analyses of sample AOI2-SU2-SA-REP1 and all %RPDs were within control limits. The laboratory also reported low recoveries of antimony in the MS analyses of sample AOI5-SU3-SA-REP1 (70% and 67%) and of copper, lead, and zinc in the MSD (analyzed twice, in association with two analytical runs). The results for these metals in the parent samples were classified as less than fully quantitative and coded with “J” validation qualifiers (all were detections). The results for antimony and zinc reported for parent sample AOI5-SU3-SA-REP1 also were qualified due to elevated MS/MSD %RPDs. All results reported for the SDs were indicated either to have been invalid or to have failed. Low PDS recoveries were reported for manganese, nickel, copper, and lead in the PDS analyses of both samples and for zinc in the PDS analysis of sample AOI2-SU2-SA-REP1. These low PDS recoveries were used as additional reasons for the application of J validation qualifiers to the results for these four metals for the parent sample. The list of reason codes for data qualification for this project does not include a distinct code for indicating when PDS recoveries are not within control limits. Therefore, when the SD result for a given metal was invalid or not within control limits and the subsequent PDS recovery also was not within control limits, the sample result was qualified with a validation qualifier of "J" (detections) or "UJ" (non-detections) with reason codes of "A/M" ("A" signifying an invalid or failed SD analysis and "M" indicating a spike recovery that was not within limits -- in this case, a PDS). If the MS and/or MSD recovery was not within control limits and the SD + PDS results also were not within control limits, the data were qualified with "J" or "UJ" with reason codes of "M/A" (rather than “M/A/M”, as the FUDSchem system will not allow a reason code to be entered twice). The laboratory performed triplicate analyses of samples AOI2-SU2-SA-REP1, AOI2-SU3-SA-REP1, AOI5-SU3-SA-REP1, and AOI5-SU3-SA-REP2. Sample results were qualified when the detection of the analyte was at least five times as great as the limit of quantitation (LOQ) and the %RPD exceeded 20%. Following this logic, qualification was limited to detections of zinc reported for sample AOI5-SU3-SA-REP1, manganese and nickel reported for sample AOI2-SU3-SA-REP1, and manganese, nickel, and zinc reported for sample AOI2-SU2-SA-REP1.
SW8330	Nitroguanidine was detected in two of the twelve ISM samples, with the results produced by the primary and confirmation analyses differing by more than 40% relative percent difference (%RPD) in both instances. The laboratory attributed the discrepancies to interferences occurring in the confirmation analyses. The detections of nitroguanidine reported for these two samples were classified as less than fully quantitative and coded with “J” validation qualifiers with reason codes of “P1”. All other data review acceptance criteria were met.

SW8330B	The laboratory control sample (LCS) yielded a low recovery of tetryl (51% vs. an acceptance range of 68-135%). This analyte is known to be problematic as it decomposes upon exposure to heat, light, and moisture. The findings of non-detect reported for tetryl for all of the ISM samples were classified as less than fully quantitative, based on the LCS recovery, and coded with "UJ" validation qualifiers with reason code "C". As noted in the laboratory case narrative, the initial analysis of sample AOI2-SU1-SA-REP2 (laboratory sample number 107799) yielded a surrogate recovery of 2.4% and no analyte detections above the MDL. The sample was re-shaken, re-filtered, and re-analyzed, with a surrogate recovery of 4.9% and possible detection of 2,6-dinitrotoluene. The sample was re-prepped on 5/10/2018, with no recovery of the surrogate. The laboratory made note of a chromatographic peak that eluted nearly a full minute earlier than the surrogate and some baseline noise, but no detections of target analytes. The second analysis (re-shaken and re-filtered) was reported and confirmation analysis of that vial was performed. The confirmation analysis had a large peak just outside the surrogate window that had a slight shoulder split off of it. This gave a surrogate value of about 2%. Another large peak eluted at the time of 2,4-dinitrotoluene, but this did not match the primary run. While the final reported surrogate recovery of 4.9% (rounded to 5.0% in the laboratory report) was very low, the repeat analyses (all with similar findings of non-detect) were deemed sufficient to warrant qualification of the results for explosives reported for sample AOI2-SU1-SA-REP2 (all of which were findings of non-detect) with "UJ" validation qualifiers, rather than "R" (rejected). No other quality issues warranting additional qualification of the sample data for explosives by Method 8330B were noted.

Cindy Lee Westergard

July 11, 2018

Reviewed by Cindy Westergard, Senior Scientist, HSW Engineering Inc.

As the First Reviewer, I certify that I have performed a data review process in accordance with the requirements of the project guidance document, and have compared the electronic data to the laboratory's hard copy report and have verified the consistency of a minimum of 10% of the reported sample results and method quality control data between the two deliverables.

July 11, 2018

Reviewed by Nigel Lewis, Project Scientist, HSW Engineering Inc.

As the Second Reviewer, I certify that I have performed a quality assurance review of the report generated by the First Reviewer.

Quality Control Outliers for test method SW6010C, MS Recovery

Data for matrix spikes/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. These data alone cannot be used to evaluate the precision and accuracy of individual samples. However, when exercising professional judgment, MS/MSD data can be used in conjunction with other available QC information. Reported results were evaluated to determine compliance with the required acceptance criteria, and summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and any associated qualified results, are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
AOI2-SU2-SA-REP1 (MS)/ 109701	Antimony	51.46	79 - 114	30 - 125	percent	J/UJ	M	
AOI2-SU2-SA-REP1 (SD)/ 109702	Antimony	52.47	79 - 114	30 - 125	percent	J/UJ	M	
AOI2-SU2-SA-REP1 (SD)/ 109702	Copper	80.16	81 - 117	30 - 117	percent	J/UJ	M	
AOI5-SU3-SA-REP1 (MS)/ 109705	Antimony	69.85	79 - 114	30 - 125	percent	J/UJ	M	
AOI5-SU3-SA-REP1 (SD)/ 109706	Lead	75.10	81 - 112	30 - 125	percent	J/UJ	M	
AOI5-SU3-SA-REP1 (SD)/ 109706	Zinc	77.39	82 - 113	30 - 125	percent	J/UJ	M	
AOI5-SU3-SA-REP1 (SD)/ 109706	Copper	77.10	81 - 117	30 - 117	percent	J/UJ	M	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

Qualified Results associated with the MS Recovery for SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI2-SU2-SA-REP1	FT	Antimony	0.810	0.230 J	0.230 J	-	mg/kg	M/TR
AOI2-SU2-SA-REP1	FT	Copper	0.400	1.90 M	1.90 J	-	mg/kg	M/A
AOI2-SU2-SA-REP1	FT	Lead	0.250	2.90 M	2.90 J	-	mg/kg	A/M
AOI2-SU2-SA-REP1	FT	Zinc	0.300	6.40 M,Y	6.40 J	-	mg/kg	A/M
AOI2-SU2-SA-REP2	FT	Antimony	0.810	0.250 J	0.250 J	-	mg/kg	M/TR
AOI2-SU2-SA-REP2	FT	Copper	0.410	1.80	1.80 J	-	mg/kg	M
AOI2-SU2-SA-REP3	FT	Antimony	0.790	0.160 J	0.160 J	-	mg/kg	M/TR
AOI2-SU2-SA-REP3	FT	Copper	0.400	2.10	2.10 J	-	mg/kg	M
AOI5-SU3-SA-REP1	FT	Antimony	0.830	0.140 JY	0.140 J	-	mg/kg	M/D/TR
AOI5-SU3-SA-REP1	FT	Copper	0.420	1.20 M	1.20 J	-	mg/kg	M/A
AOI5-SU3-SA-REP1	FT	Lead	0.260	1.90 M	1.90 J	-	mg/kg	M/A
AOI5-SU3-SA-REP1	FT	Zinc	0.310	5.60 Y	5.60 J	-	mg/kg	M
AOI5-SU3-SA-REP2	FT	Antimony	0.830	0.230 J	0.230 J	-	mg/kg	M/D/TR
AOI5-SU3-SA-REP2	FT	Copper	0.420	1.20	1.20 J	-	mg/kg	M
AOI5-SU3-SA-REP2	FT	Lead	0.260	1.70	1.70 J	-	mg/kg	M
AOI5-SU3-SA-REP2	FT	Zinc	0.310	7.90	7.90 J	-	mg/kg	M
AOI5-SU3-SA-REP3	FT	Antimony	0.840	0.170 J	0.170 J	-	mg/kg	M/D/TR
AOI5-SU3-SA-REP3	FT	Copper	0.420	1.60	1.60 J	-	mg/kg	M
AOI5-SU3-SA-REP3	FT	Lead	0.260	2.10	2.10 J	-	mg/kg	M

Qualified Results associated with the MS Recovery for SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI5-SU3-SA-REP3	FT	Zinc	0.320	3.20	3.20 J	-	mg/kg	M

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).

Quality Control Outliers for test method SW6010C, MS RPD

The objective of matrix spikes/matrix spike duplicates (MS/MSD) RPD analysis is to demonstrate acceptable method precision by the laboratory at the time of analysis. MS/MSD analyses are also performed to generate data that determines the long-term precision of the analytical method on various matrices. Non-homogenous samples can impact the apparent method precision. Summary forms were evaluated and compared to electronic data deliverables. Matrix spikes/matrix spike duplicates results that were outside of the acceptance criteria are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
AOI5-SU3-SA-REP1 (SD)/ 109706	Antimony	23.61	< 20	< 20	rpd	J/UJ	D	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

Qualified Results associated with the MS RPD for SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI5-SU3-SA-REP1	FT	Antimony	0.830	0.140 JY	0.140 J	-	mg/kg	M/D/TR
AOI5-SU3-SA-REP2	FT	Antimony	0.830	0.230 J	0.230 J	-	mg/kg	M/D/TR
AOI5-SU3-SA-REP3	FT	Antimony	0.840	0.170 J	0.170 J	-	mg/kg	M/D/TR

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).

Quality Control Outliers for test method SW8330B, LCS Recovery

The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. Reported results were evaluated to determine compliance with the required acceptance criteria, and summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and any associated qualified results, are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
109270 (BS)/ 109270	Tetryl	51.01	68 - 135	20 - 135	percent	J/UJ	C	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

Qualified Results associated with the LCS Recovery for SW8330B

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI2-SU1-SA-REP1	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI2-SU1-SA-REP2	FT	Tetryl	0.290	0.150 UQ	0.150 UJ	-	mg/kg	C/I
AOI2-SU1-SA-REP3	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI2-SU2-SA-REP1	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI2-SU2-SA-REP2	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI2-SU2-SA-REP3	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI2-SU3-SA-REP1	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI2-SU3-SA-REP2	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI2-SU3-SA-REP3	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI5-SU3-SA-REP1	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI5-SU3-SA-REP2	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI5-SU3-SA-REP3	FT	Tetryl	0.290	0.150 UQ	0.150 UJ	-	mg/kg	C

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).

Table of All Qualified Results

Test Method: SW6010C Extraction Method: SW3050

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI2-SU2-SA-REP1	FT	Antimony	0.810	0.230 J	0.230 J	-	mg/kg	M/TR
AOI2-SU2-SA-REP1	FT	Copper	0.400	1.90 M	1.90 J	-	mg/kg	M/A
AOI2-SU2-SA-REP1	FT	Lead	0.250	2.90 M	2.90 J	-	mg/kg	A/M
AOI2-SU2-SA-REP1	FT	Zinc	0.300	6.40 M,Y	6.40 J	-	mg/kg	A/M
AOI2-SU2-SA-REP2	FT	Antimony	0.810	0.250 J	0.250 J	-	mg/kg	M/TR
AOI2-SU2-SA-REP2	FT	Copper	0.410	1.80	1.80 J	-	mg/kg	M
AOI2-SU2-SA-REP3	FT	Antimony	0.790	0.160 J	0.160 J	-	mg/kg	M/TR
AOI2-SU2-SA-REP3	FT	Copper	0.400	2.10	2.10 J	-	mg/kg	M
AOI5-SU3-SA-REP1	FT	Antimony	0.830	0.140 JY	0.140 J	-	mg/kg	M/D/TR
AOI5-SU3-SA-REP1	FT	Copper	0.420	1.20 M	1.20 J	-	mg/kg	M/A
AOI5-SU3-SA-REP1	FT	Lead	0.260	1.90 M	1.90 J	-	mg/kg	M/A
AOI5-SU3-SA-REP1	FT	Zinc	0.310	5.60 Y	5.60 J	-	mg/kg	M
AOI5-SU3-SA-REP2	FT	Antimony	0.830	0.230 J	0.230 J	-	mg/kg	M/D/TR
AOI5-SU3-SA-REP2	FT	Copper	0.420	1.20	1.20 J	-	mg/kg	M
AOI5-SU3-SA-REP2	FT	Lead	0.260	1.70	1.70 J	-	mg/kg	M
AOI5-SU3-SA-REP2	FT	Zinc	0.310	7.90	7.90 J	-	mg/kg	M
AOI5-SU3-SA-REP3	FT	Antimony	0.840	0.170 J	0.170 J	-	mg/kg	M/D/TR
AOI5-SU3-SA-REP3	FT	Copper	0.420	1.60	1.60 J	-	mg/kg	M
AOI5-SU3-SA-REP3	FT	Lead	0.260	2.10	2.10 J	-	mg/kg	M
AOI5-SU3-SA-REP3	FT	Zinc	0.320	3.20	3.20 J	-	mg/kg	M

Test Method: SW8330B Extraction Method: METHOD

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI2-SU1-SA-REP1	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI2-SU1-SA-REP2	FT	Tetryl	0.290	0.150 UQ	0.150 UJ	-	mg/kg	C/I
AOI2-SU1-SA-REP3	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI2-SU2-SA-REP1	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI2-SU2-SA-REP2	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI2-SU2-SA-REP3	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI2-SU3-SA-REP1	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI2-SU3-SA-REP2	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI2-SU3-SA-REP3	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI5-SU3-SA-REP1	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI5-SU3-SA-REP2	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI5-SU3-SA-REP3	FT	Tetryl	0.290	0.150 UQ	0.150 UJ	-	mg/kg	C

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).
Trace values are not included in the qualified results table unless additional reason codes are associated.

Table of All Trace Results

Test Method: SW6010C Extraction Method: SW3050

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI2-SU2-SA-REP1	FT	Antimony	0.810	0.230 J	0.230 J	-	mg/kg	M/TR
AOI2-SU2-SA-REP2	FT	Antimony	0.810	0.250 J	0.250 J	-	mg/kg	M/TR
AOI2-SU2-SA-REP3	FT	Antimony	0.790	0.160 J	0.160 J	-	mg/kg	M/TR
AOI2-SU3-SA-REP1	FT	Antimony	0.780	0.150 J	0.150 J		mg/kg	TR
AOI2-SU3-SA-REP2	FT	Antimony	0.770	0.270 J	0.270 J		mg/kg	TR
AOI5-SU3-SA-REP1	FT	Antimony	0.830	0.140 JY	0.140 J	-	mg/kg	M/D/TR
AOI5-SU3-SA-REP2	FT	Antimony	0.830	0.230 J	0.230 J	-	mg/kg	M/D/TR
AOI5-SU3-SA-REP3	FT	Antimony	0.840	0.170 J	0.170 J	-	mg/kg	M/D/TR

Test Method: SW8330 Extraction Method: METHOD

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI5-SU3-SA-REP3	FT	Nitroguanidine	0.250	0.210 JP	0.210 J		mg/kg	TR/P1

Automated Data Review Report Summary for 135478EDD

Table of Results with Modified Qualifiers

Modified Qualifiers for test method SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	ADR Result	Modified Result	Reason
AOI2-SU2-SA-REP1	FT	Copper	0.400	1.90 M	1.90 J	1.90 J	M/A
AOI2-SU2-SA-REP1	FT	Lead	0.250	2.90 M	2.90	2.90 J	A/M
AOI2-SU2-SA-REP1	FT	Zinc	0.300	6.40 M,Y	6.40	6.40 J	A/M
AOI2-SU2-SA-REP1	FT	Manganese	0.150	17.5 Y,M	17.5	17.5 J	A/M
AOI2-SU2-SA-REP1	FT	Nickel	0.120	1.20 Y,M	1.20	1.20 J	A/M
AOI5-SU3-SA-REP1	FT	Copper	0.420	1.20 M	1.20 J	1.20 J	M/A
AOI5-SU3-SA-REP1	FT	Lead	0.260	1.90 M	1.90 J	1.90 J	M/A
AOI5-SU3-SA-REP1	FT	Manganese	0.150	17.0 M	17.0	17.0 J	A/M
AOI5-SU3-SA-REP1	FT	Nickel	0.120	0.870 M	0.870	0.870 J	A/M

Modified Qualifiers for test method SW8330

FieldSample ID	Type	Analyte	LOQ	Lab Result	ADR Result	Modified Result	Reason
AOI2-SU1-SA-REP3	FT	Nitroguanidine	0.240	0.460 P	0.460	0.460 J	P1
AOI5-SU3-SA-REP3	FT	Nitroguanidine	0.250	0.210 JP	0.210 J	0.210 J	TR/P1

Modified Qualifiers for test method SW8330B

FieldSample ID	Type	Analyte	LOQ	Lab Result	ADR Result	Modified Result	Reason
AOI2-SU1-SA-REP2	FT	2,4,6-Trinitrotoluene	0.190	0.0970 U	0.0970 U	0.0970 UJ	I
AOI2-SU1-SA-REP2	FT	2,4-Dinitrotoluene	0.290	0.150 U	0.150 U	0.150 UJ	I
AOI2-SU1-SA-REP2	FT	2,6-Dinitrotoluene	0.290	0.150 U	0.150 U	0.150 UJ	I
AOI2-SU1-SA-REP2	FT	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.290	0.150 U	0.150 U	0.150 UJ	I
AOI2-SU1-SA-REP2	FT	Nitroglycerin	0.580	0.290 U	0.290 U	0.290 UJ	I
AOI2-SU1-SA-REP2	FT	Tetryl	0.290	0.150 UQ	0.150 UJ	0.150 UJ	C/I

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).
Trace values are not included in the qualified results table unless additional reason codes are associated.

Reason Code Definitions

Code	Definition
A	Serial dilution
C	LCS Recovery
D	MS RPD
I	Surrogate recovery outside project limits.
M	MS Recovery
P1	Column RPD
TR	Trace Level Detect

Flag Code and Definitions

Flag	Definition
U	Undetected: The analyte was analyzed for, but not detected.
UJ	The analyte was not detected; however, the result is estimated due to discrepancies in meeting certain analyte-specific quality control criteria.
J	Estimated: The analyte was positively identified, the quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
R	The data are rejected due to deficiencies in meeting QC criteria and may not be used for decision making.
B	Blank contamination: The analyte was found in an associated blank above one half the RL, as well as in the sample.
UB	The analyte was also detected in an associated laboratory or field blank at a concentration comparable to the concentration in the sample. The reported result has been requalified as not detected.

Review Questions

Method: SW6010C (Trace Metals by Inductively Coupled Plasma/Atomic Emission Spectrometry)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was the Calibration within acceptance criteria?	•			
Were the required minimum levels of calibration standards used in the initial calibration?	•			
Was either analysis of an ICV performed after each ICAL or a second source standard prior to sample analysis?	•			
Were all reported analytes for the ICV within the required criteria?	•			
Were CCVs run at the required frequency and within acceptance criteria?	•			
Was a method blank prepared and analyzed with each batch?	•			
Were target analytes in the method blank less than MDL?	•			
Were target analytes in the field blank less than MDL?			•	
Was an LCS/LCSD pair prepared and analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?	•			
Was the LCS/LCSD RPD within project acceptance limits?			•	
Was a MS/MSD pair prepared with each batch?	•			
Were MS/MSD recoveries within project acceptance limits?		•		Low recoveries were reported for antimony in the MS and MSD (52% and 51%) and for copper in the MS (80%) of sample AOI2-SU2-SA-REP1; all other recoveries reported for the MS/MSD analyses of sample AOI2-SU2-SA-REP1 and all %RPDs were within control limits. The laboratory also reported low recoveries of antimony in the MS analyses of sample AOI5-SU3-SA-REP1 (70% and 67%) and of copper, lead, and zinc in the MSD (analyzed twice, in association with two analytical runs). The results for these metals in the parent samples were classified as less than fully quantitative and coded with “J” validation qualifiers (all were detections).
Was the MS/MSD RPD within project acceptance limits?		•		The results for antimony and zinc reported for parent sample AOI5-SU3-SA-REP1 also were qualified due to elevated MS/MSD %RPDs.
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?			•	Field triplicates were collected. These results are evaluated outside of the scope of this validation process.
Were QAPP specified laboratory PQLs achieved?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			
Were DoD QSM corrective actions followed if deviations were noted?	•			
Were any data rejected during the verification process?		•		

Review Questions

Method: SW8330 (Nitroaromatics and Nitramines by HPLC)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was a blank prepared and analyzed with each batch?	•			
Were target analytes in the blank less than MDL?	•			
Were target analytes in the field blank less than MDL?			•	
Was an LCS or LCS/LCSD pair analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?	•			
Was the LCS/LCSD RPD within project acceptance limits?			•	
Was a project specific MS or MS/MSD pair prepared with each batch?	•			
Were MS/MSD recoveries within project acceptance limits?	•			
Was the MS/MSD RPD within project acceptance limits?	•			
Was a project-specific duplicate analyzed, and the RPD within QAPP acceptance limits?		•		
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?			•	Evaluated outside of the scope of this validation process.
Were QAPP specified laboratory reporting limits achieved?	•			
Were surrogate recoveries within project acceptance limits?	•			
Were column comparison differences with project acceptance limits?		•		Nitroguanidine was detected in two of the twelve ISM samples, with the results produced by the primary and confirmation analyses differing by more than 40% in both instances (i.e., %RPD >40%). The laboratory attributed the discrepancies to interferences occurring in the confirmation analyses. The detections of nitroguanidine reported for these two samples were classified as less than fully quantitative and coded with “J” validation qualifiers with reason codes of “P1”.
Was the intial calibration within criteria?	•			
Was a second source check standard analyzed and within all applicable criteria?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			

Automated Data Review Report Summary for 135478EDD

Review Questions

Method: SW8330B (Nitroaromatics and Nitramines by HPLC)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was a blank prepared and analyzed with each batch?	•			
Were target analytes in the blank less than MDL?	•			
Were target analytes in the field blank less than MDL?			•	
Was an LCS or LCS/LCSD pair analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?		•		
Was the LCS/LCSD RPD within project acceptance limits?			•	
Was a project specific MS or MS/MSD pair prepared with each batch?	•			
Were MS/MSD recoveries within project acceptance limits?	•			
Was the MS/MSD RPD within project acceptance limits?	•			
Was a project-specific duplicate analyzed, and the RPD within QAPP acceptance limits?		•		
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?			•	Evaluation of field triplicates is performed by the project team, outside of the scope of this validation effort.
Were QAPP specified laboratory reporting limits achieved?	•			
Were surrogate recoveries within project acceptance limits?		•		Slightly high in two instances, but no target explosives were detected in any of the project samples.
Were column comparison differences with project acceptance limits?	•			
Was the intial calibration within criteria?	•			
Was a second source check standard analyzed and within all applicable criteria?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			

Summary of Qualified Data

SDG	Client Sample ID	Lab Sample ID	SACODE	LOGDATE	Test Method	EXMCODE	MATRIX	Analyte Name	PARLABEL	CAS	DB Result	UNITS	DB Reporting Limit	Limit Of Detection	Display Result	Qualifier*	Reason Code
135478EDD	AOI2-SU1-SA-REP1	107797	FT	4/18/2018 8:45:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135478EDD	AOI2-SU1-SA-REP2	107799	FT	4/18/2018 8:45:00 AM	SW8330B	METHOD	SO	2,4,6-Trinitrotoluene	TNT	118-96-7	0	mg/kg	0.19	0.097	0.0970	UJ	I
135478EDD	AOI2-SU1-SA-REP2	107799	FT	4/18/2018 8:45:00 AM	SW8330B	METHOD	SO	2,4-Dinitrotoluene	DNT24	121-14-2	0	mg/kg	0.29	0.15	0.150	UJ	I
135478EDD	AOI2-SU1-SA-REP2	107799	FT	4/18/2018 8:45:00 AM	SW8330B	METHOD	SO	2,6-Dinitrotoluene	DNT26	606-20-2	0	mg/kg	0.29	0.15	0.150	UJ	I
135478EDD	AOI2-SU1-SA-REP2	107799	FT	4/18/2018 8:45:00 AM	SW8330B	METHOD	SO	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	RDX	121-82-4	0	mg/kg	0.29	0.15	0.150	UJ	I
135478EDD	AOI2-SU1-SA-REP2	107799	FT	4/18/2018 8:45:00 AM	SW8330B	METHOD	SO	Nitroglycerin	NTG	55-63-0	0	mg/kg	0.58	0.29	0.290	UJ	I
135478EDD	AOI2-SU1-SA-REP2	107799	FT	4/18/2018 8:45:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.29	0.15	0.150	UJ	C/I
135478EDD	AOI2-SU1-SA-REP3	107801	FT	4/18/2018 8:45:00 AM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.46	mg/kg	0.24	0.12	0.460	J	P1
135478EDD	AOI2-SU1-SA-REP3	107801	FT	4/18/2018 8:45:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135478EDD	AOI2-SU2-SA-REP1	107791	FT	4/18/2018 10:00:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.23	mg/kg	0.81	0.4	0.230	J	M/TR
135478EDD	AOI2-SU2-SA-REP1	107791	FT	4/18/2018 10:00:00 AM	SW6010C	SW3050	SO	Copper	CU	7440-50-8	1.9	mg/kg	0.4	0.2	1.90	J	M/A
135478EDD	AOI2-SU2-SA-REP1	107791	FT	4/18/2018 10:00:00 AM	SW6010C	SW3050	SO	Lead	PB	7439-92-1	2.9	mg/kg	0.25	0.13	2.90	J	A/M
135478EDD	AOI2-SU2-SA-REP1	107792	FT	4/18/2018 10:00:00 AM	SW6010C	SW3050	SO	Manganese	MN	7439-96-5	17.5	mg/kg	0.15	0.074	17.5	J	A/M
135478EDD	AOI2-SU2-SA-REP1	107792	FT	4/18/2018 10:00:00 AM	SW6010C	SW3050	SO	Nickel	NI	7440-02-0	1.2	mg/kg	0.12	0.06	1.20	J	A/M
135478EDD	AOI2-SU2-SA-REP1	107791	FT	4/18/2018 10:00:00 AM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	6.4	mg/kg	0.3	0.15	6.40	J	A/M
135478EDD	AOI2-SU2-SA-REP1	107791	FT	4/18/2018 10:00:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135478EDD	AOI2-SU2-SA-REP2	107793	FT	4/18/2018 10:00:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.25	mg/kg	0.81	0.41	0.250	J	M/TR
135478EDD	AOI2-SU2-SA-REP2	107793	FT	4/18/2018 10:00:00 AM	SW6010C	SW3050	SO	Copper	CU	7440-50-8	1.8	mg/kg	0.41	0.2	1.80	J	M
135478EDD	AOI2-SU2-SA-REP2	107793	FT	4/18/2018 10:00:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135478EDD	AOI2-SU2-SA-REP3	107795	FT	4/18/2018 10:00:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.16	mg/kg	0.79	0.4	0.160	J	M/TR
135478EDD	AOI2-SU2-SA-REP3	107795	FT	4/18/2018 10:00:00 AM	SW6010C	SW3050	SO	Copper	CU	7440-50-8	2.1	mg/kg	0.4	0.2	2.10	J	M
135478EDD	AOI2-SU2-SA-REP3	107795	FT	4/18/2018 10:00:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135478EDD	AOI2-SU3-SA-REP1	107785	FT	4/18/2018 11:00:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.15	mg/kg	0.78	0.39	0.150	J	TR
135478EDD	AOI2-SU3-SA-REP1	107785	FT	4/18/2018 11:00:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135478EDD	AOI2-SU3-SA-REP2	107787	FT	4/18/2018 11:00:00 AM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.27	mg/kg	0.77	0.39	0.270	J	TR
135478EDD	AOI2-SU3-SA-REP2	107787	FT	4/18/2018 11:00:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135478EDD	AOI2-SU3-SA-REP3	107789	FT	4/18/2018 11:00:00 AM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135478EDD	AOI5-SU3-SA-REP1	107803	FT	4/18/2018 12:30:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.14	mg/kg	0.83	0.42	0.140	J	M/D/TR
135478EDD	AOI5-SU3-SA-REP1	107803	FT	4/18/2018 12:30:00 PM	SW6010C	SW3050	SO	Copper	CU	7440-50-8	1.2	mg/kg	0.42	0.21	1.20	J	M/A
135478EDD	AOI5-SU3-SA-REP1	107803	FT	4/18/2018 12:30:00 PM	SW6010C	SW3050	SO	Lead	PB	7439-92-1	1.9	mg/kg	0.26	0.13	1.90	J	M/A
135478EDD	AOI5-SU3-SA-REP1	107804	FT	4/18/2018 12:30:00 PM	SW6010C	SW3050	SO	Manganese	MN	7439-96-5	17	mg/kg	0.15	0.076	17.0	J	A/M
135478EDD	AOI5-SU3-SA-REP1	107804	FT	4/18/2018 12:30:00 PM	SW6010C	SW3050	SO	Nickel	NI	7440-02-0	0.87	mg/kg	0.12	0.061	0.870	J	A/M
135478EDD	AOI5-SU3-SA-REP1	107803	FT	4/18/2018 12:30:00 PM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	5.6	mg/kg	0.31	0.16	5.60	J	M
135478EDD	AOI5-SU3-SA-REP1	107803	FT	4/18/2018 12:30:00 PM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135478EDD	AOI5-SU3-SA-REP2	107805	FT	4/18/2018 12:30:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.23	mg/kg	0.83	0.42	0.230	J	M/D/TR
135478EDD	AOI5-SU3-SA-REP2	107805	FT	4/18/2018 12:30:00 PM	SW6010C	SW3050	SO	Copper	CU	7440-50-8	1.2	mg/kg	0.42	0.21	1.20	J	M
135478EDD	AOI5-SU3-SA-REP2	107805	FT	4/18/2018 12:30:00 PM	SW6010C	SW3050	SO	Lead	PB	7439-92-1	1.7	mg/kg	0.26	0.13	1.70	J	M
135478EDD	AOI5-SU3-SA-REP2	107805	FT	4/18/2018 12:30:00 PM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	7.9	mg/kg	0.31	0.16	7.90	J	M
135478EDD	AOI5-SU3-SA-REP2	107805	FT	4/18/2018 12:30:00 PM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135478EDD	AOI5-SU3-SA-REP3	107807	FT	4/18/2018 12:30:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.17	mg/kg	0.84	0.42	0.170	J	M/D/TR
135478EDD	AOI5-SU3-SA-REP3	107807	FT	4/18/2018 12:30:00 PM	SW6010C	SW3050	SO	Copper	CU	7440-50-8	1.6	mg/kg	0.42	0.21	1.60	J	M
135478EDD	AOI5-SU3-SA-REP3	107807	FT	4/18/2018 12:30:00 PM	SW6010C	SW3050	SO	Lead	PB	7439-92-1	2.1	mg/kg	0.26	0.13	2.10	J	M
135478EDD	AOI5-SU3-SA-REP3	107807	FT	4/18/2018 12:30:00 PM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	3.2	mg/kg	0.32	0.16	3.20	J	M
135478EDD	AOI5-SU3-SA-REP3	107807	FT	4/18/2018 12:30:00 PM	SW8330	METHOD	SO	Nitroguanidine	NO2GUAN	556-88-7	0.21	mg/kg	0.25	0.12	0.210	J	TR/P1
135478EDD	AOI5-SU3-SA-REP3	107807	FT	4/18/2018 12:30:00 PM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.29	0.15	0.150	UJ	C

*Includes detections that are less than the limits of quantitation (LOQs) but otherwise unqualified as a result of the validation (i.e., validation qualifiers of "J" with reason code "TR" only).

Automated Data Review Report Summary for 135509EDD

Facility:	D01MA0033-04, CP Wellfleet - Art, Sm Arms, Rocket
Event:	Phase I Sampling 2018
SDG:	135509EDD
Guidance Document:	Camp Wellfleet - Art, Sm Arms, Rocket
Prime Contractor:	ERT, Inc., Laurel, MD
Project Manager:	Tom Bachovchin
Contract Laboratory:	CT Laboratories LLC, Baraboo, WI
Data Review Contractor:	HSW Engineering, Inc.
Data Review Level:	Stage 2B Review
Primary Data Reviewer:	Cindy Westergard, Senior Scientist
Second Reviewer:	Nigel Lewis, Project Scientist
Date Submitted:	July 12, 2018

Field Sample ID	Lab Sample ID	Matrix	Type/Type Code	SW6010C	SW8330	SW8330B
AOI5-SU3-SB-REP1	108379	Solid	Field Triplicate/FT	X	X	X
AOI5-SU3-SB-REP1	108380	Solid	Field Triplicate/FT	X		
AOI5-SU3-SB-REP2	108381	Solid	Field Triplicate/FT	X	X	X
AOI5-SU3-SB-REP2	108382	Solid	Field Triplicate/FT	X		
AOI5-SU3-SB-REP3	108383	Solid	Field Triplicate/FT	X	X	X
AOI5-SU3-SB-REP3	108385	Solid	Field Triplicate/FT	X		

This report assesses the analytical data quality associated with the analyses listed on the preceding cover page. This assessment has been made through a combination of automated data review (ADR) and supplemental manual review, the details of which are described below. The approach taken in the review of this data set is consistent with the requirements contained in the Camp Wellfleet - Art, Sm Arms, Rocket and the additional guidance documents incorporated by reference to the extent possible. Where definitive guidance is not provided, results have been evaluated in a conservative manner using professional judgment.

Sample collection was managed and directed by ERT, Inc., Laurel, MD; analyses were performed by CT Laboratories LLC, Baraboo, WI and were reported under sample delivery group (SDG) 135509EDD. Data have been evaluated electronically based on electronic data deliverables (EDDs) provided by the laboratory, and hard copy data summary forms have also been reviewed during this effort and compared to the automated review output by the reviewers whose signatures appear on the following page. Findings based on the automated data submission and manual data verification processes are detailed in the ADR narrative and throughout this report.

All quality control (QC) elements associated with this SDG have been reviewed by a project chemist in accordance with the requirements defined for the project. This review is documented in the attached Data Review Checklists. The QC elements listed below were supported by the electronic deliverable and were evaluated using ADR processes.

- Blank
- Blank - Negative
- LCS Recovery
- MS Recovery
- MS RPD
- Prep Hold Time
- Surrogate
- Test Hold Time

Results of the ADR process were subsequently reviewed and updated as applicable by the data review chemists identified on the signature page. Quality control elements that were not included in the electronic deliverable were reviewed manually and findings are documented within this report. Summaries of findings and associated qualified results are documented throughout this report.

A total of 21 results (53.85%) out of the 39 results (sample and field QC samples) reported are qualified based on review and 0 results (0.00%) have been rejected. Trace values, defined as results that are qualified as estimated because they fall between the detection limit and the reporting limit/limit of quantitation, are not counted as qualified results in the above count. The qualified results are detailed throughout this report and discussed in the narrative below, where appropriate.

Narrative Comments

Three ISM samples were received by CT Laboratories, Baraboo, Wisconsin, and analyzed for a select list of explosives and metals (one liquid investigation-derived waste (IDW) sample was received, along with a trip blank; however, these two samples did not require validation). The ISM samples were received intact and at a temperature within method specified acceptance limits. The samples were dried, sieved, subsampled, and ground following the homogenization procedure specified for the project. The analyses were performed in accordance with requirements given in DOD QSM 5. The qualifiers used by the laboratory are defined in the laboratory report.

The ISM samples were collected as three field replicates (i.e., triplicates) from a single sampling location and identified with suffixes of -REP1, -REP2, and -REP3. As replicate samples are an intrinsic part of the ISM process and this project, the extent of variability among triplicate results will be evaluated by the project team. Triplicate results were reviewed by the validator to confirm the overall reasonableness of the results, with no issues of concern noted.

Analytical Method	Data Reviewer Comment
SW6010C	The dried/sieved fraction of each ISM sample was subsampled for nickel and manganese prior to the sample undergoing grinding via the puck mill, to avoid potential contamination of the samples with these metals from the puck mill. Analyses for antimony, copper, lead, and zinc were performed with the fully-homogenized, puck-milled fractions. The ISM samples were prepared and analyzed as part of two preparation batches and two analytical runs (batch #66570 / run #148424 and batch #66544 / run #148368). Low levels of manganese (0.052 mg/Kg) and nickel (0.045 mg/Kg) were detected in the method blank. The detections of these analytes in the three ISM samples exceeded the artifact threshold values such that no qualification of the results was necessary. The laboratory performed MS/MSD, serial dilution (SD), and post-digestion spike (PDS) analyses with additional volumes of sample AOI5-SU3-SB-REP1. Low recoveries were reported for antimony and manganese in the analysis of the MS and MSD (60%/66% and 80%/78%, respectively) and for copper (71%), lead (80%), and zinc (74%) in the MS; all other recoveries reported for the MS/MSD analyses and all %RPDs were within control limits. The results for these metals in the parent sample were classified as less than fully quantitative and coded with validation qualifiers of “UJ” (antimony only) or “J” (all others). The automated data review (ADR) module of FUDSchem also extended qualification to the corresponding replicate results, based on the MS/MSD recoveries. All results reported for the SD were indicated either to have been invalid or to have failed. Low PDS recoveries were reported for manganese, copper, lead, and zinc in the PDS analysis. These low PDS recoveries were used as additional reasons for the application of "J" validation qualifiers to the parent samples. The list of reason codes for data qualification for this project does not include a distinct code for indicating when PDS recoveries are not within control limits. Therefore, when the serial dilution (SD) result for a given metal was invalid or not within control limits and the subsequent PDS recovery also was not within control limits, the sample result was qualified with a validation qualifier of "J" (detections) or "UJ" (non-detections) with reason codes of "A/M" ("A" signifying an invalid or failed SD analysis and "M" indicating a spike recovery that was not within limits -- in this case, a PDS). If the MS and/or MSD recovery was not within control limits and the SD + PDS results also were not within control limits, the data were qualified with "J" or "UJ" with reason codes of "M/A" (rather than “M/A/M”, as the FUDSchem system will not allow a reason code to be entered twice). The laboratory performed duplicate analyses of sample AOI5-SU3-SB-REP1 for manganese and nickel and triplicate analyses of this sample for antimony, copper, lead, and zinc. With the exception of zinc, all results met project acceptance limits for cumulative precision. The detection of zinc reported for sample AOI5-SU3-SB-REP1 (5.3 mg/Kg), previously qualified due to MS and PDS recoveries, was additionally qualified due to the diminished cumulative precision evidenced by the laboratory triplicate analyses (i.e., reason code "D1" included).
SW8330	No quality issues requiring qualification of sample data for nitroguanidine were noted. The analyte was not detected in any of the three ISM samples.
SW8330B	The laboratory control sample (LCS) yielded a low recovery of tetryl (35% vs. an acceptance range of 68-135%). This analyte is known to be problematic as it decomposes upon exposure to heat, light, and moisture. The findings of non-detect reported for tetryl for all three ISM samples were classified as less than fully quantitative, based on the LCS recovery, and coded with “UJ” validation qualifiers with reason code “C”. No other quality issues warranting additional qualification of the sample data for explosives by Method 8330B (all findings of non-detect) were noted.

July 11, 2018

Reviewed by Cindy Westergard, Senior Scientist, HSW Engineering, Inc.

As the First Reviewer, I certify that I have performed a data review process in accordance with the requirements of the project guidance document, and have compared the electronic data to the laboratory's hard copy report and have verified the consistency of a minimum of 10% of the reported sample results and method quality control data between the two deliverables.

July 11, 2018

Reviewed by Nigel Lewis, Project Scientist, HSW Engineering, Inc.

As the Second Reviewer, I certify that I have performed a quality assurance review of the report generated by the First Reviewer.

HSW Engineering, Inc.

Quality Control Outliers for test method SW6010C, Blank

The purpose of laboratory blanks is to determine the existence and magnitude of cross-contamination problems resulting from laboratory activities. Reported results were evaluated to determine compliance with the required acceptance criteria. Summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and contaminants found in laboratory blanks are listed below along with any associated qualified results.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
109155 (LB)/ 109155	Nickel	0.04500	< 0.021	< 0.12	mg/kg	U/None	L	
109155 (LB)/ 109155	Manganese	0.05200	< 0.025	< 0.15	mg/kg	U/None	L	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

No results associated with this QC element required qualification.

Quality Control Outliers for test method SW6010C, MS Recovery

Data for matrix spikes/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate acceptable compound recovery by the laboratory at the time of sample analysis. These data alone cannot be used to evaluate the precision and accuracy of individual samples. However, when exercising professional judgment, MS/MSD data can be used in conjunction with other available QC information. Reported results were evaluated to determine compliance with the required acceptance criteria, and summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and any associated qualified results, are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
AOI5-SU3-SB-REP1 (MS)/ 109153	Manganese	79.51	84 - 114	30 - 125	percent	J/UJ	M	
AOI5-SU3-SB-REP1 (SD)/ 109154	Manganese	77.96	84 - 114	30 - 125	percent	J/UJ	M	
AOI5-SU3-SB-REP1 (MS)/ 109713	Antimony	59.51	79 - 114	30 - 125	percent	J/UJ	M	
AOI5-SU3-SB-REP1 (MS)/ 109713	Copper	70.97	81 - 117	30 - 117	percent	J/UJ	M	
AOI5-SU3-SB-REP1 (MS)/ 109713	Zinc	73.68	82 - 113	30 - 125	percent	J/UJ	M	
AOI5-SU3-SB-REP1 (MS)/ 109713	Lead	80.16	81 - 112	30 - 125	percent	J/UJ	M	
AOI5-SU3-SB-REP1 (SD)/ 109714	Antimony	66.40	79 - 114	30 - 125	percent	J/UJ	M	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

Qualified Results associated with the MS Recovery for SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI5-SU3-SB-REP1	FT	Manganese	0.150	18.1 M	18.1 J	-	mg/kg	M/A
AOI5-SU3-SB-REP1	FT	Antimony	0.790	0.390 U	0.390 UJ	-	mg/kg	M
AOI5-SU3-SB-REP1	FT	Copper	0.390	5.90 M	5.90 J	-	mg/kg	M/A
AOI5-SU3-SB-REP1	FT	Lead	0.250	2.30 M	2.30 J	-	mg/kg	M/A
AOI5-SU3-SB-REP1	FT	Zinc	0.300	5.30 Y,M	5.30 J		mg/kg	M/A/D1
AOI5-SU3-SB-REP2	FT	Manganese	0.150	17.7	17.7 J	-	mg/kg	M
AOI5-SU3-SB-REP2	FT	Antimony	0.820	0.140 J	0.140 J	-	mg/kg	M/TR
AOI5-SU3-SB-REP2	FT	Copper	0.410	3.90	3.90 J	-	mg/kg	M
AOI5-SU3-SB-REP2	FT	Lead	0.260	2.40	2.40 J	-	mg/kg	M
AOI5-SU3-SB-REP2	FT	Zinc	0.310	5.20	5.20 J	-	mg/kg	M
AOI5-SU3-SB-REP3	FT	Manganese	0.150	15.1	15.1 J	-	mg/kg	M
AOI5-SU3-SB-REP3	FT	Antimony	0.790	0.400 U	0.400 UJ	-	mg/kg	M
AOI5-SU3-SB-REP3	FT	Copper	0.400	3.60	3.60 J	-	mg/kg	M
AOI5-SU3-SB-REP3	FT	Lead	0.250	2.40	2.40 J	-	mg/kg	M
AOI5-SU3-SB-REP3	FT	Zinc	0.300	5.80	5.80 J	-	mg/kg	M

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).

Quality Control Outliers for test method SW8330B, LCS Recovery

The laboratory control sample/laboratory control sample duplicate (LCS/LCSD) serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. Reported results were evaluated to determine compliance with the required acceptance criteria, and summary forms were evaluated and compared to electronic data deliverables. Findings of this review, and any associated qualified results, are listed below.

Sample ID/ Lab Sample ID	Analyte	Result	Warning Limits	Control Limits	Units	Qualifier	Reason Code	Comment
109294 (BS)/ 109294	Tetryl	34.72	68 - 135	20 - 135	percent	J/UJ	C	
109294 (BS)/ 109294	2,4,6-Trinitrotoluene	70.83	71 - 120	20 - 120	percent	J/UJ	C	

Where two qualifiers are listed, such as 'J/UJ', the first applies to positive results, and the second to non-detect results.
Upper and Lower Warning and Control Limits are abbreviated UWL, LWL, UCL, and LCL in the Comment field.

Qualified Results associated with the LCS Recovery for SW8330B

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI5-SU3-SB-REP1	FT	2,4,6-Trinitrotoluene	0.200	0.100 U	0.100 UJ	-	mg/kg	C
AOI5-SU3-SB-REP1	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI5-SU3-SB-REP2	FT	2,4,6-Trinitrotoluene	0.200	0.100 U	0.100 UJ	-	mg/kg	C
AOI5-SU3-SB-REP2	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI5-SU3-SB-REP3	FT	2,4,6-Trinitrotoluene	0.200	0.100 U	0.100 UJ	-	mg/kg	C
AOI5-SU3-SB-REP3	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).

Engineering, Inc.

Table of All Qualified Results

Test Method: SW6010C Extraction Method: SW3050

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI5-SU3-SB-REP1	FT	Manganese	0.150	18.1 M	18.1 J	-	mg/kg	M/A
AOI5-SU3-SB-REP1	FT	Antimony	0.790	0.390 U	0.390 UJ	-	mg/kg	M
AOI5-SU3-SB-REP1	FT	Copper	0.390	5.90 M	5.90 J	-	mg/kg	M/A
AOI5-SU3-SB-REP1	FT	Lead	0.250	2.30 M	2.30 J	-	mg/kg	M/A
AOI5-SU3-SB-REP1	FT	Zinc	0.300	5.30 Y,M	5.30 J		mg/kg	M/A/D1
AOI5-SU3-SB-REP2	FT	Manganese	0.150	17.7	17.7 J	-	mg/kg	M
AOI5-SU3-SB-REP2	FT	Antimony	0.820	0.140 J	0.140 J	-	mg/kg	M/TR
AOI5-SU3-SB-REP2	FT	Copper	0.410	3.90	3.90 J	-	mg/kg	M
AOI5-SU3-SB-REP2	FT	Lead	0.260	2.40	2.40 J	-	mg/kg	M
AOI5-SU3-SB-REP2	FT	Zinc	0.310	5.20	5.20 J	-	mg/kg	M
AOI5-SU3-SB-REP3	FT	Manganese	0.150	15.1	15.1 J	-	mg/kg	M
AOI5-SU3-SB-REP3	FT	Antimony	0.790	0.400 U	0.400 UJ	-	mg/kg	M
AOI5-SU3-SB-REP3	FT	Copper	0.400	3.60	3.60 J	-	mg/kg	M
AOI5-SU3-SB-REP3	FT	Lead	0.250	2.40	2.40 J	-	mg/kg	M
AOI5-SU3-SB-REP3	FT	Zinc	0.300	5.80	5.80 J	-	mg/kg	M

Test Method: SW8330B Extraction Method: METHOD

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI5-SU3-SB-REP1	FT	2,4,6-Trinitrotoluene	0.200	0.100 U	0.100 UJ	-	mg/kg	C
AOI5-SU3-SB-REP1	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI5-SU3-SB-REP2	FT	2,4,6-Trinitrotoluene	0.200	0.100 U	0.100 UJ	-	mg/kg	C
AOI5-SU3-SB-REP2	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C
AOI5-SU3-SB-REP3	FT	2,4,6-Trinitrotoluene	0.200	0.100 U	0.100 UJ	-	mg/kg	C
AOI5-SU3-SB-REP3	FT	Tetryl	0.300	0.150 UQ	0.150 UJ	-	mg/kg	C

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).
Trace values are not included in the qualified results table unless additional reason codes are associated.

Automated Data Review Report Summary for 135509EDD

Table of All Trace Results

Test Method: SW6010C   Extraction Method: SW3050

FieldSample ID	Type	Analyte	LOQ	Lab Result	Qualified Result	Bias	Units	Reason
AOI5-SU3-SB-REP2	FT	Antimony	0.820	0.140 J	0.140 J	-	mg/kg	M/TR

Automated Data Review Report Summary for 135509EDD

Table of Results with Modified Qualifiers

Modified Qualifiers for test method SW6010C

FieldSample ID	Type	Analyte	LOQ	Lab Result	ADR Result	Modified Result	Reason
AOI5-SU3-SB-REP1	FT	Copper	0.390	5.90 M	5.90 J	5.90 J	M/A
AOI5-SU3-SB-REP1	FT	Lead	0.250	2.30 M	2.30 J	2.30 J	M/A
AOI5-SU3-SB-REP1	FT	Zinc	0.300	5.30 Y,M	5.30 J	5.30 J	M/A/D1
AOI5-SU3-SB-REP1	FT	Manganese	0.150	18.1 M	18.1 J	18.1 J	M/A

Analytes not found in project samples are reported as not detected at the limit of detection (LOD).
Trace values are not included in the qualified results table unless additional reason codes are associated.

Reason Code Definitions

Code	Definition
A	Serial dilution
C	LCS Recovery
D1	Lab Replicate RPD
L	Lab Blank
M	MS Recovery
TR	Trace Level Detect

Flag Code and Definitions

Flag	Definition
U	Undetected: The analyte was analyzed for, but not detected.
UJ	The analyte was not detected; however, the result is estimated due to discrepancies in meeting certain analyte-specific quality control criteria.
J	Estimated: The analyte was positively identified, the quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
R	The data are rejected due to deficiencies in meeting QC criteria and may not be used for decision making.
B	Blank contamination: The analyte was found in an associated blank above one half the RL, as well as in the sample.
UB	The analyte was also detected in an associated laboratory or field blank at a concentration comparable to the concentration in the sample. The reported result has been requalified as not detected.

Review Questions

Method: SW6010C (Trace Metals by Inductively Coupled Plasma/Atomic Emission Spectrometry)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was the Calibration within acceptance criteria?	•			
Were the required minimum levels of calibration standards used in the initial calibration?	•			
Was either analysis of an ICV performed after each ICAL or a second source standard prior to sample analysis?	•			
Were all reported analytes for the ICV within the required criteria?	•			
Were CCVs run at the required frequency and within acceptance criteria?	•			
Was a method blank prepared and analyzed with each batch?	•			
Were target analytes in the method blank less than MDL?		•		Low levels of manganese (0.052 mg/Kg) and nickel (0.045 mg/Kg) were detected in the method blank. The detections of these analytes in the three ISM samples exceeded the artifact threshold values such that no qualification of the results was necessary.
Were target analytes in the field blank less than MDL?			•	
Was an LCS/LCSD pair prepared and analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?	•			
Was the LCS/LCSD RPD within project acceptance limits?		•		An LCSD was not required or reported.
Was a MS/MSD pair prepared with each batch?	•			
Were MS/MSD recoveries within project acceptance limits?		•		Manganese, zinc and lead were recovered below the acceptance criteria. Detected results in the parent sample (AOI5-SU3-SB-REP1) were coded with a "J" qualifier.
Was the MS/MSD RPD within project acceptance limits?	•			
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?		•		
Were QAPP specified laboratory PQLs achieved?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			
Were DoD QSM corrective actions followed if deviations were noted?	•			
Were any data rejected during the verification process?		•		

Review Questions

Method: SW8330 (Nitroaromatics and Nitramines by HPLC)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was a blank prepared and analyzed with each batch?	•			
Were target analytes in the blank less than MDL?	•			
Were target analytes in the field blank less than MDL?			•	
Was an LCS or LCS/LCSD pair analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?	•			
Was the LCS/LCSD RPD within project acceptance limits?		•		
Was a project specific MS or MS/MSD pair prepared with each batch?	•			
Were MS/MSD recoveries within project acceptance limits?	•			
Was the MS/MSD RPD within project acceptance limits?	•			
Was a project-specific duplicate analyzed, and the RPD within QAPP acceptance limits?		•		
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?			•	Evaluated outside of the scope of this validation process.
Were QAPP specified laboratory reporting limits achieved?	•			
Were surrogate recoveries within project acceptance limits?	•			
Were column comparison differences with project acceptance limits?	•			No nitroguanidine was detected in any of the samples.
Was the intial calibration within criteria?	•			
Was a second source check standard analyzed and within all applicable criteria?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			

Review Questions

Method: SW8330B (Nitroaromatics and Nitramines by HPLC)				
Review Questions	Yes	No	NA	Comment
Did Chain-of-Custody information agree with laboratory report and EDD for requested field samples and tests?	•			
Were samples preserved properly and received in good condition?	•			
Were holding times met?	•			
Were all requested target analytes reported?	•			
Was a blank prepared and analyzed with each batch?	•			
Were target analytes in the blank less than MDL?	•			
Were target analytes in the field blank less than MDL?			•	
Was an LCS or LCS/LCSD pair analyzed with each batch?	•			
Were LCS/LCSD recoveries within project acceptance limits?		•		Tetryl was recovered below control limits in the LCS. The findings of non-detect reported for the samples for this analyte were classified as less than fully quantitative and coded with "UJ" validation qualifiers.
Was the LCS/LCSD RPD within project acceptance limits?			•	
Was a project specific MS or MS/MSD pair prepared with each batch?	•			
Were MS/MSD recoveries within project acceptance limits?	•			
Was the MS/MSD RPD within project acceptance limits?	•			
Was a project-specific duplicate analyzed, and the RPD within QAPP acceptance limits?		•		
If a field duplicate was analyzed, were the RPDs within QAPP acceptance limits?			•	Data for field triplicates is evaluated by the project team, outside of the scope of this validation effort.
Were QAPP specified laboratory reporting limits achieved?	•			
Were surrogate recoveries within project acceptance limits?	•			
Were column comparison differences with project acceptance limits?	•			No target explosives were detected in any of the samples.
Was the intial calibration within criteria?	•			
Was a second source check standard analyzed and within all applicable criteria?	•			
Have all Laboratory Case Narrative comments/findings been addressed in the data review process?	•			

Summary of Qualified Data

SDG	Client Sample ID	Lab Sample ID	SACODE	LOGDATE	Test Method	EXMCODE	MATRIX	Analyte Name	PARLABEL	CAS	DB Result	UNITS	DB Reporting Limit	Limit Of Detection	Display Result	Qualifier*	Reason Code
135509EDD	109155	109155	LB	4/24/2018 9:45:00 AM	SW6010C	SW3050	SQ	Manganese	MN	7439-96-5	0.052	mg/kg	0.15	0.025	0.0520	J	TR
135509EDD	109155	109155	LB	4/24/2018 9:45:00 AM	SW6010C	SW3050	SQ	Nickel	NI	7440-02-0	0.045	mg/kg	0.12	0.021	0.0450	J	TR
135509EDD	AOI5-SU3-SB-REP1	108379	FT	4/18/2018 2:40:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0	mg/kg	0.79	0.39	0.390	UJ	M
135509EDD	AOI5-SU3-SB-REP1	108379	FT	4/18/2018 2:40:00 PM	SW6010C	SW3050	SO	Copper	CU	7440-50-8	5.9	mg/kg	0.39	0.2	5.90	J	M/A
135509EDD	AOI5-SU3-SB-REP1	108379	FT	4/18/2018 2:40:00 PM	SW6010C	SW3050	SO	Lead	PB	7439-92-1	2.3	mg/kg	0.25	0.12	2.30	J	M/A
135509EDD	AOI5-SU3-SB-REP1	108380	FT	4/18/2018 2:40:00 PM	SW6010C	SW3050	SO	Manganese	MN	7439-96-5	18.1	mg/kg	0.15	0.073	18.1	J	M/A
135509EDD	AOI5-SU3-SB-REP1	108379	FT	4/18/2018 2:40:00 PM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	5.3	mg/kg	0.3	0.15	5.30	J	M/A/D1
135509EDD	AOI5-SU3-SB-REP1	108379	FT	4/18/2018 2:40:00 PM	SW8330B	METHOD	SO	2,4,6-Trinitrotoluene	TNT	118-96-7	0	mg/kg	0.2	0.1	0.100	UJ	C
135509EDD	AOI5-SU3-SB-REP1	108379	FT	4/18/2018 2:40:00 PM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135509EDD	AOI5-SU3-SB-REP2	108381	FT	4/18/2018 2:40:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0.14	mg/kg	0.82	0.41	0.140	J	M/TR
135509EDD	AOI5-SU3-SB-REP2	108381	FT	4/18/2018 2:40:00 PM	SW6010C	SW3050	SO	Copper	CU	7440-50-8	3.9	mg/kg	0.41	0.21	3.90	J	M
135509EDD	AOI5-SU3-SB-REP2	108381	FT	4/18/2018 2:40:00 PM	SW6010C	SW3050	SO	Lead	PB	7439-92-1	2.4	mg/kg	0.26	0.13	2.40	J	M
135509EDD	AOI5-SU3-SB-REP2	108382	FT	4/18/2018 2:40:00 PM	SW6010C	SW3050	SO	Manganese	MN	7439-96-5	17.7	mg/kg	0.15	0.077	17.7	J	M
135509EDD	AOI5-SU3-SB-REP2	108381	FT	4/18/2018 2:40:00 PM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	5.2	mg/kg	0.31	0.15	5.20	J	M
135509EDD	AOI5-SU3-SB-REP2	108381	FT	4/18/2018 2:40:00 PM	SW8330B	METHOD	SO	2,4,6-Trinitrotoluene	TNT	118-96-7	0	mg/kg	0.2	0.1	0.100	UJ	C
135509EDD	AOI5-SU3-SB-REP2	108381	FT	4/18/2018 2:40:00 PM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C
135509EDD	AOI5-SU3-SB-REP3	108383	FT	4/18/2018 2:40:00 PM	SW6010C	SW3050	SO	Antimony	SB	7440-36-0	0	mg/kg	0.79	0.4	0.400	UJ	M
135509EDD	AOI5-SU3-SB-REP3	108383	FT	4/18/2018 2:40:00 PM	SW6010C	SW3050	SO	Copper	CU	7440-50-8	3.6	mg/kg	0.4	0.2	3.60	J	M
135509EDD	AOI5-SU3-SB-REP3	108383	FT	4/18/2018 2:40:00 PM	SW6010C	SW3050	SO	Lead	PB	7439-92-1	2.4	mg/kg	0.25	0.12	2.40	J	M
135509EDD	AOI5-SU3-SB-REP3	108385	FT	4/18/2018 2:40:00 PM	SW6010C	SW3050	SO	Manganese	MN	7439-96-5	15.1	mg/kg	0.15	0.077	15.1	J	M
135509EDD	AOI5-SU3-SB-REP3	108383	FT	4/18/2018 2:40:00 PM	SW6010C	SW3050	SO	Zinc	ZN	7440-66-6	5.8	mg/kg	0.3	0.15	5.80	J	M
135509EDD	AOI5-SU3-SB-REP3	108383	FT	4/18/2018 2:40:00 PM	SW8330B	METHOD	SO	2,4,6-Trinitrotoluene	TNT	118-96-7	0	mg/kg	0.2	0.1	0.100	UJ	C
135509EDD	AOI5-SU3-SB-REP3	108383	FT	4/18/2018 2:40:00 PM	SW8330B	METHOD	SO	Tetryl	TETRYL	479-45-8	0	mg/kg	0.3	0.15	0.150	UJ	C

*Includes detections that are less than the limits of quantitation (LOQs) but otherwise unqualified as a result of the validation (i.e., validation qualifiers of "J" with reason code "TR" only).

APPENDIX D.3: DATA SUMMARY TABLES

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Appendix D, Table D-1a
Former Camp Wellfleet
IS Site Surface Soil Sampling Results

Method	Analyte Name	PSL	Eco-SSL	BTV	UNITS	AOI1-SU1-SA-REP1	AOI1-SU1-SA-REP2	AOI1-SU1-SA-REP3	AOI1-SU2-SA-REP1	AOI1-SU2-SA-REP2	AOI1-SU2-SA-REP3
SW6010C	Antimony	3.1	0.27	3.4	mg/kg	**0.170 J**	**0.130 J**	**0.190 J**	**0.160 J**	**0.150 J**	**0.140 J**
SW6010C	Copper	310	28	4.145	mg/kg	**3.00**	**6.00**	**8.40**	**1.60**	**3.10**	**2.50**
SW6010C	Lead	200	11	23.1	mg/kg	**6.50**	**9.00**	**10.7**	**5.00**	**6.00**	**8.30**
SW6010C	Manganese	180	220	109.8	mg/kg	**15.5**	**10.5**	**11.5**	**10.5**	**14.8**	**12.7**
SW6010C	Nickel	150	38	1.924	mg/kg	**0.890**	**0.680**	**0.940**	**0.620**	**0.640**	**0.680**
SW6010C	Zinc	1,000	46	7.69	mg/kg	**20.0**	**16.5**	**14.9**	**8.60**	**9.90**	**7.70**
SW8330	Nitroguanidine	630	NSL	NSL	mg/kg	**0.870 J**	**0.890 J**	**0.500 J**	0.120 U	0.120 U	**0.710 J**
SW8330B	2,4,6-Trinitrotoluene	3.6	NSL	NSL	mg/kg	0.0980 U	0.100 U	0.100 U	0.0980 U	0.0980 U	0.0990 U
SW8330B	2,4-Dinitrotoluene	0.7	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	2,6-Dinitrotoluene	0.36	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	Nitroglycerin	0.63	NSL	NSL	mg/kg	0.290 U	0.300 U	0.300 U	0.290 U	0.290 U	0.300 U
SW8330B	Tetryl	16	NSL	NSL	mg/kg	0.150 UJ	0.150 UJ	0.150 UJ	0.150 UJ	0.150 UJ	0.150 UJ

Qualifiers

J The reported result is an estimated value
U Not Detected (limit of detection [LOD] shown)
UJ Not Detected (LOD is estimated)

PSL Project Screening Level is the lowest value of the USEPA Regional Screening Level (RSL) for Residential Soil, or the S-1 & GW-1 Massachusetts Contingency Plan (MCP) Table 2
BTV Background Threshold Value
Eco-SSL USEPA Ecological Soil Screening Levels, "https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents", last accessed 25 September 2018
NSL No screening level identified
mg/kg milligrams per kilogram

Detected results are bolded.
PSL Exceedances of screening level are shaded.
Eco-SSL exceedances are underlined.
BTV exceedances are printed in blue font.

All samples were collected in April 2018.

Appendix D, Table D-1a
Former Camp Wellfleet
IS Site Surface Soil Sampling Results

Method	Analyte Name	PSL	Eco-SSL	BTV	UNITS	AOI1-SU3-SA-REP1	AOI1-SU3-SA-REP2	AOI1-SU3-SA-REP3	AOI2-SU1-SA-REP1	AOI2-SU1-SA-REP2	AOI2-SU1-SA-REP3
SW6010C	Antimony	3.1	0.27	3.4	mg/kg	0.400 U	**0.150 J**	**0.150 J**	0.390 U	0.390 U	0.400 U
SW6010C	Copper	310	28	4.145	mg/kg	**0.760**	**0.880**	**0.880**	**0.710**	**0.580**	**0.950**
SW6010C	Lead	200	11	23.1	mg/kg	**4.10**	**5.30**	**5.60**	**3.00**	**2.50**	**2.20**
SW6010C	Manganese	180	220	109.8	mg/kg	**13.3**	**13.4 J**	**13.1**	**9.20**	**8.90**	**9.60**
SW6010C	Nickel	150	38	1.924	mg/kg	**0.780**	**0.770 J**	**0.700**	**0.370**	**0.420**	**0.470**
SW6010C	Zinc	1,000	46	7.69	mg/kg	**7.50**	**7.70**	**7.70**	**1.90**	**1.70**	**1.50**
SW8330	Nitroguanidine	630	NSL	NSL	mg/kg	**0.690 J**	**0.550 J**	**0.630 J**	0.110 U	0.110 U	**0.460 J**
SW8330B	2,4,6-Trinitrotoluene	3.6	NSL	NSL	mg/kg	0.0980 U	0.0990 U	0.100 U	0.100 U	0.0970 UJ	0.100 U
SW8330B	2,4-Dinitrotoluene	0.7	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 UJ	0.150 U
SW8330B	2,6-Dinitrotoluene	0.36	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 UJ	0.150 U
SW8330B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 UJ	0.150 U
SW8330B	Nitroglycerin	0.63	NSL	NSL	mg/kg	0.290 U	0.300 U	0.300 U	0.300 U	0.290 UJ	0.300 U
SW8330B	Tetryl	16	NSL	NSL	mg/kg	0.150 UJ	0.150 UJ	0.150 UJ	0.150 UJ	0.150 UJ	0.150 UJ

Qualifiers

J	The reported result is an estimated value
U	Not Detected (limit of detection [LOD] shown)
UJ	Not Detected (LOD is estimated)
PSL	Project Screening Level is the lowest value of the USEPA Regional Screening Level (RSL) for Residential Soil, or the S-1 & GW-1 Massachusetts Contingency Plan (MCP) Table 2
BTV	Background Threshold Value
Eco-SSL	USEPA Ecological Soil Screening Levels, "https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents", last accessed 25 September 2018
NSL	No screening level identified
mg/kg	milligrams per kilogram

Detected results are bolded.
PSL Exceedances of screening level are shaded.
Eco-SSL exceedances are underlined.
BTV exceedances are printed in blue font.

All samples were collected in April 2018.

Appendix D, Table D-1a
Former Camp Wellfleet
IS Site Surface Soil Sampling Results

Method	Analyte Name	PSL	Eco-SSL	BTV	UNITS	AOI2-SU2-SA-REP1	AOI2-SU2-SA-REP2	AOI2-SU2-SA-REP3	AOI2-SU3-SA-REP1	AOI2-SU3-SA-REP2	AOI2-SU3-SA-REP3
SW6010C	Antimony	3.1	0.27	3.4	mg/kg	**0.230 J**	**0.250 J**	**0.160 J**	**0.150 J**	**0.270 J**	<u>0.410 U</u>
SW6010C	Copper	310	28	4.145	mg/kg	**1.90 J**	**1.80 J**	**2.10 J**	**1.20**	**2.50**	**1.50**
SW6010C	Lead	200	11	23.1	mg/kg	**2.90 J**	**3.60**	**3.40**	**3.10**	**5.80**	**3.80**
SW6010C	Manganese	180	220	109.8	mg/kg	**17.5 J**	**18.0**	**9.40**	**8.90**	**12.4**	**15.1**
SW6010C	Nickel	150	38	1.924	mg/kg	**1.20 J**	**1.30**	**0.450**	**0.740**	**0.990**	**0.900**
SW6010C	Zinc	1,000	46	7.69	mg/kg	**6.40 J**	**6.50**	**3.90**	**6.00**	**3.80**	**3.00**
SW8330	Nitroguanidine	630	NSL	NSL	mg/kg	0.120 U	0.120 U	0.120 U	0.120 U	0.110 U	0.120 U
SW8330B	2,4,6-Trinitrotoluene	3.6	NSL	NSL	mg/kg	0.0990 U	0.100 U	0.0990 U	0.100 U	0.0990 U	0.0990 U
SW8330B	2,4-Dinitrotoluene	0.7	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	2,6-Dinitrotoluene	0.36	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	Nitroglycerin	0.63	NSL	NSL	mg/kg	0.300 U	0.300 U	0.300 U	0.300 U	0.300 U	0.300 U
SW8330B	Tetryl	16	NSL	NSL	mg/kg	0.150 UJ	0.150 UJ	0.150 UJ	0.150 UJ	0.150 UJ	0.150 UJ

Qualifiers

J	The reported result is an estimated value
U	Not Detected (limit of detection [LOD] shown)
UJ	Not Detected (LOD is estimated)
PSL	Project Screening Level is the lowest value of the USEPA Regional Screening Level (RSL) for Residential Soil, or the S-1 & GW-1 Massachusetts Contingency Plan (MCP) Table 2
BTV	Background Threshold Value
Eco-SSL	USEPA Ecological Soil Screening Levels, "https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents", last accessed 25 September 2018
NSL	No screening level identified
mg/kg	milligrams per kilogram

Detected results are bolded.
PSL Exceedances of screening level are shaded.
<u>Eco-SSL exceedances are underlined.</u>
BTV exceedances are printed in blue font.

All samples were collected in April 2018.

Appendix D, Table D-1a
Former Camp Wellfleet
IS Site Surface Soil Sampling Results

Method	Analyte Name	PSL	Eco-SSL	BTV	UNITS	AOI3-SU1-SA-REP1	AOI3-SU1-SA-REP2	AOI3-SU1-SA-REP3	AOI3-SU2-SA-REP1	AOI3-SU2-SA-REP2	AOI3-SU2-SA-REP3
SW6010C	Antimony	3.1	0.27	3.4	mg/kg	**0.200 J**	**0.140 J**	**0.160 J**	**0.160 J**	**0.230 J**	**0.140 J**
SW6010C	Copper	310	28	4.145	mg/kg	**1.40**	**1.60**	**1.50**	**0.690**	**0.780**	**0.700**
SW6010C	Lead	200	11	23.1	mg/kg	**3.40**	**3.60**	**3.50**	**2.40 J**	**3.10**	**2.60**
SW6010C	Manganese	180	220	109.8	mg/kg	**20.3**	**28.2**	**21.7**	**10.1 J**	**10.4**	**11.7**
SW6010C	Nickel	150	38	1.924	mg/kg	**0.890**	**0.600**	**0.580**	**0.680**	**0.660**	**0.550**
SW6010C	Zinc	1,000	46	7.69	mg/kg	**14.0**	**15.7**	**14.9**	**4.90 J**	**4.90 J**	**2.00 J**
SW8330	Nitroguanidine	630	NSL	NSL	mg/kg	0.120 U	0.110 U	0.120 UJ	**0.540 J**	**0.810 J**	**0.580 J**
SW8330B	2,4,6-Trinitrotoluene	3.6	NSL	NSL	mg/kg	0.0980 U	0.0970 U	0.100 U	0.0980 U	0.0980 U	0.0990 J
SW8330B	2,4-Dinitrotoluene	0.7	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 J
SW8330B	2,6-Dinitrotoluene	0.36	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 J
SW8330B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 J
SW8330B	Nitroglycerin	0.63	NSL	NSL	mg/kg	0.290 U	0.290 U	0.300 U	0.290 U	0.300 U	0.300 J
SW8330B	Tetryl	16	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 J

Qualifiers
J The reported result is an estimated value
U Not Detected (limit of detection [LOD] shown)
UJ Not Detected (LOD is estimated)

PSL Project Screening Level is the lowest value of the USEPA Regional Screening Level (RSL) for Residential Soil, or the S-1 & GW-1 Massachusetts Contingency Plan (MCP) Table 2
BTV Background Threshold Value
Eco-SSL USEPA Ecological Soil Screening Levels, "https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents", last accessed 25 September 2018
NSL No screening level identified
mg/kg milligrams per kilogram

Detected results are bolded.
PSL Exceedances of screening level are shaded.
Eco-SSL exceedances are underlined.
BTV exceedances are printed in blue font.

All samples were collected in April 2018.

Appendix D, Table D-1a
Former Camp Wellfleet
IS Site Surface Soil Sampling Results

Method	Analyte Name	PSL	Eco-SSL	BTV	UNITS	AOI3-SU3-SA-REP1	AOI3-SU3-SA-REP2	AOI3-SU3-SA-REP3	AOI4-SU1-SA-REP1	AOI4-SU1-SA-REP2	AOI4-SU1-SA-REP3
SW6010C	Antimony	3.1	0.27	3.4	mg/kg	**0.220 J**	**0.200 J**	**0.230 J**	**0.170 J**	**0.220 J**	**0.210 J**
SW6010C	Copper	310	28	4.145	mg/kg	**1.50**	**1.50**	**1.60**	**0.840**	**1.50**	**0.980**
SW6010C	Lead	200	11	23.1	mg/kg	**3.00**	**3.00**	**3.00**	**3.00**	**2.60**	**3.10**
SW6010C	Manganese	180	220	109.8	mg/kg	**15.0**	**15.0**	**16.2**	**12.2**	**10.9**	**9.70**
SW6010C	Nickel	150	38	1.924	mg/kg	**0.860**	**0.390**	**0.500**	**1.00**	**0.930**	**0.870**
SW6010C	Zinc	1,000	46	7.69	mg/kg	**13.4**	**13.3**	**13.7**	**3.20**	**2.50**	**3.40**
SW8330	Nitroguanidine	630	NSL	NSL	mg/kg	0.110 U	0.110 UJ	0.120 UJ	**0.590 J**	**0.320 J**	**0.620 J**
SW8330B	2,4,6-Trinitrotoluene	3.6	NSL	NSL	mg/kg	0.0990 U	0.0970 U	0.0990 U	0.0970 U	0.0990 U	0.100 U
SW8330B	2,4-Dinitrotoluene	0.7	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	2,6-Dinitrotoluene	0.36	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	Nitroglycerin	0.63	NSL	NSL	mg/kg	0.300 U	0.290 U	0.300 U	0.290 U	0.300 U	0.300 U
SW8330B	Tetryl	16	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U

Qualifiers
J The reported result is an estimated value
U Not Detected (limit of detection [LOD] shown)
UJ Not Detected (LOD is estimated)

PSL Project Screening Level is the lowest value of the USEPA Regional Screening Level (RSL) for Residential Soil, or the S-1 & GW-1 Massachusetts Contingency Plan (MCP) Table 2
BTV Background Threshold Value
Eco-SSL USEPA Ecological Soil Screening Levels, "https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents", last accessed 25 September 2018
NSL No screening level identified
mg/kg milligrams per kilogram

Detected results are bolded.
PSL Exceedances of screening level are shaded.
Eco-SSL exceedances are underlined.
BTV exceedances are printed in blue font.

All samples were collected in April 2018.

Appendix D, Table D-1a
Former Camp Wellfleet
IS Site Surface Soil Sampling Results

Method	Analyte Name	PSL	Eco-SSL	BTV	UNITS	AOI4-SU2-SA-REP1	AOI4-SU2-SA-REP2	AOI4-SU2-SA-REP3	AOI4-SU3-SA-REP1	AOI4-SU3-SA-REP2	AOI4-SU3-SA-REP3
SW6010C	Antimony	3.1	0.27	3.4	mg/kg	**0.130 J**	<u>0.420 UJ</u>	<u>0.420 UJ</u>	**0.220 J**	**0.220 J**	**0.130 J**
SW6010C	Copper	310	28	4.145	mg/kg	**0.670 J**	**0.730**	**0.770**	**0.820**	**1.10**	**0.990**
SW6010C	Lead	200	11	23.1	mg/kg	**3.30**	**6.90**	**3.40**	**3.00**	**4.50**	**4.20**
SW6010C	Manganese	180	220	109.8	mg/kg	**37.0**	**32.5**	**42.2**	**80.7**	**74.4**	**72.8**
SW6010C	Nickel	150	38	1.924	mg/kg	**1.40**	**0.970**	**1.10**	**1.30**	**1.40**	**1.40**
SW6010C	Zinc	1,000	46	7.69	mg/kg	**7.00 J**	**8.00 J**	**4.20 J**	**2.90**	**3.60**	**3.20**
SW8330	Nitroguanidine	630	NSL	NSL	mg/kg	**0.420 J**	**0.500 J**	0.120 U	**0.370 J**	**0.480 J**	**0.470 J**
SW8330B	2,4,6-Trinitrotoluene	3.6	NSL	NSL	mg/kg	0.0990 U	0.0980 U	0.0990 U	0.0980 U	0.0980 U	0.100 U
SW8330B	2,4-Dinitrotoluene	0.7	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	2,6-Dinitrotoluene	0.36	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	Nitroglycerin	0.63	NSL	NSL	mg/kg	0.300 U	0.290 U	0.300 U	0.290 U	0.290 U	0.300 U
SW8330B	Tetryl	16	NSL	NSL	mg/kg	0.150 UJ	0.150 UJ	0.150 UJ	0.150 U	0.150 U	0.150 U

Qualifiers
J	The reported result is an estimated value
U	Not Detected (limit of detection [LOD] shown)
UJ	Not Detected (LOD is estimated)

PSL	Project Screening Level is the lowest value of the USEPA Regional Screening Level (RSL) for Residential Soil, or the S-1 & GW-1 Massachusetts Contingency Plan (MCP) Table 2
BTV	Background Threshold Value
Eco-SSL	USEPA Ecological Soil Screening Levels, "https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents", last accessed 25 September 2018
NSL	No screening level identified
mg/kg	milligrams per kilogram

Detected results are bolded.
PSL Exceedances of screening level are shaded.
<u>Eco-SSL exceedances are underlined.</u>
BTV exceedances are printed in blue font.

All samples were collected in April 2018.

Appendix D, Table D-1a
Former Camp Wellfleet
IS Site Surface Soil Sampling Results

Method	Analyte Name	PSL	Eco-SSL	BTV	UNITS	AOI4-SU4-SA-REP1	AOI4-SU4-SA-REP2	AOI4-SU4-SA-REP3	AOI4-SU5-SA-REP1	AOI4-SU5-SA-REP2	AOI4-SU5-SA-REP3
SW6010C	Antimony	3.1	0.27	3.4	mg/kg	**0.130 J**	**0.160 J**	**0.140 J**	0.390 UJ	0.400 UJ	**0.150 J**
SW6010C	Copper	310	28	4.145	mg/kg	**0.730**	**0.990**	**0.850**	**1.40 J**	**1.50**	**1.40**
SW6010C	Lead	200	11	23.1	mg/kg	**3.90**	**6.60**	**5.00**	**3.70 J**	**3.80 J**	**3.60 J**
SW6010C	Manganese	180	220	109.8	mg/kg	**18.1**	**17.8**	**18.6**	**11.6**	**9.70**	**10.1**
SW6010C	Nickel	150	38	1.924	mg/kg	**0.570**	**0.740**	**0.610**	**1.30**	**1.20**	**1.40**
SW6010C	Zinc	1,000	46	7.69	mg/kg	**5.50**	**6.10**	**3.20**	**15.8 J**	**18.2**	**15.4**
SW8330	Nitroguanidine	630	NSL	NSL	mg/kg	0.120 U	0.120 U	0.120 U	**0.200 J**	0.110 UJ	0.120 U
SW8330B	2,4,6-Trinitrotoluene	3.6	NSL	NSL	mg/kg	0.0980 U	0.0990 U	0.0990 U	0.0960 U	0.0960 U	0.0970 U
SW8330B	2,4-Dinitrotoluene	0.7	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.140 U	0.140 U	0.150 U
SW8330B	2,6-Dinitrotoluene	0.36	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.140 U	0.140 U	0.150 U
SW8330B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.140 U	0.140 U	0.150 U
SW8330B	Nitroglycerin	0.63	NSL	NSL	mg/kg	0.290 U	0.300 U	0.300 U	0.290 U	0.290 U	0.290 U
SW8330B	Tetryl	16	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.140 U	0.140 U	0.150 U

Qualifiers
J The reported result is an estimated value
U Not Detected (limit of detection [LOD] shown)
UJ Not Detected (LOD is estimated)

PSL Project Screening Level is the lowest value of the USEPA Regional Screening Level (RSL) for Residential Soil, or the S-1 & GW-1 Massachusetts Contingency Plan (MCP) Table 2
BTV Background Threshold Value
Eco-SSL USEPA Ecological Soil Screening Levels, "https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents", last accessed 25 September 2018
NSL No screening level identified
mg/kg milligrams per kilogram

Detected results are bolded.
PSL Exceedances of screening level are shaded.
Eco-SSL exceedances are underlined.
BTV exceedances are printed in blue font.

All samples were collected in April 2018.

Appendix D, Table D-1a
Former Camp Wellfleet
IS Site Surface Soil Sampling Results

Method	Analyte Name	PSL	Eco-SSL	BTV	UNITS	AOI5-SU1-SA-REP1	AOI5-SU1-SA-REP2	AOI5-SU1-SA-REP3	AOI5-SU2-SA-REP1	AOI5-SU2-SA-REP2	AOI5-SU2-SA-REP3
SW6010C	Antimony	3.1	0.27	3.4	mg/kg	**0.240 J**	**<u>0.280 J</u>**	**0.190 J**	**<u>0.300 J</u>**	**0.190 J**	**0.250 J**
SW6010C	Copper	310	28	4.145	mg/kg	**1.70**	**1.60**	**1.30**	**1.60**	**1.60**	**1.60**
SW6010C	Lead	200	11	23.1	mg/kg	**3.10**	**3.00**	**2.50**	**3.00**	**2.90**	**3.00**
SW6010C	Manganese	180	220	109.8	mg/kg	**13.2**	**12.6**	**12.4**	**15.7**	**20.8**	**17.7**
SW6010C	Nickel	150	38	1.924	mg/kg	**1.10**	**0.750**	**0.750**	**1.00**	**1.30**	**0.980**
SW6010C	Zinc	1,000	46	7.69	mg/kg	**13.9**	**13.5**	**11.1**	**13.7**	**13.5**	**13.5**
SW8330	Nitroguanidine	630	NSL	NSL	mg/kg	0.120 UJ	0.120 U	0.120 U	0.110 UJ	0.120 U	0.120 UJ
SW8330B	2,4,6-Trinitrotoluene	3.6	NSL	NSL	mg/kg	0.0970 U	0.0990 U	0.0980 U	0.0990 U	0.0970 U	0.100 U
SW8330B	2,4-Dinitrotoluene	0.7	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	2,6-Dinitrotoluene	0.36	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	Nitroglycerin	0.63	NSL	NSL	mg/kg	0.290 U	0.300 U	0.290 U	0.300 U	0.290 U	0.300 U
SW8330B	Tetryl	16	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U

Qualifiers

J	The reported result is an estimated value
U	Not Detected (limit of detection [LOD] shown)
UJ	Not Detected (LOD is estimated)
PSL	Project Screening Level is the lowest value of the USEPA Regional Screening Level (RSL) for Residential Soil, or the S-1 & GW-1 Massachusetts Contingency Plan (MCP) Table 2
BTV	Background Threshold Value
Eco-SSL	USEPA Ecological Soil Screening Levels, "https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents", last accessed 25 September 2018
NSL	No screening level identified
mg/kg	milligrams per kilogram

Detected results are bolded.
PSL Exceedances of screening level are shaded.
<u>Eco-SSL exceedances are underlined.</u>
BTV exceedances are printed in blue font.

All samples were collected in April 2018.

Appendix D, Table D-1a
Former Camp Wellfleet
IS Site Surface Soil Sampling Results

Method	Analyte Name	PSL	Eco-SSL	BTV	UNITS	AOI5-SU3-SA-REP1	AOI5-SU3-SA-REP2	AOI5-SU3-SA-REP3
SW6010C	Antimony	3.1	0.27	3.4	mg/kg	**0.140 J**	**0.230 J**	**0.170 J**
SW6010C	Copper	310	28	4.145	mg/kg	**1.20 J**	**1.20 J**	**1.60 J**
SW6010C	Lead	200	11	23.1	mg/kg	**1.90 J**	**1.70 J**	**2.10 J**
SW6010C	Manganese	180	220	109.8	mg/kg	**17.0 J**	**17.8**	**19.0**
SW6010C	Nickel	150	38	1.924	mg/kg	**0.870 J**	**1.10**	**0.970**
SW6010C	Zinc	1,000	46	7.69	mg/kg	**5.60 J**	**7.90 J**	**3.20 J**
SW8330	Nitroguanidine	630	NSL	NSL	mg/kg	0.120 U	0.110 U	**0.210 J**
SW8330B	2,4,6-Trinitrotoluene	3.6	NSL	NSL	mg/kg	0.0990 U	0.0990 U	0.0970 U
SW8330B	2,4-Dinitrotoluene	0.7	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U
SW8330B	2,6-Dinitrotoluene	0.36	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U
SW8330B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U
SW8330B	Nitroglycerin	0.63	NSL	NSL	mg/kg	0.300 U	0.300 U	0.290 U
SW8330B	Tetryl	16	NSL	NSL	mg/kg	0.150 UJ	0.150 UJ	0.150 UJ

Qualifiers
J The reported result is an estimated value
U Not Detected (limit of detection [LOD] shown)
UJ Not Detected (LOD is estimated)

PSL Project Screening Level is the lowest value of the USEPA Regional Screening Level (RSL) for Residential Soil, or the S-1 & GW-1 Massachusetts Contingency Plan (MCP) Table 2
BTV Background Threshold Value
Eco-SSL USEPA Ecological Soil Screening Levels, "https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents", last accessed 25 September 2018
NSL No screening level identified
mg/kg milligrams per kilogram

Detected results are bolded.
PSL Exceedances of screening level are shaded.
Eco-SSL exceedances are underlined.
BTV exceedances are printed in blue font.

All samples were collected in April 2018.

Appendix D, Table D-1b
Former Camp Wellfleet
IS Site Subsurface Soil Sampling Results

Method	Analyte Name	PSL	Eco-SSL	BTV	UNITS	AOI3-SU1-SB-REP1	AOI3-SU1-SB-REP2	AOI3-SU1-SB-REP3	AOI4-SU2-SB-REP1	AOI4-SU2-SB-REP2	AOI4-SU2-SB-REP3
SW6010C	Antimony	3.1	0.27	3.4	mg/kg	0.400 U	0.410 U	**0.160 J**	0.400 UJ	**0.130 J**	0.410 UJ
SW6010C	Copper	310	28	3.76	mg/kg	**1.40**	**1.40**	**1.60**	**0.800**	**0.770**	**0.850**
SW6010C	Lead	200	11	4.242	mg/kg	**3.50**	**3.60**	**3.70**	**1.70**	**1.90**	**1.70**
SW6010C	Manganese	180	220	109.8	mg/kg	**26.1**	**28.9**	**25.8**	**71.8 J**	**68.9 J**	**63.0 J**
SW6010C	Nickel	150	38	2.81	mg/kg	**0.980**	**0.970**	**0.940**	**1.70**	**2.30**	**1.40**
SW6010C	Zinc	1,000	46	19.19	mg/kg	**14.5**	**14.8**	**15.9**	**4.00**	**6.30**	**3.80**
SW8330	Nitroguanidine	630	NSL	NSL	mg/kg	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U
SW8330B	2,4,6-Trinitrotoluene	3.6	NSL	NSL	mg/kg	0.0980 U	0.0980 U	0.0980 U	0.0990 U	0.0990 U	0.0970 U
SW8330B	2,4-Dinitrotoluene	0.7	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	2,6-Dinitrotoluene	0.36	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	Nitroglycerin	0.63	NSL	NSL	mg/kg	0.290 U	0.290 U	0.290 U	0.300 U	0.300 U	0.290 U
SW8330B	Tetryl	16	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 UJ	0.150 UJ	0.150 UJ

Qualifiers

J The reported result is an estimated value

U Not Detected (limit of detection [LOD] shown)

UJ Not Detected (LOD is estimated)

PSL Project Screening Level is the lowest value of the USEPA
Regional Screening Level (RSL) for Residential Soil, or
the S-1 & GW-1 Massachusetts Contingency Plan (MCP) Table 2

BTV Background Threshold Value

Eco-SSL USEPA Ecological Soil Screening Levels,
"https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents", last accessed 25 September 2018

NSL No screening level identified

mg/kg milligrams per kilogram

Detected results are bolded.

PSL Exceedances of screening level are shaded.

Eco-SSL exceedances are underlined.

BTV exceedances are printed in blue font.

All samples were collected in April 2018.

Appendix D, Table D-1b
Former Camp Wellfleet
IS Site Subsurface Soil Sampling Results

Method	Analyte Name	PSL	Eco-SSL	BTV	UNITS	AOI5-SU3-SB-REP1	AOI5-SU3-SB-REP2	AOI5-SU3-SB-REP3
SW6010C	Antimony	3.1	0.27	3.4	mg/kg	0.390 UJ	**0.140 J**	0.400 UJ
SW6010C	Copper	310	28	3.76	mg/kg	**5.90 J**	**3.90 J**	**3.60 J**
SW6010C	Lead	200	11	4.242	mg/kg	**2.30 J**	**2.40 J**	**2.40 J**
SW6010C	Manganese	180	220	109.8	mg/kg	**18.1 J**	**17.7 J**	**15.1 J**
SW6010C	Nickel	150	38	2.81	mg/kg	**1.10**	**1.20**	**0.960**
SW6010C	Zinc	1,000	46	19.19	mg/kg	**5.30 J**	**5.20 J**	**5.80 J**
SW8330	Nitroguanidine	630	NSL	NSL	mg/kg	0.120 U	0.120 U	0.120 U
SW8330B	2,4,6-Trinitrotoluene	3.6	NSL	NSL	mg/kg	0.100 UJ	0.100 UJ	0.100 UJ
SW8330B	2,4-Dinitrotoluene	0.7	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U
SW8330B	2,6-Dinitrotoluene	0.36	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U
SW8330B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U
SW8330B	Nitroglycerin	0.63	NSL	NSL	mg/kg	0.300 U	0.300 U	0.300 U
SW8330B	Tetryl	16	NSL	NSL	mg/kg	0.150 UJ	0.150 UJ	0.150 UJ

Qualifiers
J The reported result is an estimated value
U Not Detected (limit of detection [LOD] shown)
UJ Not Detected (LOD is estimated)

PSL Project Screening Level is the lowest value of the USEPA
Regional Screening Level (RSL) for Residential Soil, or
the S-1 & GW-1 Massachusetts Contingency Plan (MCP) Table 2
BTV Background Threshold Value
Eco-SSL USEPA Ecological Soil Screening Levels,
"https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents", last accessed 25 September 2018
NSL No screening level identified
mg/kg milligrams per kilogram

Detected results are bolded.
PSL Exceedances of screening level are shaded.
Eco-SSL exceedances are underlined.
BTV exceedances are printed in blue font.

All samples were collected in April 2018.

Appendix D, Table D-2
Former Camp Wellfleet
Site Soil Discrete Borings Sampling Results

Method	Analyte Name	PSL	Eco-SSL	MA BKG	UNITS	AOI1-SU2-SO01-8-10	AOI1-SU2-SO02-8-10	AOI1-SU2-SO03-8-10	AOI1-SU2-SO04-8-10	WELLFLEET-FD1 parent sample AOI1-SU2-SO04-8-10	AOI1-SU3-SO01-8-10
SW6010C	Antimony	3.1	0.27	1	mg/kg	**0.220 J**	0.430 U	0.410 U	0.410 U	**0.180 J**	0.400 U
SW6010C	Copper	310	28	40	mg/kg	**0.430**	**0.320 J**	**0.340 J**	**0.350 J**	**0.410**	**0.270 J**
SW6010C	Lead	200	11	100	mg/kg	**1.10**	**1.00**	**1.10**	**1.20**	**1.10**	**0.910**
SW6010C	Manganese	180	220	300	mg/kg	**7.60**	**10.1**	**10.4**	**11.9**	**10.7 J**	**8.70 J**
SW6010C	Nickel	150	38	20	mg/kg	**0.71**	**0.55**	**0.53**	**0.58**	**0.67**	**0.51**
SW6010C	Zinc	1,000	46	100	mg/kg	**5.10**	**1.90**	**1.60**	**4.80**	**5.10 J**	**4.80 J**
SW8330	Nitroguanidine	630	NSL	NSL	mg/kg	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U
SW8330B	2,4,6-Trinitrotoluene	3.6	NSL	NSL	mg/kg	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.0990 U
SW8330B	2,4-Dinitrotoluene	0.7	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	2,6-Dinitrotoluene	0.36	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U
SW8330B	Nitroglycerin	0.63	NSL	NSL	mg/kg	0.300 U	0.300 U	0.300 U	0.300 U	0.300 U	0.300 U
SW8330B	Tetryl	16	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U	0.150 U

Qualifiers

J	The reported result is an estimated value
U	Not Detected (limit of detection [LOD] shown)
UJ	Not Detected (LOD is estimated)
PSL	Project Screening Level is the lowest value of the USEPA Regional Screening Level (RSL) for Residential Soil, or the S-1 & GW-1 Massachusetts Contingency Plan (MCP) Table 2
MA BKG	Massachusettes background concentrations for metals in soil
Eco-SSL	USEPA Ecological Soil Screening Levels, "https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents", last accessed 25 September 2018
NSL	No screening level identified
mg/kg	milligrams per kilogram

Detected results are bolded.
PSL Exceedances of screening level are shaded.
Eco-SSL exceedances are underlined.
MA BKG exceedances are printed in blue font.

All samples were collected in April 2018.

Appendix D, Table D-2
Former Camp Wellfleet
Site Soil Discrete Borings Sampling Results

Method	Analyte Name	PSL	Eco-SSL	MA BKG	UNITS	AOI1-SU3-SO02-8-10	AOI1-SU3-SO03-8-10	AOI1-SU3-SO04-8-10
SW6010C	Antimony	3.1	0.27	1	mg/kg	0.410 U	0.410 U	0.400 U
SW6010C	Copper	310	28	40	mg/kg	**0.440**	**1.10**	**0.620**
SW6010C	Lead	200	11	100	mg/kg	**1.30**	**3.10**	**2.60**
SW6010C	Manganese	180	220	300	mg/kg	**13.6**	**11.8**	**14.7**
SW6010C	Nickel	150	38	20	mg/kg	**0.82**	**0.84**	**0.84**
SW6010C	Zinc	1,000	46	100	mg/kg	**4.60**	**4.20**	**10.0**
SW8330	Nitroguanidine	630	NSL	NSL	mg/kg	0.120 U	0.120 U	0.120 U
SW8330B	2,4,6-Trinitrotoluene	3.6	NSL	NSL	mg/kg	0.100 U	0.0990 U	0.100 U
SW8330B	2,4-Dinitrotoluene	0.7	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U
SW8330B	2,6-Dinitrotoluene	0.36	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U
SW8330B	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U
SW8330B	Nitroglycerin	0.63	NSL	NSL	mg/kg	0.300 U	0.300 U	0.300 U
SW8330B	Tetryl	16	NSL	NSL	mg/kg	0.150 U	0.150 U	0.150 U

Qualifiers
J The reported result is an estimated value
U Not Detected (limit of detection [LOD] shown)
UJ Not Detected (LOD is estimated)

PSL Project Screening Level is the lowest value of the USEPA Regional Screening Level (RSL) for Residential Soil, or the S-1 & GW-1 Massachusetts Contingency Plan (MCP) Table 2
MA BKG Massachusettes background concentrations for metals in soil
Eco-SSL USEPA Ecological Soil Screening Levels, "https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents", last accessed 25 September 2018
NSL No screening level identified
mg/kg milligrams per kilogram

Detected results are bolded.
PSL Exceedances of screening level are shaded.
Eco-SSL exceedances are underlined.
MA BKG exceedances are printed in blue font.

All samples were collected in April 2018.

Appendix D, Table D-3
Former Camp Wellfleet
ISM Background Sampling Results

Method	Analyte Name	PSL	UNITS	BKG-SU1-SA	BKG-SU1-SB	BKG-SU2-SA-REP1	BKG-SU2-SA-REP2	BKG-SU2-SA-REP3	BKG-SU2-SB-REP1	BKG-SU2-SB-REP2	BKG-SU2-SB-REP3
SW6010C	Antimony	3.1	mg/kg	**0.440 J**	**0.170 J**	**0.300 J**	**0.240 J**	**0.200 J**	**0.410 J**	**0.340 J**	**0.210 J**
	Copper	310	mg/kg	**3.60**	**1.70**	**2.70**	**2.20**	**2.40**	**2.10**	**1.60**	**1.70**
	Lead	200	mg/kg	**6.80**	**3.40 J**	**5.90**	**6.40**	**6.60**	**3.60**	**3.50**	**2.90 J**
	Manganese	180	mg/kg	**17.6**	**55.6 J**	**17.6**	**16.6**	**15.5**	**75.9**	**76.8**	**96.9**
	Nickel	150	mg/kg	**0.880**	**2.10**	**0.950**	**1.30**	**0.760**	**2.40**	**2.30**	**2.70**
	Zinc	1,000	mg/kg	**6.80**	**17.0 J**	**6.80**	**5.80**	**4.50**	**8.20 J**	**7.90**	**17.2 J**
SW8330	Nitroguanidine	630	mg/kg	0.110 UJ	0.120 U	**0.730 J**	0.120 U	0.110 UJ	0.120 U	0.110 UJ	0.120 U
SW8330B	2,4,6-Trinitrotoluene	3.6	mg/kg	0.0990 U	0.0980 U	0.0990 U	0.0970 U	0.0950 U	0.0970 U	0.0990 U	0.0960 U
	2,4-Dinitrotoluene	0.7	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.140 U	0.140 U	0.150 U	0.140 U
	2,6-Dinitrotoluene	0.36	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.140 U	0.140 U	0.150 U	0.140 U
	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.140 U	0.140 U	0.150 U	0.140 U
	Nitroglycerin	0.63	mg/kg	0.300 U	0.290 U	0.300 U	0.290 U	0.280 U	0.290 U	0.300 U	0.290 U
	Tetryl	16	mg/kg	0.150 U	0.150 U	0.150 U	0.150 U	0.140 U	0.140 U	0.150 U	0.140 U

Qualifiers

J	The reported result is an estimated value
U	Not Detected (limit of detection [LOD] shown)
UJ	Not Detected (LOD is estimated)
PSL	Project Screening Level is the lowest value of the USEPA Regional Screening Level (RSL) for Residential Soil, or the S-1 & GW-1 Massachusetts Contingency Plan (MCP) Table 2
mg/kg	milligrams per kilogram

Detected results are bolded.
Exceedances of screening level are shaded.

All samples were collected in April 2018.

Appendix D, Table D-3
Former Camp Wellfleet
ISM Background Sampling Results

Method	Analyte Name	PSL	UNITS	BKG-SU3-SA	BKG-SU3-SB	BKG-SU4-SA	BKG-SU4-SB	BKG-SU5-SA	BKG-SU5-SB	BKG-SU6-SA	BKG-SU6-SB	BKG-SU7-SA	BKG-SU7-SB
SW6010C	Antimony	3.1	mg/kg	**0.210 J**	**0.380 J**	**3.40**	**0.280 J**	**0.160 J**	**0.150 J**	**0.270 J**	**0.220 J**	**0.340 J**	**0.340 J**
	Copper	310	mg/kg	**1.7**	**3.00 J**	**3.10**	**1.70**	**2.40**	**1.30**	**3.20**	**1.90**	**3.40**	**1.30**
	Lead	200	mg/kg	**5.50 J**	**4.10 J**	**23.1**	**3.30**	**5.60**	**2.70**	**5.40**	**3.40**	**5.80**	**3.70**
	Manganese	180	mg/kg	**35.0**	**18.2 J**	**13.6**	**19.6**	**7.70**	**21.0**	**11.0**	**30.4**	**13.1**	**20.6**
	Nickel	150	mg/kg	**1.70**	**1.70**	**1.50**	**2.00**	**0.900**	**2.20**	**1.50**	**2.70**	**0.690**	**2.10**
	Zinc	1,000	mg/kg	**6.50 J**	**7.90 J**	**6.80**	**16.5**	**6.40 J**	**6.70**	**7.40**	**9.00**	**7.00**	**7.00**
SW8330	Nitroguanidine	630	mg/kg	0.120 U	0.120 U	0.120 UJ	0.110 U	0.110 U	0.120 U	0.110 U	0.110 U	0.120 UJ	0.110 U
SW8330B	2,4,6-Trinitrotoluene	3.6	mg/kg	0.0980 U	0.100 U	0.0960 U	0.0980 U	0.0980 U	0.0970 U	0.0950 U	0.100 U	0.0960 U	0.100 U
	2,4-Dinitrotoluene	0.7	mg/kg	0.150 U	0.150 U	0.140 U	0.150 U	0.150 U	0.150 U	0.140 U	0.150 U	0.140 U	0.150 U
	2,6-Dinitrotoluene	0.36	mg/kg	0.150 U	0.150 U	0.140 U	0.150 U	0.150 U	0.150 U	0.140 U	0.150 U	0.140 U	0.150 U
	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1	mg/kg	0.150 U	0.150 U	0.140 U	0.150 U	0.150 U	0.150 U	0.140 U	0.150 U	0.140 U	0.150 U
	Nitroglycerin	0.63	mg/kg	0.300 U	0.300 U	0.290 U	0.290 U	0.290 U	0.290 U	0.280 U	0.300 U	0.290 U	0.300 U
	Tetryl	16	mg/kg	0.150 U	0.150 U	0.140 U	0.150 U	0.150 U	0.150 U	0.140 U	0.150 U	0.140 U	0.150 U

Qualifiers

J	The reported result is an estimated value
U	Not Detected (limit of detection [LOD] shown)
UJ	Not Detected (LOD is estimated)
PSL	Project Screening Level is the lowest value of the USEF
mg/kg	milligrams per kilogram

Detected results are bolded.
Exceedances of screening level are shaded.

All samples were collected in April 2018.

Appendix D, Table D-4
Former Camp Wellfleet
Groundwater (Drinking Water Supply Well) Sampling Results

Method	Analyte Name	PSL	UNITS	WELLB-GW-1
SW6010C	Antimony	6	µg/L	**3.80 J**
	Copper	1,300	µg/L	**20.8 J**
	Lead	15	µg/L	**3.30 J**
	Manganese	300	µg/L	**5.70**
	Nickel	100	µg/L	3.00 U
	Zinc	NS	µg/L	**18.1**
SW8330	Nitroguanidine	NS	µg/L	60.0 U
SW8330B	2,4,6-Trinitrotoluene	NS	µg/L	0.220 U
	2,4-Dinitrotoluene	NS	µg/L	0.110 U
	2,6-Dinitrotoluene	NS	µg/L	0.110 U
	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	NS	µg/L	0.110 U
	Nitroglycerin	NS	µg/L	0.430 U
	Tetryl	NS	µg/L	0.220 U

Qualifiers
J The reported result is an estimated value
U Not Detected (limit of detection [LOD] shown)

PSL Project Screening Level (either the Massachusetts Maximum Contaminant Levels or Massachusetts Drinking Water Guidelines, MassDEP, 2017)

NS No Screening Level Identified
µg/L micrograms per liter

Detected results are bolded.
Exceedances of screening level are shaded.

All samples were collected in April 2018.

APPENDIX D.4: LABORATORY LEVEL IV REPORTS

(provided on CD only)

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APPENDIX E: MEC RISK MATRIX ASSESSMENT

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MEC Risk Assessment Matrices – AOI-01

Matrix 1 – Likelihood of Encounter. This matrix relates the site characterization data for amount of MEC to site use (including accessibility) to determine the likelihood of encountering MEC at a specific site.

Matrix 1. Likelihood of Encounter

Likelihood of Encounter, Matrix 1: Amount of MEC vs. Access Conditions		**Access Conditions (frequency of use)**			
		Regular (e.g., daily use, open access)	**Often** (e.g., less regular or periodic use, some access)	**Intermittent** (e.g., some irregular use, or access limited)	**Rare** (e.g., very limited use, access prevented)
Amount of MEC	• MEC is visible on the surface and detected in the subsurface.	Frequent	Frequent	Likely	Occasional
	• The area is identified as a Concentrated Munitions Use Area (CMUA) where MEC is known or suspected (e.g., MD indicative of MEC is identified) to be present in surface and subsurface.	Frequent	Likely	Occasional	Seldom
	• MEC presence based on physical evidence (e.g., MD indicative of MEC), although the area is not a CMUA, or • The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 1.0/acre at 95% confidence).	Likely	Occasional	Seldom	Unlikely
	• MEC presence is based on isolated historical discoveries (e.g., EOD report) prior to investigation, or • A DERP response action has been conducted to physically remove MEC and known or suspected hazard remains to support this selection, (e.g., surface removal where subsurface not addressed) or • The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 0.5/acre at 95% confidence).	Occasional	Seldom	Unlikely	Unlikely
	• MEC presence is suspected based on historical evidence of munitions use only, or • *A DERP response action has been conducted to physically remove surface and subsurface MEC (evidence that some residual hazard remains to support this selection)*, or • The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 0.25/acre at 95% confidence).	Seldom	**Seldom**	Unlikely	Unlikely
	• Investigation of the MRS did not identify evidence of MEC presence, or • A DERP response action has been conducted that will achieve UU/UE.	Unlikely	Unlikely	Unlikely	Unlikely

Amount of MEC Justification:

AOI-01 is an area of burial/disposal pits. This area was initially considered an Open Burn/Open Detonation, but findings from a removal action conducted to physically remove subsurface MEC ultimately determined these to be disposal pits for MD and non-munitions debris. No MEC was found, and the matrix selection is that a DERP response action has been conducted to physically remove surface and subsurface MEC (but evidence that some residual hazard remains to support this selection).

No MEC was found in AOI-01. The following MD items were found in the subsurface of AOI-01:

- MD: Numerous items (1,040 lbs MD in single burial pit), including 3.5” practice rockets, 3 expended M2 anti-personnel mines, 407 M48 flashtubes, 1 m7A3 2.36” practice rocket, and part of an inert filled M65 1,000lb “Dove” guided bomb.

Access Condition Justification:

AOI-01 is a low traffic area. While accessible by park visitors, the rough trails make traversing by vehicle difficult. Pedestrian traffic is common on the unpaved trails. There is some semi-dense natural vegetation that limits pedestrian access, however there are no man-made barrier restrictions. Therefore, access or frequency of use for AOI-01 is assessed as ***Often***.

Matrix 1 Result: ***Seldom***

Matrix 2 – Severity of Incident. This matrix assesses the likelihood of encounter rating (from Matrix 1) as related to the <u>severity</u> of an unintentional detonation.

Matrix 2. Severity of Incident

Severity of Explosive Incident, Matrix 2: Severity vs. Likelihood of Encounter		**Likelihood of Encounter**				
		Frequent: Regular, or inevitable occurrences	**Likely:** Several or numerous occurrences	**Occasional:** Sporadic or intermittent occurrences	**Seldom:** Infrequent, rare occurrences	**Unlikely:** Not probable
Severity Associated with Specific Munitions items	**Catastrophic/Critical:** May result in 1 or more deaths, permanent total or partial disability, or hospitalization	A	A	B	B	D
	Modest: May result in 1 (or more) injury resulting in emergency medical treatment, without hospitalization	B	B	B	C	D
	Minor: May result in 1 or more injuries requiring first aid or medical treatment	B	C	C	C	D
	Improbable: No injury is anticipated	D	D	D	**D**	D

"A" indicates conditions most likely to result in determination of an unacceptable risk.
"D" indicates conditions most likely to result in determination of an acceptable scenarios.

<u>Severity Justification:</u>

No MEC was found and no severity is associated with MD. Therefore, the severity is assessed as ***Improbable***.

<u>Matrix 2 Result:</u> ***D***

Matrix 3 – Likelihood of Detonation. This matrix relates sensitivity of the MEC items to the likelihood for energy to be imparted to an item during an encounter by specific land users.

Matrix 3. Likelihood of Detonation

Likelihood of Detonation, Matrix 3: Munitions Sensitivity vs. Likelihood of Energy to be Imparted		Likelihood to Impart Energy on an Item		
		High e.g., areas planned for development, or seasonally tilled	***Modest*** e.g., undeveloped, wildlife refuge, parks	***Inconsequential*** e.g., not anticipated, prevented, mitigated
Sensitivity: Susceptibility to Detonation	***High*** (e.g., classified as sensitive)	1	1	3
	Moderate (e.g., high explosive (HE) or pyrotechnics)	1	2	3
	Low (e.g., propellant or bulk secondary explosives)	1	3	3
	Not Sensitive	2	**3**	3

Sensitivity Justification:

No MEC was found and no level of sensitivity is associated with MD. Therefore, the sensitivity is assessed as ***Not Sensitive.***

Likelihood to Impart Energy Justification:

AOI-01 is a low traffic area. While accessible to park visitors, it is a largely undeveloped area, and the rough trails make traversing by vehicle difficult. It is not an area where workers perform significant maintenance operations such as excavating or grading. Therefore, the likelihood to impart energy is assessed as ***Modest.***

Matrix 3 Result: ***3***

Matrix 4 – Acceptable and Unacceptable Site Conditions. This final matrix combines the results of Matrices 2 and 3 to differentiate Acceptable and Unacceptable site conditions.

Matrix 4: Acceptable and Unacceptable Site Conditions

Acceptable and Unacceptable Site Conditions		Result From Matrix 2			
		A	B	C	D
Result from Matrix 3	1	Unacceptable	Unacceptable	Unacceptable	Acceptable
	2	Unacceptable	Unacceptable	Acceptable	Acceptable
	3	Unacceptable	Acceptable	Acceptable	**Acceptable**

Matrix 2 Result: ***D***

Matrix 3 Result: ***3***

Matrix 4 Result: ***Acceptable***

The risk matrices demonstrate that AOI-01 currently has an acceptable risk from MEC hazards on due to the absence of MEC and the resulting combination of severity of incident and likelihood of detonation factors.

Therefore, the baseline site condition for AOI-01 is assessed to be ***Acceptable***.

Acceptable baseline conditions do not need to proceed to the next phase of the CERCLA response process, as no further action is warranted.

MEC Risk Assessment Matrices – AOI-02

Matrix 1 – Likelihood of Encounter. This matrix relates the site characterization data for amount of MEC to site use (including accessibility) to determine the likelihood of encountering MEC at a specific site.

Matrix 1. Likelihood of Encounter

Likelihood of Encounter, Matrix 1: Amount of MEC vs. Access Conditions		**Access Conditions (frequency of use)**			
		Regular (e.g., daily use, open access)	**Often** (e.g., less regular or periodic use, some access)	**Intermittent** (e.g., some irregular use, or access limited)	**Rare** (e.g., very limited use, access prevented)
Amount of MEC	• MEC is visible on the surface and detected in the subsurface.	Frequent	Frequent	Likely	Occasional
	• The area is identified as a Concentrated Munitions Use Area (CMUA) where MEC is known or suspected (e.g., MD indicative of MEC is identified) to be present in surface and subsurface.	Frequent	Likely	Occasional	Seldom
	• *MEC presence based on physical evidence (e.g., MD indicative of MEC), although the area is not a CMUA*, or • The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 1.0/acre at 95% confidence).	**Likely**	Occasional	Seldom	Unlikely
	• MEC presence is based on isolated historical discoveries (e.g., EOD report) prior to investigation, or • A DERP response action has been conducted to physically remove MEC and known or suspected hazard remains to support this selection, (e.g., surface removal where subsurface not addressed) or • The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 0.5/acre at 95% confidence).	Occasional	Seldom	Unlikely	Unlikely
	• MEC presence is suspected based on historical evidence of munitions use only, or • A DERP response action has been conducted to physically remove surface and subsurface MEC (evidence that some residual hazard remains to support this selection), or • The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 0.25/acre at 95% confidence).	Seldom	Seldom	Unlikely	Unlikely
	• Investigation of the MRS did not identify evidence of MEC presence, or • A DERP response action has been conducted that will achieve UU/UE.	Unlikely	Unlikely	Unlikely	Unlikely

Amount of MEC Justification:

AOI-02 is the Former Artillery Firing Line. These were firing points for 90mm and other artillery, primarily firing out to sea (the ocean range is AOI-06). MEC presence has been established; while no MEC were found during the EE/CA or Removal Actions, a 76mm anti-aircraft artillery round was found within this area (Marconi Beach) in October 2016 and was determined to be MEC.

The MEC item found was a result of the erosion of the high bluff with the item ultimately found in the beach area. As this AOI includes most of the Former Camp Wellfleet FUDS shoreline, it may also see munition items washing ashore following storm events.

MEC amount is based on physical evidence although there is no indication that the area is a CMUA. The 76mm MEC round was not considered an isolated discovery as the EE/CA report includes documentation of many "OE" items being found in this area over the years.

Although the MEC item was found on the surface, the MEC density as shown in the DQO table in Appendix B is below the project-specific threshold of 1 TOI/acre.

The following MEC and MD items were found in the surface or subsurface of AOI-02:

- MEC: 76mm anti-aircraft artillery. Remnants of packaging material were present on the item, indicating it had not been fired, and thus it is classified as discarded military munitions (DMM).

- MD: 50 caliber machine gun ammunition, fuze cans, shipping clips for 90mm fuzes, and 30 caliber ammunition cans, calcium hydride canisters, and unknown frag.

Access Condition Justification:

This AOI is a moderate to high traffic beach access area. It contains unpaved and paved trails and paved roads. While most of the northern part of AOI-02 contains high volume pedestrian and vehicle traffic associated with beach access, the central and southern portions contain a low volume of traffic because there are few trails and a high density of natural vegetation that limits pedestrian access. However, the southern beach areas are essentially open access through adjacent AOI-05. As there are no barriers to the beach, the access or frequency of use for AOI-02 is assessed as ***Regular***.

Matrix 1 Result: ***Likely***

Matrix 2 – Severity of Incident. This matrix assesses the likelihood of encounter rating (from Matrix 1) as related to the severity of an unintentional detonation.

Matrix 2. Severity of Incident

Severity of Explosive Incident, Matrix 2: Severity vs. Likelihood of Encounter		Likelihood of Encounter				
		Frequent: Regular, or inevitable occurrences	**Likely:** Several or numerous occurrences	**Occasional:** Sporadic or intermittent occurrences	**Seldom:** Infrequent, rare occurrences	**Unlikely:** Not probable
Severity Associated with Specific Munitions items	**Catastrophic/Critical:** May result in 1 or more deaths, permanent total or partial disability, or hospitalization	A	**A**	B	B	D
	Modest: May result in 1 (or more) injury resulting in emergency medical treatment, without hospitalization	B	B	B	C	D
	Minor: May result in 1 or more injuries requiring first aid or medical treatment	B	C	C	C	D
	Improbable: No injury is anticipated	D	D	D	D	D

"A" indicates conditions most likely to result in determination of an unacceptable risk.
"D" indicates conditions most likely to result in determination of an acceptable scenarios.

Severity Justification:

Detonation of the identified MEC item while being handled by a human would likely result in at least partial disability or hospitalization. Therefore, the severity is assessed as ***Catastrophic/Critical*.**

Matrix 2 Result: *A*

Matrix 3 – Likelihood of Detonation. This matrix relates sensitivity of the MEC items to the likelihood for energy to be imparted to an item during an encounter by specific land users.

Matrix 3. Likelihood of Detonation

Likelihood of Detonation, Matrix 3: Munitions Sensitivity vs. Likelihood of Energy to be Imparted		**Likelihood to Impart Energy on an Item**		
		High e.g., areas planned for development, or seasonally tilled	***Modest*** e.g., undeveloped, wildlife refuge, parks	***Inconsequential*** e.g., not anticipated, prevented, mitigated
Sensitivity: Susceptibility to Detonation	***High*** (e.g., classified as sensitive)	1	1	3
	Moderate (e.g., high explosive (HE) or pyrotechnics)	1	**2**	3
	Low (e.g., propellant or bulk secondary explosives)	1	3	3
	Not Sensitive	2	3	3

<u>Sensitivity Justification:</u>

The identified MEC item contained some amount of HE. Therefore, the sensitivity is assessed as ***Moderate***.

<u>Likelihood to Impart Energy Justification:</u>

AOI-02 is a regular, open access area. Park workers performing maintenance operations such as excavating or grading, could encounter MEC. Park visitors (treasure hunters, etc.) could use metal detectors to discover and excavate MEC, or MEC could be found following erosion from the bluffs and migration to the surface. Therefore, the likelihood to impart energy is assessed as ***Modest.***

<u>Matrix 3 Result:</u> ***2***

Matrix 4 – Acceptable and Unacceptable Site Conditions. This final matrix combines the results of Matrices 2 and 3 to differentiate Acceptable and Unacceptable site conditions.

Matrix 4: Acceptable and Unacceptable Site Conditions

Acceptable and Unacceptable Site Conditions		Result From Matrix 2			
		A	B	C	D
Result from Matrix 3	1	Unacceptable	Unacceptable	Unacceptable	Acceptable
	2	**Unacceptable**	Unacceptable	Acceptable	Acceptable
	3	Unacceptable	Acceptable	Acceptable	Acceptable

Matrix 2 Result: ***A***

Matrix 3 Result: ***2***

Matrix 4 Result: ***Unacceptable***

The risk matrices demonstrate that AOI-02 currently has an unacceptable risk from MEC hazards due to the combination of severity of incident and likelihood of detonation factors.

Therefore, the baseline site condition for AOI-02 is assessed to be ***Unacceptable***.

Unacceptable initial conditions typically proceed to the next phase of the CERCLA response process, where remedial action is warranted. Evaluation of the matrices indicates that the unacceptable risk for this area could be reduced to an acceptable risk by reducing/eliminating the likelihood for humans to encounter the MEC in this area.

MEC Risk Assessment Matrices – AOI-03

Matrix 1 – Likelihood of Encounter. This matrix relates the site characterization data for amount of MEC to site use (including accessibility) to determine the likelihood of encountering MEC at a specific site.

Matrix 1. Likelihood of Encounter

<table>
<tr><th colspan="2" rowspan="2">Likelihood of Encounter, Matrix 1:
Amount of MEC vs. Access Conditions</th><th colspan="4">Access Conditions (frequency of use)</th></tr>
<tr><th>Regular
(e.g., daily use, open access)</th><th>Often
(e.g., less regular or periodic use, some access)</th><th>Intermittent
(e.g., some irregular use, or access limited)</th><th>Rare
(e.g., very limited use, access prevented)</th></tr>
<tr><td rowspan="6">Amount of MEC</td><td>• MEC is visible on the surface and detected in the subsurface.</td><td>Frequent</td><td>Frequent</td><td>Likely</td><td>Occasional</td></tr>
<tr><td>• The area is identified as a Concentrated Munitions Use Area (CMUA) where MEC is known or suspected (e.g., MD indicative of MEC is identified) to be present in surface and subsurface.</td><td>Frequent</td><td>Likely</td><td>Occasional</td><td>Seldom</td></tr>
<tr><td>• MEC presence based on physical evidence (e.g., MD indicative of MEC), although the area is not a CMUA, or
• The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 1.0/acre at 95% confidence).</td><td>Likely</td><td>Occasional</td><td>Seldom</td><td>Unlikely</td></tr>
<tr><td>• MEC presence is based on isolated historical discoveries (e.g., EOD report) prior to investigation, or
• A DERP response action has been conducted to physically remove MEC and known or suspected hazard remains to support this selection, (e.g., surface removal where subsurface not addressed) or
• The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 0.5/acre at 95% confidence).</td><td>Occasional</td><td>Seldom</td><td>Unlikely</td><td>Unlikely</td></tr>
<tr><td>• MEC presence is suspected based on historical evidence of munitions use only, or
• A DERP response action has been conducted to physically remove surface and subsurface MEC (evidence that some residual hazard remains to support this selection), or
• The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 0.25/acre at 95% confidence).</td><td>Seldom</td><td>Seldom</td><td>Unlikely</td><td>Unlikely</td></tr>
<tr><td>• Investigation of the MRS did not identify evidence of MEC presence, or
• A DERP response action has been conducted that will achieve UU/UE.</td><td>Unlikely</td><td>Unlikely</td><td>Unlikely</td><td>Unlikely</td></tr>
</table>

Amount of MEC Justification:

AOI-03 is the former Ammunition Supply Point, with multiple U-shaped revetments possibly used to store ammunition. It also includes an area of multiple ground scars identified from 1943 and 1947 aerial photos.

A single Rifle Smoke Grenade, found in Area L during the EE/CA, is considered to be MEC (pyrotechnic). Additionally, abundant MD was found during previous investigations. This MEC finding is considered to be an isolated discovery because no other munitions use is historically known in the area. The rifle smoke grenade was found in a grid with no other MEC or MD, approximately 1,000 feet to the south of the other grids that did contain MD (mostly shipping-related and not indicative of a CMUA).

The following MEC and MD items were found in the surface or subsurface of AOI-03:

- MEC: Rifle Smoke Grenade.
- MD: Multiple fuze shipping spacers, some small arms debris.

Access Condition Justification:

AOI-03 is a moderate traffic area. It contains unpaved trails and a paved road. The unpaved trails see moderate pedestrian traffic, and the paved road sees vehicle traffic. There is a gate limiting vehicle traffic onto unpaved trails, and there is some semi-dense natural vegetation and rough terrain that limits pedestrian access, however there are no man-made barrier restrictions to pedestrians. Therefore, access or frequency of use for AOI-03 is assessed as ***Often***.

Matrix 1 Result: ***Seldom***

Matrix 2 – Severity of Incident. This matrix assesses the likelihood of encounter rating (from Matrix 1) as related to the severity of an unintentional detonation.

Matrix 2. Severity of Incident

Severity of Explosive Incident, Matrix 2: Severity vs. Likelihood of Encounter		**Likelihood of Encounter**				
		Frequent: Regular, or inevitable occurrences	**Likely:** Several or numerous occurrences	**Occasional:** Sporadic or intermittent occurrences	**Seldom:** Infrequent, rare occurrences	**Unlikely:** Not probable
Severity Associated with Specific Munitions items	**Catastrophic/Critical:** May result in 1 or more deaths, permanent total or partial disability, or hospitalization	A	A	B	B	D
	Modest: May result in 1 (or more) injury resulting in emergency medical treatment, without hospitalization	B	B	B	**C**	D
	Minor: May result in 1 or more injuries requiring first aid or medical treatment	B	C	C	C	D
	Improbable: No injury is anticipated	D	D	D	D	D

"A" indicates conditions most likely to result in determination of an unacceptable risk.
"D" indicates conditions most likely to result in determination of an acceptable scenarios.

Severity Justification:

Detonation of the Rifle Smoke Grenade item while being handled by a human would likely result in injury with emergency medical treatment, without hospitalization. Therefore, the severity is assessed as ***Modest.***

Matrix 2 Result: ***C***

Matrix 3 – Likelihood of Detonation. This matrix relates sensitivity of the MEC items to the likelihood for energy to be imparted to an item during an encounter by specific land users.

Matrix 3. Likelihood of Detonation

Likelihood of Detonation, Matrix 3: Munitions Sensitivity vs. Likelihood of Energy to be Imparted		**Likelihood to Impart Energy on an Item**		
		High e.g., areas planned for development, or seasonally tilled	***Modest*** e.g., undeveloped, wildlife refuge, parks	***Inconsequential*** e.g., not anticipated, prevented, mitigated
Sensitivity: Susceptibility to Detonation	***High*** (e.g., classified as sensitive)	1	1	3
	Moderate (e.g., high explosive (HE) or pyrotechnics)	1	**2**	3
	Low (e.g., propellant or bulk secondary explosives)	1	3	3
	Not Sensitive	2	3	3

Sensitivity Justification:

The identified MEC item contained some pyrotechnics. Therefore, the sensitivity is assessed as ***Moderate***.

Likelihood to Impart Energy Justification:

AOI-03 is a moderate traffic area with periodic use and some access. It is largely an undeveloped portion of a park, and not an area where workers perform significant maintenance operations such as excavating or grading. Therefore, the likelihood to impart energy is assessed as ***Modest***.

Matrix 3 Result: *2*

Matrix 4 – Acceptable and Unacceptable Site Conditions. This final matrix combines the results of Matrices 2 and 3 to differentiate Acceptable and Unacceptable site conditions.

Matrix 4: Acceptable and Unacceptable Site Conditions

Acceptable and Unacceptable Site Conditions		Result From Matrix 2			
		A	B	C	D
Result from Matrix 3	1	Unacceptable	Unacceptable	Unacceptable	Acceptable
	2	Unacceptable	Unacceptable	**Acceptable**	Acceptable
	3	Unacceptable	Acceptable	Acceptable	Acceptable

Matrix 2 Result: ***C***

Matrix 3 Result: ***2***

Matrix 4 Result: ***Acceptable***

The risk matrices demonstrate that AOI-03 currently has an acceptable risk from MEC hazards due to the combination of severity of incident and likelihood of detonation factors.

Therefore, the baseline site condition for AOI-03 is assessed to be ***Acceptable***.

Unacceptable initial conditions typically proceed to the next phase of the CERCLA response process, where remedial action is warranted. Evaluation of the matrices indicates that the unacceptable risk for this area could be reduced to an acceptable risk by reducing/eliminating the likelihood for humans to encounter the MEC in this area.

MEC Risk Assessment Matrices – AOI-04

Matrix 1 – Likelihood of Encounter. This matrix relates the site characterization data for amount of MEC to site use (including accessibility) to determine the likelihood of encountering MEC at a specific site.

Matrix 1. Likelihood of Encounter

Likelihood of Encounter, Matrix 1: Amount of MEC vs. Access Conditions		**Access Conditions (frequency of use)**			
		Regular (e.g., daily use, open access)	**Often** (e.g., less regular or periodic use, some access)	**Intermittent** (e.g., some irregular use, or access limited)	**Rare** (e.g., very limited use, access prevented)
Amount of MEC	• MEC is visible on the surface and detected in the subsurface.	Frequent	Frequent	Likely	Occasional
	• The area is identified as a Concentrated Munitions Use Area (CMUA) where MEC is known or suspected (e.g., MD indicative of MEC is identified) to be present in surface and subsurface.	Frequent	Likely	Occasional	Seldom
	• MEC presence based on physical evidence (e.g., MD indicative of MEC), although the area is not a CMUA, or • The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 1.0/acre at 95% confidence).	Likely	Occasional	Seldom	Unlikely
	• MEC presence is based on isolated historical discoveries (e.g., EOD report) prior to investigation, or • *A DERP response action has been conducted to physically remove MEC and known or suspected hazard remains to support this selection, (e.g., surface removal where subsurface not addressed)* or • The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 0.5/acre at 95% confidence).	Occasional	**Seldom**	Unlikely	Unlikely
	• MEC presence is suspected based on historical evidence of munitions use only, or • A DERP response action has been conducted to physically remove surface and subsurface MEC (evidence that some residual hazard remains to support this selection), or • The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 0.25/acre at 95% confidence).	Seldom	Seldom	Unlikely	Unlikely
	• Investigation of the MRS did not identify evidence of MEC presence, or • A DERP response action has been conducted that will achieve UU/UE.	Unlikely	Unlikely	Unlikely	Unlikely

Amount of MEC Justification:

AOI-04 combines EE/CA investigation areas C, F, and J. These are bomb target areas and a burial site. The amount of MEC is that a removal action has occurred (associated with single point anomaly excavations) to physically remove subsurface MEC (only MD was found), but since not all targets were dug, it is possible that suspected hazards may remain.

No MEC was found in AOI-04. The following MD items were found in the surface and subsurface of AOI-04:

- MD: Numerous items including abundant fuze shipping spacers, some small arms debris, one empty Dove Missile/1000-pound bomb, one empty 250-pound bomb, 186 M28A1 flash tubes from 106mm projectile cartridge cases, and fragments of grenade spoons.

Access Condition Justification:

AOI-04 is a moderate traffic area. It contains unpaved trails and a paved road. The unpaved trails see moderate pedestrian traffic, and the paved road sees vehicle traffic. There is some semi-dense natural vegetation and rough terrain that limits pedestrian access, however there are no man-made barrier restrictions. Therefore, access or frequency of use for AOI-04 is assessed as ***Often***.

Matrix 1 Result: ***Seldom***

Matrix 2 – Severity of Incident. This matrix assesses the likelihood of encounter rating (from Matrix 1) as related to the <u>severity</u> of an unintentional detonation.

Matrix 2. Severity of Incident

Severity of Explosive Incident, Matrix 2: Severity vs. Likelihood of Encounter		**Likelihood of Encounter**				
		Frequent: Regular, or inevitable occurrences	**Likely:** Several or numerous occurrences	**Occasional:** Sporadic or intermittent occurrences	**Seldom:** Infrequent, rare occurrences	**Unlikely:** Not probable
Severity Associated with Specific Munitions items	**Catastrophic/Critical:** May result in 1 or more deaths, permanent total or partial disability, or hospitalization	A	A	B	B	D
	Modest: May result in 1 (or more) injury resulting in emergency medical treatment, without hospitalization	B	B	B	C	D
	Minor: May result in 1 or more injuries requiring first aid or medical treatment	B	C	C	C	D
	Improbable: No injury is anticipated	D	D	D	**D**	D

"A" indicates conditions most likely to result in determination of an unacceptable risk.
"D" indicates conditions most likely to result in determination of an acceptable scenarios.

<u>Severity Justification:</u>

No MEC was found and no severity is associated with MD. Therefore, the severity is assessed as ***Improbable***.

<u>Matrix 2 Result:</u> ***D***

Matrix 3 – Likelihood of Detonation. This matrix relates sensitivity of the MEC items to the likelihood for energy to be imparted to an item during an encounter by specific land users.

Matrix 3. Likelihood of Detonation

Likelihood of Detonation, Matrix 3: Munitions Sensitivity vs. Likelihood of Energy to be Imparted		**Likelihood to Impart Energy on an Item**		
		High e.g., areas planned for development, or seasonally tilled	***Modest*** e.g., undeveloped, wildlife refuge, parks	***Inconsequential*** e.g., not anticipated, prevented, mitigated
Sensitivity: Susceptibility to Detonation	***High*** (e.g., classified as sensitive)	1	1	3
	Moderate (e.g., high explosive (HE) or pyrotechnics)	1	2	3
	Low (e.g., propellant or bulk secondary explosives)	1	3	3
	Not Sensitive	2	**3**	3

Sensitivity Justification:

No MEC was found and no level of sensitivity is associated with MD. Therefore, the sensitivity is assessed as ***Not Sensitive.***

Likelihood to Impart Energy Justification:

AOI-04 is a moderate traffic area. There is some semi-dense natural vegetation and rough terrain that limits pedestrian access, however there are no man-made barrier restrictions. It is not an area where workers perform significant maintenance operations such as excavating or grading. Therefore, the likelihood to impart energy is assessed as ***Modest.***

Matrix 3 Result: ***3***

Matrix 4 – Acceptable and Unacceptable Site Conditions. This final matrix combines the results of Matrices 2 and 3 to differentiate Acceptable and Unacceptable site conditions.

Matrix 4: Acceptable and Unacceptable Site Conditions

Acceptable and Unacceptable Site Conditions		Result From Matrix 2			
		A	B	C	D
Result from Matrix 3	1	Unacceptable	Unacceptable	Unacceptable	Acceptable
	2	Unacceptable	Unacceptable	Acceptable	Acceptable
	3	Unacceptable	Acceptable	Acceptable	**Acceptable**

Matrix 2 Result: ***D***

Matrix 3 Result: ***3***

Matrix 4 Result: ***Acceptable***

The risk matrices demonstrate that AOI-04 currently has an acceptable risk from MEC hazards on due to the absence of MEC and the resulting combination of severity of incident and likelihood of detonation factors.

Therefore, the baseline site condition for AOI-04 is assessed to be ***Acceptable***.

Acceptable baseline conditions do not need to proceed to the next phase of the CERCLA response process, as no further action is warranted.

MEC Risk Assessment Matrices – AOI-05

Matrix 1 – Likelihood of Encounter. This matrix relates the site characterization data for amount of MEC to site use (including accessibility) to determine the likelihood of encountering MEC at a specific site.

Matrix 1. Likelihood of Encounter

Likelihood of Encounter, Matrix 1: Amount of MEC vs. Access Conditions		**Access Conditions (frequency of use)**			
		Regular (e.g., daily use, open access)	**Often** (e.g., less regular or periodic use, some access)	**Intermittent** (e.g., some irregular use, or access limited)	**Rare** (e.g., very limited use, access prevented)
Amount of MEC	• MEC is visible on the surface and detected in the subsurface.	Frequent	Frequent	Likely	Occasional
	• The area is identified as a Concentrated Munitions Use Area (CMUA) where MEC is known or suspected (e.g., MD indicative of MEC is identified) to be present in surface and subsurface.	Frequent	Likely	Occasional	Seldom
	• *MEC presence based on physical evidence (e.g., MD indicative of MEC), although the area is not a CMUA*, or • The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 1.0/acre at 95% confidence).	**Likely**	Occasional	Seldom	Unlikely
	• MEC presence is based on isolated historical discoveries (e.g., EOD report) prior to investigation, or • A DERP response action has been conducted to physically remove MEC and known or suspected hazard remains to support this selection, (e.g., surface removal where subsurface not addressed) or • The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 0.5/acre at 95% confidence).	Occasional	Seldom	Unlikely	Unlikely
	• MEC presence is suspected based on historical evidence of munitions use only, or • A DERP response action has been conducted to physically remove surface and subsurface MEC (evidence that some residual hazard remains to support this selection), or • The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 0.25/acre at 95% confidence).	Seldom	Seldom	Unlikely	Unlikely
	• Investigation of the MRS did not identify evidence of MEC presence, or • A DERP response action has been conducted that will achieve UU/UE.	Unlikely	Unlikely	Unlikely	Unlikely

<u>Amount of MEC Justification:</u>

AOI-05 is a former Rocket Range and Small Arms Range. The small arms range has been completely covered by the large paved parking lot. The southern portion includes a small 5-acre removal action area. Multiple pieces of frag from 3.5" rockets and 105mm projectiles found during the previous investigations or removal action are considered HE frag or MD indicative of MEC.

MEC amount is based on physical evidence (MD indicative of MEC) although there is no indication that the area is a CMUA.

As this AOI includes portions of the Former Camp Wellfleet FUDS shoreline, MEC finds could result from erosion of the bluffs and the subsequent migration of the item to the surface, or munition items could wash ashore following storm events.

In addition to the presence of MD indicative of MEC, the MEC density as shown in the DQO table in Appendix B is well below the project-specific threshold of 1 TOI/acre.

The following MD indicative of MEC items and MD items were found in the surface or subsurface of AOI-05:

- MD Indicative of MEC: HE frag from 3.5" Rockets and 105mm projectiles.
- MD: 50 cal bullet, miscellaneous scrap.

<u>Access Condition Justification:</u>

AOI-05 is a high traffic beach access area. It contains unpaved and paved trails, a paved road and a large paved parking lot. While there is some semi-dense natural vegetation that limits pedestrian access, there are no man-made barrier restrictions. Access to the beach is open with daily use. Therefore, the access or frequency of use for AOI-05 is assessed as ***Regular***.

<u>Matrix 1 Result:</u> ***Likely***

Matrix 2 – Severity of Incident. This matrix assesses the likelihood of encounter rating (from Matrix 1) as related to the <u>severity</u> of an unintentional detonation.

Matrix 2. Severity of Incident

Severity of Explosive Incident, Matrix 2: Severity vs. Likelihood of Encounter		Likelihood of Encounter				
		Frequent: Regular, or inevitable occurrences	**Likely:** Several or numerous occurrences	**Occasional:** Sporadic or intermittent occurrences	**Seldom:** Infrequent, rare occurrences	**Unlikely:** Not probable
Severity Associated with Specific Munitions items	**Catastrophic/Critical:** May result in 1 or more deaths, permanent total or partial disability, or hospitalization	A	**A**	B	B	D
	Modest: May result in 1 (or more) injury resulting in emergency medical treatment, without hospitalization	B	B	B	C	D
	Minor: May result in 1 or more injuries requiring first aid or medical treatment	B	C	C	C	D
	Improbable: No injury is anticipated	D	D	D	D	D

"A" indicates conditions most likely to result in determination of an unacceptable risk.
"D" indicates conditions most likely to result in determination of an acceptable scenarios.

<u>Severity Justification:</u>

Detonation of suspected MEC items while being handled by a human would likely result in at least partial disability or hospitalization. Therefore, the severity is assessed as ***Catastrophic/Critical*.**

<u>Matrix 2 Result:</u> ***A***

Matrix 3 – Likelihood of Detonation. This matrix relates sensitivity of the MEC items to the likelihood for energy to be imparted to an item during an encounter by specific land users.

Matrix 3. Likelihood of Detonation

Likelihood of Detonation, Matrix 3: Munitions Sensitivity vs. Likelihood of Energy to be Imparted		Likelihood to Impart Energy on an Item		
		High e.g., areas planned for development, or seasonally tilled	***Modest*** e.g., undeveloped, wildlife refuge, parks	***Inconsequential*** e.g., not anticipated, prevented, mitigated
Sensitivity: Susceptibility to Detonation	***High*** (e.g., classified as sensitive)	1	1	3
	Moderate (e.g., high explosive (HE) or pyrotechnics)	1	**2**	3
	Low (e.g., propellant or bulk secondary explosives)	1	3	3
	Not Sensitive	2	3	3

<u>Sensitivity Justification:</u>

The suspected MEC items would contain some amount of HE. Therefore, the sensitivity is assessed as ***Moderate*****.**

<u>Likelihood to Impart Energy Justification:</u>

AOI-05 is a regular, open access area. Park workers performing maintenance operations such as excavating or grading, could encounter MEC. Park visitors (treasure hunters', etc) could use metal detectors to discover and excavate MEC, or MEC could be found following erosion from the bluffs and migration to the surface. Therefore, the likelihood to impart energy is assessed as ***Moderate*****.**

<u>Matrix 3 Result:</u> ***2***

Matrix 4 – Acceptable and Unacceptable Site Conditions. This final matrix combines the results of Matrices 2 and 3 to differentiate Acceptable and Unacceptable site conditions.

Matrix 4: Acceptable and Unacceptable Site Conditions

Acceptable and Unacceptable Site Conditions		Result From Matrix 2			
		A	B	C	D
Result from Matrix 3	1	Unacceptable	Unacceptable	Unacceptable	Acceptable
	2	**Unacceptable**	Unacceptable	Acceptable	Acceptable
	3	Unacceptable	Acceptable	Acceptable	Acceptable

Matrix 2 Result: ***A***

Matrix 3 Result: ***2***

Matrix 4 Result: ***Unacceptable***

The risk matrices demonstrate that AOI-05 currently has an unacceptable risk from MEC hazards due to the combination of severity of incident and likelihood of detonation factors.

Therefore, the baseline site condition for AOI-05 is assessed to be ***Unacceptable***.

Unacceptable initial conditions typically proceed to the next phase of the CERCLA response process, where remedial action is warranted. Evaluation of the matrices indicates that the unacceptable risk for this area could be reduced to an acceptable risk by reducing/eliminating the likelihood for humans to encounter the MEC in this area.

MEC Risk Assessment Matrices – AOI-06

Matrix 1 – Likelihood of Encounter. This matrix relates the site characterization data for amount of MEC to site use (including accessibility) to determine the likelihood of encountering MEC at a specific site.

Matrix 1. Likelihood of Encounter

Likelihood of Encounter, Matrix 1: ***Amount of MEC vs. Access Conditions***		**Access Conditions (frequency of use)**			
		Regular (e.g., daily use, open access)	**Often** (e.g., less regular or periodic use, some access)	**Intermittent** (e.g., some irregular use, or access limited)	**Rare** (e.g., very limited use, access prevented)
Amount of MEC	• MEC is visible on the surface and detected in the subsurface.	Frequent	Frequent	Likely	Occasional
	• The area is identified as a Concentrated Munitions Use Area (CMUA) where MEC is known or suspected (e.g., MD indicative of MEC is identified) to be present in surface and subsurface.	Frequent	Likely	Occasional	Seldom
	• MEC presence based on physical evidence (e.g., MD indicative of MEC), although the area is not a CMUA, or • The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 1.0/acre at 95% confidence).	Likely	Occasional	Seldom	Unlikely
	• MEC presence is based on isolated historical discoveries (e.g., EOD report) prior to investigation, or • A DERP response action has been conducted to physically remove MEC and known or suspected hazard remains to support this selection, (e.g., surface removal where subsurface not addressed) or • The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 0.5/acre at 95% confidence).	Occasional	Seldom	Unlikely	Unlikely
	• *MEC presence is suspected based on historical evidence of munitions use only*, or • A DERP response action has been conducted to physically remove surface and subsurface MEC (evidence that some residual hazard remains to support this selection), or • The MEC concentration is below a project-specific threshold to support this selection (e.g., less than 0.25/acre at 95% confidence).	**Seldom**	Seldom	Unlikely	Unlikely
	• Investigation of the MRS did not identify evidence of MEC presence, or • A DERP response action has been conducted that will achieve UU/UE.	Unlikely	Unlikely	Unlikely	Unlikely

Amount of MEC Justification:

AOI-06 is the Range Fan of Artillery Targets in Ocean. This RI assumes that MEC is potentially present in the ocean range fan, since anti-aircraft and rocket firing at targets over the ocean was conducted for approximately 20 years (i.e., historical evidence only). However, there is no known documentation of MEC or MD findings by fishermen or divers in the area.

This AOI could also be a source of MEC/MD to AOI-02 and AOI-05 if munition items wash ashore following storm events, but there is no strong evidence of this occurring on a frequent basis and the more likely source of MEC findings on the beach is erosion of the bluffs.

The following MEC items might conservatively be expected to be in the ocean range fan:

- MEC: 76mm anti-aircraft artillery, 90mm and 105mm projectiles, 3.5" rockets.

Access Condition Justification:

AOI-06 is the Ocean portion of the Artillery Range Fan. It is considered to be open access and daily use for recreational swimming, as well as fishing and diving. As there are no barriers to these waters, the access or frequency of use for AOI-06 is assessed as ***Regular***.

Matrix 1 Result: ***Seldom***

Matrix 2 – Severity of Incident. This matrix assesses the likelihood of encounter rating (from Matrix 1) as related to the severity of an unintentional detonation.

Matrix 2. Severity of Incident

Severity of Explosive Incident, Matrix 2: Severity vs. Likelihood of Encounter		**Likelihood of Encounter**				
		Frequent: Regular, or inevitable occurrences	**Likely:** Several or numerous occurrences	**Occasional:** Sporadic or intermittent occurrences	**Seldom:** Infrequent, rare occurrences	**Unlikely:** Not probable
Severity Associated with Specific Munitions items	**Catastrophic/Critical:** May result in 1 or more deaths, permanent total or partial disability, or hospitalization	A	A	B	**B**	D
	Modest: May result in 1 (or more) injury resulting in emergency medical treatment, without hospitalization	B	B	B	C	D
	Minor: May result in 1 or more injuries requiring first aid or medical treatment	B	C	C	C	D
	Improbable: No injury is anticipated	D	D	D	D	D

"A" indicates conditions most likely to result in determination of an unacceptable risk.
"D" indicates conditions most likely to result in determination of an acceptable scenarios.

Severity Justification:

Detonation of the identified MEC items while being handled by a human would likely result in at least partial disability or hospitalization. Therefore, the severity is assessed as ***Catastrophic/Critical*.**

Matrix 2 Result: ***B***

Matrix 3 – Likelihood of Detonation. This matrix relates sensitivity of the MEC items to the likelihood for energy to be imparted to an item during an encounter by specific land users.

Matrix 3. Likelihood of Detonation

Likelihood of Detonation, Matrix 3: Munitions Sensitivity vs. Likelihood of Energy to be Imparted		Likelihood to Impart Energy on an Item		
		High e.g., areas planned for development, or seasonally tilled	***Modest*** e.g., undeveloped, wildlife refuge, parks	***Inconsequential*** e.g., not anticipated, prevented, mitigated
Sensitivity: Susceptibility to Detonation	***High*** (e.g., classified as sensitive)	1	1	3
	Moderate (e.g., high explosive (HE) or pyrotechnics)	1	**2**	3
	Low (e.g., propellant or bulk secondary explosives)	1	3	3
	Not Sensitive	2	3	3

<u>Sensitivity Justification:</u>

The identified MEC items would contain some amount of HE. Therefore, the sensitivity is assessed as ***Moderate*.**

<u>Likelihood to Impart Energy Justification:</u>

AOI-06 is an open access and daily use area for recreational swimming, as well as fishing and diving. However, recreational users are not very likely to encounter MEC, although it is possible. Therefore, the likelihood to impart energy is assessed as ***Modest.***

<u>Matrix 3 Result:</u> ***2***

Matrix 4 – Acceptable and Unacceptable Site Conditions. This final matrix combines the results of Matrices 2 and 3 to differentiate Acceptable and Unacceptable site conditions.

Matrix 4: Acceptable and Unacceptable Site Conditions

Acceptable and Unacceptable Site Conditions		Result From Matrix 2			
		A	B	C	D
Result from Matrix 3	1	Unacceptable	Unacceptable	Unacceptable	Acceptable
	2	Unacceptable	**Unacceptable**	Acceptable	Acceptable
	3	Unacceptable	Acceptable	Acceptable	Acceptable

Matrix 2 Result: ***A***

Matrix 3 Result: ***2***

Matrix 4 Result: ***Unacceptable***

The risk matrices demonstrate that AOI-06 currently has an unacceptable risk from MEC hazards due to the combination of severity of incident and likelihood of detonation factors.

Therefore, the baseline site condition for AOI-06 is assessed to be ***Unacceptable***.

Unacceptable initial conditions typically proceed to the next phase of the CERCLA response process, where remedial action is warranted. Evaluation of the matrices indicates that the unacceptable risk for this area could be reduced to an acceptable risk by reducing/eliminating the likelihood for humans to encounter the MEC in this area.

APPENDIX F: MUNITIONS RESPONSE SITE PRIORITIZATION PROTOCOL

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Table A

MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from Service and DoD databases. 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 (e.g., benzene, trichloroethylene) found at the MRS, and any potentially exposed human and ecological receptors. If possible, include a map of the MRS.

Munitions Response Site Name: Area of Interest **(AOI)-01**
Component: U.S. Army Corps of Engineers Formerly Used Defense Site (FUDS) Program
Installation/Property Name: Former Camp Wellfleet
Location (City, County, State): Town of Wellfleet, Barnstable County, Massachusetts
Site Name/Project Name (Project No.): Former Camp Wellfleet FUDS

Date Information Entered/Updated: 08/13/2018
Point of Contact (Name/Phone): Gina Kaso, CENAE PM (978-318-8180)
Project Phase (check only one):

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

Media Evaluated (check all that apply):

☐ Groundwater	☐ Sediment (human receptor)
☑ Surface soil – Subsurface 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, or MC known or suspected to be present. When possible, identify munitions, CWM, and MC by type:

Camp Wellfleet training activities occurred from 1942 to 1961. It is currently owned and managed by the National Park Service (NPS) as part of the Cape Cod National Seashore.

AOI-01 is an area of burial/disposal pits. This area was initially considered an Open Burn/Open Detonation, but findings from a removal action conducted to physically remove subsurface MEC ultimately determined these to be disposal pits for MD and non-munitions debris. MEC presence is possible if other disposal pits exist in the AOI (see RI Section 3.1.1).

No MEC was found in AOI-01. The following MD items were found in the subsurface of AOI-01: Numerous items (1,040 lbs MD in single burial pit), including 3.5" practice rockets, 3 expended M2 anti-personnel mines, 407 M48 flashtubes, 1 m7A3 2.36" practice rocket, and part of an inert filled M65 1,000lb "Dove" guided bomb.

However, using the MEC risk assessment matrix methodology (RI Appendix E), no unacceptable MEC risks are posed by this AOI.

For MC characterization, Incremental Soil (IS) sampling of surface soil was conducted from three sampling units (SUs) within the burial pits, and eight discrete subsurface soil samples from two SUs. Analytical parameters included select metals (antimony, copper, lead, manganese, nickel, and zinc) and select explosives (RDX, TNT, nitroglycerin, 2,4-dinitrotoluene, 2,6-dinitrotoluene, tetryl, and nitroguanidine (See RI Sections 3.3 and 3.4).

MC sampling results indicated two metals above background in soil, but the screen against project screening levels showed no MC releases, no risks to human health and the environment, and therefore, no HHRA or SLERA were conducted.

Description of Pathways for Human and Ecological Receptors:
The source of potential MC is primarily the result of historical military activities, including the firing of artillery, practice bombing, and small arms. Exposure to receptors by ingestion, inhalation, and dermal contact are potentially complete

pathways. Groundwater is not a pathway of concern unless MC soil sampling results indicate a possible impact to groundwater.

Potential for contact with MEC includes walking over surface MEC, handling/collecting MEC, or contact with subsurface MEC due to any intrusive activities (see RI Section 3.1.2).

Description of Receptors (Human and Ecological):
Potential receptors to MC in the Former Camp Wellfleet include human populations, animal species, or habitats that may be exposed to site-related MC in soil or groundwater. Human receptors include Recreational Users (including fishermen), Site Workers (including NPS Staff and Road/Utility Workers), and Construction Workers. Ecological receptors include various birds, mammals, invertebrates, flora, and fauna that occur within the Former Camp Wellfleet (see RI Section 3.3.1).

However, a complete pathway requires a source of contaminants, and based on site sampling results, no MC contaminant source was identified. The updated CSM (RI Figure 16) shows that there are no complete pathways for MC based on the sample results.

While no MEC has been found, potential for MEC in burial pits was scored. However, based on the MEC risk matrix methodology assessment of no unacceptable explosive risks (RI Section 5.1.1), this AOI has been given the **alternative rating of No Longer Required**.

There is no physical or historical evidence indicating that CWM was present at this AOI. Therefore, **the CHE module has been assigned the alternative rating of No Known or Suspected CWM Hazard**.

MC sampling results indicated two metals above background in soil, but the screening against project screening levels showed no MC releases, and no risks to human health and the environment, and accordingly, **the HHE module has been assigned the alternative rating of No Known or Suspected MC Hazard.**

The overall Priority Rating for AOI-01 is ‘No Longer Required’, based on the EHE module.

Table 1

EHE Module: Munitions Type Data Element Table

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

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

Classification	Description	Score
Sensitive	◆ UXO that are considered most 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). ◆ 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)	◆ UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered "sensitive." ◆ 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)	◆ UXO containing a pyrotechnic filler other than white phosphorus (e.g., flares, signals, simulators, smoke grenades). ◆ DMM containing a pyrotechnic filler other than white phosphorus (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)	◆ 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	◆ UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ 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	◆ DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ DMM that are 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)	◆ DMM containing a pyrotechnic filler (i.e., red phosphorus), other than white phosphorus filler, that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	10
Practice	◆ UXO that are practice munitions that are not associated with a sensitive fuze. ◆ 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	◆ UXO or DMM containing a riot control agent filler (e.g., tear gas).	3
Small arms	◆ 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 **<u>the single highest score</u>** from above in the box to the right (maximum score = 30).	25

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

While no MEC was found in AOI-01, the table is scored based on potential MEC (potential DMM in burn pit).

The following MD items were found in the subsurface of AOI-01: Numerous items (1,040 lbs MD in single burial pit), including 3.5" practice rockets, 3 expended M2 anti-personnel mines, 407 M48 flashtubes, 1 m7A3 2.36" practice rocket, and part of an inert filled M65 1,000lb "Dove" guided bomb (see RI Table 3-1).

Table 2

EHE Module: Source of Hazard Data Element Table

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

Note: The terms *former range, practice munitions, small arms range, 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 and associated buffer and safety zones.	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.	$\boxed{5}$
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 **<u>the single highest score</u>** from above in the box to the right (maximum score = 10).	$\boxed{5}$

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

AOI-01 is an area of burial/disposal pits. This area was initially considered an Open Burn/Open Detonation, but findings from a removal action conducted to physically remove subsurface MEC ultimately determined these to be disposal pits for MD and non-munitions debris (see RI Section 3.1.1).

Table 3

EHE Module: Location of Munitions Data Element Table

DIRECTIONS: Below are eight classifications of munitions locations and their descriptions. Circle the scores that correspond with **all** the locations where munitions are known or suspected to be present at the MRS.

Note: The terms *confirmed, surface, subsurface, small arms ammunition, 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 (i.e., a confirmed report such as an explosive ordnance disposal [EOD], police, or fire department report that an incident or accident that involved UXO or DMM occurred) 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 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 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 as 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.	$\boxed{10}$
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).	$\boxed{10}$

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

There is physical evidence of munitions in the form of the recovered MD. See RI Section 3.1.2.

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 the MRS. 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.	$\boxed{8}$
Barrier to MRS access is complete but not monitored	◆ There is a barrier preventing access to all parts of the MRS, but there is no surveillance (e.g., by a guard) to ensure that the barrier is effectively preventing access to all parts of the MRS.	5
Barrier to MRS access is complete and monitored	◆ There is a barrier preventing access to all parts of the MRS, and there is active, continual surveillance (e.g., by a guard, video monitoring) to ensure that the barrier is effectively preventing access to all parts of the MRS.	0
EASE OF ACCESS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	**8**

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

While AOI-01 is accessible by park visitors, the rough trails make traversing by vehicle difficult. Pedestrian traffic is common on the unpaved trails. There is some semi-dense natural vegetation that acts as a natural barrier to limit pedestrian access, however there are no man-made barrier restrictions. See RI Figures 3 & 4, and Section 2.1.

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. ◆ The MRS is at a location that is owned by DoD, but that DoD has leased to another entity and for which DoD does not control access 24 hours per day.	$\boxed{5}$
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 Protocol 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).	$\boxed{5}$

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

This is a FUDS, owned and managed by the NPS, with a smaller portion owned and managed by the Town of Wellfleet (see RI Sections 1.2 and 1.3).

Table 6

EHE Module: Population Density Data Element Table

DIRECTIONS: Below are three classifications for population density and their descriptions. Determine the population density per square mile that most closely corresponds with the population of the MRS, including the area within a two-mile radius of the MRS's perimeter. Circle the most appropriate score.

Note: Use the U.S. Census Bureau tract data available to capture the **highest** population density within a two-mile radius of the perimeter of the MRS.

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

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

The population density per square mile in the county in which the Former Camp Wellfleet is located is approximately 548: https://www.census.gov/quickfacts/fact/table/barnstablecountymassachusetts/PST045217

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 potential population near the MRS. Determine the number of inhabited structures within two miles of the MRS boundary and circle the score that corresponds with the number of inhabited structures.

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.

There are many more than 26 or more inhabited structures using Google Earth to calculate the total number of inhabited structures within the two-mile radius for this AOI. Inhabited structures include homes, commercial buildings, motels/hotels, and beach houses for use by recreational visitors.

Table 8

EHE Module: Types of Activities/Structures Data Element Table

DIRECTIONS: Below are five classifications of activities and/or inhabited structures 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 scores 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.	$\boxed{5}$
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.

Types of activities/structures within 2 miles include NPS buildings, homes, commercial buildings, motels/hotels, and beach houses for use by recreational visitors. See RI Figures 1 & 3, and Section 2.1.

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 resources present on 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.	$\boxed{3}$
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).	$\boxed{3}$

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

Ecological receptors include various birds, mammals, invertebrates, flora, and fauna that occur within the Former Camp Wellfleet. Wildlife species at the Cape Cod National Seashore include twelve species of amphibians, 370 species of birds, 59 species of mammals, five species of migratory marine turtles, and 13 species of land-based reptiles (NPS website, https://www.nps.gov/caco)(see RI Section 3.3.1).

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
Munitions Type	Table 1	25	30
Source of Hazard	Table 2	5	
Accessibility Factor Data Elements			
Location of Munitions	Table 3	10	23
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	**No Longer Required**

Based on the MEC risk matrix methodology assessment of no unacceptable explosive risks (RI Section 5.1.1) for this AOI, the Alternative Rating of No Longer Required has been given.

Table 11

CHE Module: CWM Configuration Data Element Table

DIRECTIONS: Below are seven classifications of CWM configuration and their descriptions. Circle the scores that correspond with **all** the 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, that are either UXO, or explosively configured damaged DMM	The CWM known or suspected of being present at the MRS are: ◆ 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 undamaged 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/DMM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS are: ◆ Nonexplosively configured CWM/DMM either damaged or undamaged ◆ Bulk CWM (e.g., ton container).	15
CAIS K941 and CAIS K942	◆ The CWM/DMM known or suspected of being present at the MRS are CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12
CAIS (chemical agent identification sets)	◆ 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.	$\boxed{0}$
CWM CONFIGURATION	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	$\boxed{0}$

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

There is no physical or historical evidence indicating that CWM was present at AOI-01. See RI Section 1.5.

Tables 12 through 19 are intentionally omitted

Per Active Army Guidance (U.S. Army, 2009)

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

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

Table 21

HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's groundwater and their comparison values (from Appendix B of the Primer) 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 contaminant ratios together, including any additional groundwater 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.

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).		

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 the 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).	

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).	
	No Known or Suspected Groundwater MC Hazard	☐

Groundwater was not a pathway of concern for this AOI and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant ratios together, including any additional surface water 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 with human endpoints present in the surface water, select the box at the bottom of the table.

Contaminant	Maximum Concentration (μg/L)	Comparison Value (μg/L)	Ratios
CHF Scale	*CHF Value*	**Sum The Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$$

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

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 the 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).	

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).	

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

Surface water was not a pathway of concern and was not sampled (see RI Section 3.3.1).

Table 23

HHE Module: Sediment – Human 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 of the Primer) 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 contaminant ratios together, including any additional sediment 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 with human endpoints present in the sediment, select the box at the bottom of the table.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
CHF Scale	*CHF Value*	**Sum The Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$$

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

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 the 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).	

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).	

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

Sediment was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant ratios together, including any additional surface water 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 with ecological endpoints present in the surface water, select the box at the bottom of the table.

Contaminant	Maximum Concentration (μg/L)	Comparison Value (μg/L)	Ratios
CHF Scale	*CHF Value*	**Sum the Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$$

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

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 the 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).	

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).	

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

Surface water was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant ratios together, including any additional sediment 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 with ecological endpoints present in the sediment, select the box at the bottom of the table.*

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).		

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 the 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).	

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).	

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

Sediment was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant **ratios** together, including any additional surface soil contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record **CHF Value**. If there is no known or suspected MC hazard with present in the surface soil, select the box at the bottom of the table.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
Copper	8.40	3,100	0.003
Zinc	20.0	23,000	0.0009
CHF Scale	**CHF Value**	**Sum the Ratios**	0.004
CHF > 100	**H (High)**	$\text{CHF} = \sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		L

Migratory Pathway Factor

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

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

Receptor Factor

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

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

No Known or Suspected Surface Soil MC Hazard ☐

Soil sampling included IS surface soil samples from three SUs within the burial pits, and eight discrete subsurface soil samples from two SUs.

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 in any given medium present at the MRS. **This is a supplemental table designed to hold information about contaminants that do no 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 of the Primer) 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: **Do not 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 **HHE Ratings** 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)					NA
Surface Water/Human Endpoint (Table 22)					NA
Sediment/ Human Endpoint (Table 23)					NA
Surface Water/Ecological Endpoint (Table 24)					NA
Sediment/Ecological Endpoint (Table 25)					NA
Surface Soil (Table 26)	L	M	M		**MML**

DIRECTIONS (cont.):

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

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.

HHE MODULE RATING	E

HHE Ratings (for reference only)

Combination	Rating
HHH	A
HHM	B
HHL	C
HMM	C
HML	D
MMM	D
HLL	E
MML	E
MLL	F
LLL	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected MC Hazard

MC sampling results indicated two metals above background in soil, but the RI screen against project screening levels showed no MC releases, no risks to human health and the environment, and accordingly, **the HHE module has been assigned the alternative rating of 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 relative priority in the MRS Priority or Alternative MRS Rating 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 PRIORITY or ALTERNATIVE MRS RATING				**No Longer Required**	

Table A

MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from Service and DoD databases. 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 (e.g., benzene, trichloroethylene) found at the MRS, and any potentially exposed human and ecological receptors. If possible, include a map of the MRS.

Munitions Response Site Name: Area of Interest **(AOI)-02**
Component: U.S. Army Corps of Engineers Formerly Used Defense Site (FUDS) Program
Installation/Property Name: Former Camp Wellfleet
Location (City, County, State): Town of Wellfleet, Barnstable County, Massachusetts
Site Name/Project Name (Project No.): Former Camp Wellfleet FUDS

Date Information Entered/Updated: 08/13/2018
Point of Contact (Name/Phone): Gina Kaso, CENAE PM (978-318-8180)
Project Phase (check only one):

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

Media Evaluated (check all that apply):

☐ Groundwater	☐ Sediment (human receptor)
☑ Surface soil – Subsurface 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, or MC known or suspected to be present. When possible, identify munitions, CWM, and MC by type:

Camp Wellfleet training activities occurred from 1942 to 1961. It is currently owned and managed by the National Park Service (NPS) as part of the Cape Cod National Seashore.

AOI-02 is the Former Artillery Firing Line. These were firing points for 90mm and other artillery, primarily firing out to sea (the ocean range is AOI-06). MEC presence has been established; while no MEC were found during the EE/CA or Zapata Removal Actions, a 76mm anti-aircraft artillery round was found within this area (Marconi Beach) in October 2016 and was determined to be MEC. The MEC item found was a result of the erosion of the high bluff with the item ultimately found in the beach area (see RI Section 3.1.1). As this AOI includes most of the Former Camp Wellfleet FUDS shoreline, it may also see munition items washing ashore following storm events.

The following MEC and MD items were found in the surface or subsurface of AOI-02:

MEC: 76mm anti-aircraft artillery. MD: 50 caliber machine gun ammunition, fuze cans, shipping clips for 90mm fuzes, and 30 caliber ammunition cans, calcium hydride canisters, and unknown frag. The item was considered to be DMM based on remnants of packaging.

For MC characterization, Incremental Soil (IS) sampling of surface soil was conducted from three sampling units (SUs). As described in RI Table 3-9, SU locations were based on TEC ground scars and/or previous munitions debris finds. Analytical parameters included select metals (antimony, copper, lead, manganese, nickel, and zinc) and select explosives (RDX, TNT, nitroglycerin, 2,4-dinitrotoluene, 2,6-dinitrotoluene, tetryl, and nitroguanidine (See RI Sections 3.3 and 3.4).

All results for all samples for this AOI were less than the background indicating that there were no MC releases, no risks to human health and the environment, and therefore, no HHRA or SLERA were conducted.

Description of Pathways for Human and Ecological Receptors:
The source of potential MC is primarily the result of historical military activities, including the firing of artillery, practice bombing, and small arms. Exposure to receptors by ingestion, inhalation, and dermal contact are potentially complete

pathways. Groundwater is not a pathway of concern unless MC soil sampling results indicate a possible impact to groundwater.

Potential for contact with MEC includes walking over surface MEC, handling/collecting MEC, or contact with subsurface MEC due to any intrusive activities (see RI Section 3.1.3).

Description of Receptors (Human and Ecological):

Potential receptors to MC in the Former Camp Wellfleet include human populations, animal species, or habitats that may be exposed to site-related MC in soil or groundwater. Human receptors include Recreational Users (including fishermen), Site Workers (including NPS Staff and Road/Utility Workers), and Construction Workers. Ecological receptors include various birds, mammals, invertebrates, flora, and fauna that occur within the Former Camp Wellfleet (see RI Section 3.3.1).

However, a complete pathway requires a source of contaminants, and based on site sampling results, no MC contaminant source was identified. The updated CSM (RI Figure 16) shows that there are no complete pathways for MC based on the sample results.

MEC has been found (76mm anti-aircraft artillery). MD has been recovered, including 50 caliber machine gun ammunition, fuze cans, shipping clips for 90mm fuzes, and 30 caliber ammunition cans, calcium hydride canisters, and unknown frag. Based on this scenario, **the EHE module has been assigned an ‘A’ rating.**

There is no physical or historical evidence indicating that CWM was present at this AOI. Therefore, **the CHE module has been assigned the alternative rating of No Known or Suspected CWM Hazard**.

MC sampling results indicated no constituents above background in soil, and therefore no MC releases or risks to human health and the environment, and accordingly, **the HHE module has been assigned the alternative rating of No Known or Suspected MC Hazard.**

The overall Priority Rating for AOI-02 is ‘2’, based on the EHE module.

Table 1

EHE Module: Munitions Type Data Element Table

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

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

Classification	Description	Score
Sensitive	◆ UXO that are considered most 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). ◆ 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)	◆ UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered "sensitive." ◆ DMM containing a high-explosive filler that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	$\boxed{25}$
Pyrotechnic (used or damaged)	◆ UXO containing a pyrotechnic filler other than white phosphorus (e.g., flares, signals, simulators, smoke grenades). ◆ DMM containing a pyrotechnic filler other than white phosphorus (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)	◆ 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	◆ UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ 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	◆ DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ DMM that are 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)	◆ DMM containing a pyrotechnic filler (i.e., red phosphorus), other than white phosphorus filler, that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	10
Practice	◆ UXO that are practice munitions that are not associated with a sensitive fuze. ◆ 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	◆ UXO or DMM containing a riot control agent filler (e.g., tear gas).	3
Small arms	◆ 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 **<u>the single highest score</u>** from above in the box to the right (maximum score = 30).	$\boxed{25}$

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

MEC has been found (76mm anti-aircraft artillery). See RI Table 3-1.

Table 2

EHE Module: Source of Hazard Data Element Table

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

Note: The terms *former range, practice munitions, small arms range, 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 and associated buffer and safety zones.	$\boxed{10}$
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).	$\boxed{10}$

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

AOI-02 is the Former Artillery Firing Line. These were firing points for 90mm and other artillery, primarily firing out to sea. MEC presence has been established with a 76mm anti-aircraft artillery round migrating to the surface as a result of the erosion of the high bluff (see RI Section 3.1.1). As this AOI includes most of the Former Camp Wellfleet FUDS shoreline, it is also likely to see munition items washing ashore following storm events.

Table 3

EHE Module: Location of Munitions Data Element Table

DIRECTIONS: Below are eight classifications of munitions locations and their descriptions. Circle the scores that correspond with **all** the locations where munitions are known or suspected to be present at the MRS.

Note: The terms *confirmed, surface, subsurface, small arms ammunition, 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 (i.e., a confirmed report such as an explosive ordnance disposal [EOD], police, or fire department report that an incident or accident that involved UXO or DMM occurred) indicates there are UXO or DMM on the surface of the MRS.	$\boxed{25}$
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 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 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 as 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).	$\boxed{25}$

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

MEC presence has been established with a 76mm anti-aircraft artillery round recovered from the surface (RI Section 3.1.2).

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 the MRS. Circle the score that corresponds with the ease of access to the MRS.

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

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

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

AOI-02 is a moderate to high traffic beach access area. While the central and southern portions contain few trails and a high density of natural vegetation that limits pedestrian access, most of the northern part of AOI-02 contains high volume pedestrian and vehicle traffic associated with beach access. The southern beach areas are essentially open access through adjacent AOI-05. See Figures 3 & 4, and Section 2.1.

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. ◆ The MRS is at a location that is owned by DoD, but that DoD has leased to another entity and for which DoD does not control access 24 hours per day.	$\boxed{5}$
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 Protocol 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).	$\boxed{5}$

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

This is a FUDS, owned and managed by the NPS, with a smaller portion owned and managed by the Town of Wellfleet (see RI Sections 1.2 and 1.3).

Table 6

EHE Module: Population Density Data Element Table

DIRECTIONS: Below are three classifications for population density and their descriptions. Determine the population density per square mile that most closely corresponds with the population of the MRS, including the area within a two-mile radius of the MRS's perimeter. Circle the most appropriate score.

Note: Use the U.S. Census Bureau tract data available to capture the **highest** population density within a two-mile radius of the perimeter of the MRS.

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

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

The population density per square mile in the county in which the Former Camp Wellfleet is located is approximately 548: https://www.census.gov/quickfacts/fact/table/barnstablecountymassachusetts/PST045217

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 potential population near the MRS. Determine the number of inhabited structures within two miles of the MRS boundary and circle the score that corresponds with the number of inhabited structures.

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.

There are many more than 26 or more inhabited structures using Google Earth to calculate the total number of inhabited structures within the two-mile radius for this AOI. Inhabited structures include homes, commercial buildings, motels/hotels, and beach houses for use by recreational visitors.

Table 8

EHE Module: Types of Activities/Structures Data Element Table

DIRECTIONS: Below are five classifications of activities and/or inhabited structures 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 scores 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.

Types of activities/structures within 2 miles include NPS buildings, homes, commercial buildings, motels/hotels, and beach houses for use by recreational visitors. See Figures 1 & 3, and Section 2.1.

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 resources present on the MRS.

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

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

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

Ecological receptors include various birds, mammals, invertebrates, flora, and fauna that occur within the Former Camp Wellfleet. Wildlife species at the Cape Cod National Seashore include twelve species of amphibians, 370 species of birds, 59 species of mammals, five species of migratory marine turtles, and 13 species of land-based reptiles (NPS website, https://www.nps.gov/caco)(see RI Section 3.3.1).

Cultural resources include the historic Marconi Tower in the northern part of the AOI. See Figures 2 & 3, and Section 2.1.

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
Munitions Type	Table 1	25	35
Source of Hazard	Table 2	10	
Accessibility Factor Data Elements			
Location of Munitions	Table 3	25	40
Ease of Access	Table 4	10	
Status of Property	Table 5	5	
Receptor Factor Data Elements			
Population Density	Table 6	5	20
Population Near Hazard	Table 7	5	
Types of Activities/Structures	Table 8	5	
Ecological and /or Cultural Resources	Table 9	5	
		EHE MODULE TOTAL	**95**

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	**A**

Table 11

CHE Module: CWM Configuration Data Element Table

DIRECTIONS: Below are seven classifications of CWM configuration and their descriptions. Circle the scores that correspond with **all** the 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, that are either UXO, or explosively configured damaged DMM	The CWM known or suspected of being present at the MRS are: ◆ 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 undamaged 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/DMM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS are: ◆ Nonexplosively configured CWM/DMM either damaged or undamaged ◆ Bulk CWM (e.g., ton container).	15
CAIS K941 and CAIS K942	◆ The CWM/DMM known or suspected of being present at the MRS are CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12
CAIS (chemical agent identification sets)	◆ 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.	$\boxed{0}$
CWM CONFIGURATION	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	$\boxed{0}$

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

There is no physical or historical evidence indicating that CWM was present at this AOI. See RI Section 1.5.

Tables 12 through 19 are intentionally omitted

Per Active Army Guidance (U.S. Army, 2009)

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

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

Table 21

HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's groundwater and their comparison values (from Appendix B of the Primer) 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 contaminant ratios together, including any additional groundwater 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.

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).		

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 the 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).	

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).	
	No Known or Suspected Groundwater MC Hazard	☐

Groundwater was not a pathway of concern for this AOI (see RI Section 3.3.1).

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 of the Primer) 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 contaminant ratios together, including any additional surface water 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 with human endpoints present in the surface water, select the box at the bottom of the table.

Contaminant	Maximum Concentration (μg/L)	Comparison Value (μg/L)	Ratios
CHF Scale	*CHF Value*	**Sum The Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$$

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

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 the 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).	

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

Surface water was not a pathway of concern and was not sampled (see RI Section 3.3.1).

Table 23

HHE Module: Sediment – Human 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 of the Primer) 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 contaminant ratios together, including any additional sediment 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 with human endpoints present in the sediment, select the box at the bottom of the table.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
CHF Scale	*CHF Value*	**Sum The Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$$

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

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 the 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).	

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).	

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

Sediment was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant ratios together, including any additional surface water 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 with ecological endpoints present in the surface water, select the box at the bottom of the table.

Contaminant	Maximum Concentration (μg/L)	Comparison Value (μg/L)	Ratios
CHF Scale	*CHF Value*	**Sum the Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$$

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

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 the 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).	

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).	

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

Surface water was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant ratios together, including any additional sediment 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 with ecological endpoints present in the sediment, select the box at the bottom of the table.*

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
CHF Scale	*CHF Value*	**Sum the Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$$

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

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 the 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).	

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).	

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

Sediment was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant **ratios** together, including any additional surface soil contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record **CHF Value**. If there is no known or suspected MC hazard with present in the surface soil, select the box at the bottom of the table.

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).		

Migratory Pathway Factor

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

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

Receptor Factor

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

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

No Known or Suspected Surface Soil MC Hazard ☑

Soil sampling included IS sampling of surface soil collected from three sampling units SUs. However, all results were less than the background.

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 in any given medium present at the MRS. **This is a supplemental table designed to hold information about contaminants that do no 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 of the Primer) 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: **Do not 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 **HHE Ratings** 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)					NA
Surface Water/Human Endpoint (Table 22)					NA
Sediment/ Human Endpoint (Table 23)					NA
Surface Water/Ecological Endpoint (Table 24)					NA
Sediment/Ecological Endpoint (Table 25)					NA
Surface Soil (Table 26)					**No Known or Suspected Hazard**

DIRECTIONS (cont.):

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

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.

HHE MODULE RATING	NKSH

HHE Ratings (for reference only)

Combination	Rating
HHH	A
HHM	B
HHL	C
HMM	C
HML	D
MMM	D
HLL	E
MML	E
MLL	F
LLL	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected MC Hazard

Because all results were less than the background for this AOI, there is no MC release and no unacceptable risk is posed by any media, and therefore, the HHE module has been assigned an alternative rating of No Known or Suspected 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 relative priority in the MRS Priority or Alternative MRS Rating 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 PRIORITY or ALTERNATIVE MRS RATING				**2**	

Table A

MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from Service and DoD databases. 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 (e.g., benzene, trichloroethylene) found at the MRS, and any potentially exposed human and ecological receptors. If possible, include a map of the MRS.

Munitions Response Site Name: Area of Interest **(AOI)-03**
Component: U.S. Army Corps of Engineers Formerly Used Defense Site (FUDS) Program
Installation/Property Name: Former Camp Wellfleet
Location (City, County, State): Town of Wellfleet, Barnstable County, Massachusetts
Site Name/Project Name (Project No.): Former Camp Wellfleet FUDS

Date Information Entered/Updated: 08/13/2018
Point of Contact (Name/Phone): Gina Kaso, CENAE PM (978-318-8180)
Project Phase (check only one):

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

Media Evaluated (check all that apply):

☑ Groundwater	☐ Sediment (human receptor)
☑ Surface soil – Subsurface 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, or MC known or suspected to be present. When possible, identify munitions, CWM, and MC by type:

Camp Wellfleet training activities occurred from 1942 to 1961. It is currently owned and managed by the National Park Service (NPS) as part of the Cape Cod National Seashore.

AOI-03 is the former Ammunition Supply Point, with multiple U-shaped revetments possibly used to store ammunition. It also includes an area of multiple ground scars identified from 1943 and 1947 aerial photos.

A single Rifle Smoke Grenade found during the EE/CA was considered to be MEC. Additionally, abundant MD was found during previous investigations (see RI Section 3.1.1).

The following MEC item and MD items were found in the surface or subsurface of AOI-03:

MEC: Rifle Smoke Grenade.
MD: Multiple fuze shipping spacers, some small arms debris.

However, using the MEC risk assessment matrix methodology (RI Appendix E), no unacceptable MEC risks are posed by this AOI.

For MC characterization, Incremental Soil (IS) sampling of surface soil was conducted from three sampling units (SUs) and IS subsurface soil samples from one SU. As described in RI Table 3-9, SU locations were based on previous munitions debris finds. Analytical parameters included select metals (antimony, copper, lead, manganese, nickel, and zinc) and select explosives (RDX, TNT, nitroglycerin, 2,4-dinitrotoluene, 2,6-dinitrotoluene, tetryl, and nitroguanidine (See RI Sections 3.3 and 3.4).

MC sampling results determined that additional soil or groundwater sampling was not warranted. The RI screening indicated that there were no MC releases, no risks to human health and the environment, and therefore, no HHRA or SLERA were conducted.

Description of Pathways for Human and Ecological Receptors:
The source of potential MC is primarily the result of historical military activities, including the firing of artillery, practice bombing, and small arms. Exposure to receptors by ingestion, inhalation, and dermal contact are potentially complete pathways. Groundwater is not a pathway of concern unless MC soil sampling results indicate a possible impact to groundwater.

Potential for contact with MEC includes walking over surface MEC, handling/collecting MEC, or contact with subsurface MEC due to any intrusive activities (see RI Section 3.1.2).

Description of Receptors (Human and Ecological):
Potential receptors to MC in the Former Camp Wellfleet include human populations, animal species, or habitats that may be exposed to site-related MC in soil or groundwater. Human receptors include Recreational Users (including fishermen), Site Workers (including NPS Staff and Road/Utility Workers), and Construction Workers. Ecological receptors include various birds, mammals, invertebrates, flora, and fauna that occur within the Former Camp Wellfleet (see RI Section 3.3.1).

However, a complete pathway requires a source of contaminants, and based on site sampling results, no MC contaminant source was identified. The updated CSM (RI Figure 16) shows that there are no complete pathways for MC based on the sample results.

MEC (Rifle Smoke Grenade), and MD (multiple fuze shipping spacers, some small arms debris) have been found. However, based on the MEC risk matrix methodology assessment of no unacceptable explosive risks (RI Section 5.1.1), this AOI has been given the **alternative rating of No Longer Required**.

There is no physical or historical evidence indicating that CWM was present at this AOI. Therefore, **the CHE module has been assigned the alternative rating of No Known or Suspected CWM Hazard**.

MC sampling results indicated metals above background in soil and groundwater, but the RI screen against project screening levels showed no MC releases, no risks to human health and the environment, and accordingly, **the HHE module has been assigned the alternative rating of No Known or Suspected MC Hazard.**

The overall Priority Rating for AOI-03 is 'No Longer Required', based on the EHE module.

Table 1

EHE Module: Munitions Type Data Element Table

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

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

Classification	Description	Score
Sensitive	◆ UXO that are considered most 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). ◆ 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)	◆ UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered "sensitive." ◆ 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)	◆ UXO containing a pyrotechnic filler other than white phosphorus (e.g., flares, signals, simulators, smoke grenades). ◆ DMM containing a pyrotechnic filler other than white phosphorus (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)	◆ 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	◆ UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ 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	◆ DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ DMM that are 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)	◆ DMM containing a pyrotechnic filler (i.e., red phosphorus), other than white phosphorus filler, that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	10
Practice	◆ UXO that are practice munitions that are not associated with a sensitive fuze. ◆ 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	◆ UXO or DMM containing a riot control agent filler (e.g., tear gas).	3
Small arms	◆ 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).	**20**

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

MEC (Rifle Smoke Grenade) has been found (see RI Table 3-1).

Table 2

EHE Module: Source of Hazard Data Element Table

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

Note: The terms *former range, practice munitions, small arms range, 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 and associated buffer and safety zones.	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).	$\boxed{2}$
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).	$\boxed{2}$

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

AOI-03 is the former Ammunition Supply Point, with multiple U-shaped revetments possibly used to store ammunition (see RI Section 3.1.1). This is the best fit from the choices provided.

Table 3

EHE Module: Location of Munitions Data Element Table

DIRECTIONS: Below are eight classifications of munitions locations and their descriptions. Circle the scores that correspond with **all** the locations where munitions are known or suspected to be present at the MRS.

Note: The terms *confirmed, surface, subsurface, small arms ammunition, 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 (i.e., a confirmed report such as an explosive ordnance disposal [EOD], police, or fire department report that an incident or accident that involved UXO or DMM occurred) 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 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 heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM.	$\boxed{20}$
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 as 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).	$\boxed{20}$

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

MEC presence has been established with the Rifle Smoke Grenade recovered from the subsurface. See RI Section 3.1.2.

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 the MRS. 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.	$\boxed{8}$
Barrier to MRS access is complete but not monitored	◆ There is a barrier preventing access to all parts of the MRS, but there is no surveillance (e.g., by a guard) to ensure that the barrier is effectively preventing access to all parts of the MRS.	5
Barrier to MRS access is complete and monitored	◆ There is a barrier preventing access to all parts of the MRS, and there is active, continual surveillance (e.g., by a guard, video monitoring) to ensure that the barrier is effectively preventing access to all parts of the MRS.	0
EASE OF ACCESS	**DIRECTIONS:** Record **<u>the single highest score</u>** from above in the box to the right (maximum score = 10).	$\boxed{8}$

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

AOI-03 is a moderate traffic area with unpaved trails and a paved road. There is a gate limiting vehicle traffic onto unpaved trails, and there is some semi-dense natural vegetation and rough terrain that act as a natural barrier that limits pedestrian access, however there are no man-made barrier restrictions to pedestrians. See RI Figures 3 & 4, and Section 2.1.

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. ◆ The MRS is at a location that is owned by DoD, but that DoD has leased to another entity and for which DoD does not control access 24 hours per day.	$\boxed{5}$
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 Protocol 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.

This is a FUDS, owned and managed by the NPS, with a smaller portion owned and managed by the Town of Wellfleet (see RI Sections 1.2 and 1.3).

Table 6

EHE Module: Population Density Data Element Table

DIRECTIONS: Below are three classifications for population density and their descriptions. Determine the population density per square mile that most closely corresponds with the population of the MRS, including the area within a two-mile radius of the MRS's perimeter. Circle the most appropriate score.

Note: Use the U.S. Census Bureau tract data available to capture the **highest** population density within a two-mile radius of the perimeter of the MRS.

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

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

The population density per square mile in the county in which the Former Camp Wellfleet is located is approximately 548: https://www.census.gov/quickfacts/fact/table/barnstablecountymassachusetts/PST045217

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 potential population near the MRS. Determine the number of inhabited structures within two miles of the MRS boundary and circle the score that corresponds with the number of inhabited structures.

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.

There are many more than 26 or more inhabited structures using Google Earth to calculate the total number of inhabited structures within the two-mile radius for this AOI. Inhabited structures include homes, commercial buildings, motels/hotels, and beach houses for use by recreational visitors.

Table 8

EHE Module: Types of Activities/Structures Data Element Table

DIRECTIONS: Below are five classifications of activities and/or inhabited structures 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 scores 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.	$\boxed{5}$
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.

Types of activities/structures within 2 miles include NPS buildings, homes, commercial buildings, motels/hotels, and beach houses for use by recreational visitors. See RI Figures 1 & 3, and Section 2.1.

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 resources present on 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.	$\boxed{3}$
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).	$\boxed{3}$

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

Ecological receptors include various birds, mammals, invertebrates, flora, and fauna that occur within the Former Camp Wellfleet. Wildlife species at the Cape Cod National Seashore include twelve species of amphibians, 370 species of birds, 59 species of mammals, five species of migratory marine turtles, and 13 species of land-based reptiles (NPS website, https://www.nps.gov/caco)(see RI Section 3.3.1).

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
Munitions Type	Table 1	20	22
Source of Hazard	Table 2	2	
Accessibility Factor Data Elements			
Location of Munitions	Table 3	20	33
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	73

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	**No Longer Required**

Based on the MEC risk matrix methodology assessment of no unacceptable explosive risks (RI Section 5.1.1) for this AOI, the Alternative Rating of No Longer Required has been given

Table 11

CHE Module: CWM Configuration Data Element Table

DIRECTIONS: Below are seven classifications of CWM configuration and their descriptions. Circle the scores that correspond with **all** the 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, that are either UXO, or explosively configured damaged DMM	The CWM known or suspected of being present at the MRS are: ◆ 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 undamaged 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/DMM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS are: ◆ Nonexplosively configured CWM/DMM either damaged or undamaged ◆ Bulk CWM (e.g., ton container).	15
CAIS K941 and CAIS K942	◆ The CWM/DMM known or suspected of being present at the MRS are CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12
CAIS (chemical agent identification sets)	◆ 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.

There is no physical or historical evidence indicating that CWM was present at this AOI. See RI Section 1.5.

Tables 12 through 19 are intentionally omitted

Per Active Army Guidance (U.S. Army, 2009)

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

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

Table 21

HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's groundwater and their comparison values (from Appendix B of the Primer) 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 contaminant ratios together, including any additional groundwater 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.

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios
Antimony	3.8	15	0.25
Copper	20.8	1,500	0.01
Lead	3.3	15	0.22
Manganese	5.7	1700	0.003
Zinc	18.1	11,000	0.002
CHF Scale	*CHF Value*	**Sum The Ratios**	**0.49**
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$$

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

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the 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 the presence of geological structures or physical controls).	**L**
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	**L**

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the 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).	**M**
	No Known or Suspected Groundwater MC Hazard	☐

The single groundwater sample was collected from within this AOI (see RI Section 5.3.4). Physical controls (treatment system) make this a confined migration pathway factor.

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 of the Primer) 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 contaminant ratios together, including any additional surface water 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 with human endpoints present in the surface water, select the box at the bottom of the table.

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).		

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 the 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).	

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

Surface water was not a pathway of concern and was not sampled (see RI Section 3.3.1).

Table 23

HHE Module: Sediment – Human 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 of the Primer) 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 contaminant ratios together, including any additional sediment 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 with human endpoints present in the sediment, select the box at the bottom of the table.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
CHF Scale	*CHF Value*	**Sum The Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$$

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

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 the 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).	

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).	

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

Sediment was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant ratios together, including any additional surface water 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 with ecological endpoints present in the surface water, select the box at the bottom of the table.

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).		

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 the 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).	

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).	

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

Surface water was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant ratios together, including any additional sediment 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 with ecological endpoints present in the sediment, select the box at the bottom of the table.*

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
CHF Scale	*CHF Value*	**Sum the Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$$

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

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 the 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).	

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).	

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

Sediment was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant **ratios** together, including any additional surface soil contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record **CHF Value**. If there is no known or suspected MC hazard with present in the surface soil, select the box at the bottom of the table.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
Zinc	15.7	23,000	0.0007
CHF Scale	**CHF Value**	**Sum the Ratios**	0.0007
CHF > 100	**H (High)**	$CHF = \sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		L

Migratory Pathway Factor

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

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

Receptor Factor

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

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

No Known or Suspected Surface Soil MC Hazard ☐

Soil sampling included IS sampling of surface soil collected from three sampling units SUs and IS subsurface soil from one SU.

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 in any given medium present at the MRS. **This is a supplemental table designed to hold information about contaminants that do no 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 of the Primer) 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: **Do not 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 **HHE Ratings** 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)	L	L	M	MLL	**F**
Surface Water/Human Endpoint (Table 22)					NA
Sediment/ Human Endpoint (Table 23)					NA
Surface Water/Ecological Endpoint (Table 24)					NA
Sediment/Ecological Endpoint (Table 25)					NA
Surface Soil (Table 26)	L	M	M	MML	**E**

DIRECTIONS (cont.):

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

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.

HHE MODULE RATING	E

HHE Ratings (for reference only)

Combination	Rating
HHH	A
HHM	B
HHL	C
HMM	C
HML	D
MMM	D
HLL	E
MML	E
MLL	F
LLL	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected MC Hazard

MC sampling results indicated metals above background in soil and groundwater, but the RI screen against project screening levels showed no MC releases, no risks to human health and the environment, and accordingly, **the HHE module has been assigned the alternative rating of 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 relative priority in the MRS Priority or Alternative MRS Rating 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 PRIORITY or ALTERNATIVE MRS RATING				**No Longer Required**	

Table A

MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from Service and DoD databases. 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 (e.g., benzene, trichloroethylene) found at the MRS, and any potentially exposed human and ecological receptors. If possible, include a map of the MRS.

Munitions Response Site Name: Area of Interest **(AOI)-04**
Component: U.S. Army Corps of Engineers Formerly Used Defense Site (FUDS) Program
Installation/Property Name: Former Camp Wellfleet
Location (City, County, State): Town of Wellfleet, Barnstable County, Massachusetts
Site Name/Project Name (Project No.): Former Camp Wellfleet FUDS

Date Information Entered/Updated: 08/13/2018
Point of Contact (Name/Phone): Gina Kaso, CENAE PM (978-318-8180)
Project Phase (check only one):

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

Media Evaluated (check all that apply):

☐ Groundwater	☐ Sediment (human receptor)
☑ Surface soil – Subsurface 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, or MC known or suspected to be present. When possible, identify munitions, CWM, and MC by type:

Camp Wellfleet training activities occurred from 1942 to 1961. It is currently owned and managed by the National Park Service (NPS) as part of the Cape Cod National Seashore.

AOI-04 combines EE/CA investigation areas C, F, and J. These are bomb target areas and a burial site. Limited previous removal actions (associated with single point anomaly excavations) conducted to physically remove subsurface MEC found only MD, but not all targets were dug and it is possible that suspected hazards may remain (see RI Section 3.1.1).

No MEC was found in AOI-04. The following MD items were found in the surface and subsurface of AOI-04: Numerous items including abundant fuze shipping spacers, some small arms debris, one empty Dove Missile/1000-pound bomb, one empty 250-pound bomb, 186 M28A1 flash tubes from 106mm projectile cartridge cases, and fragments of grenade spoons. These were inert or practice rounds.

Using the MEC risk assessment matrix methodology (RI Appendix E), no unacceptable MEC risks are posed by this AOI.

For MC characterization, Incremental Soil (IS) sampling of surface soil was conducted from five sampling units (SUs) and IS subsurface soil samples from one SU. As described in RI Table 3-9, SU locations were based on the location of a possible burn pit or previous munitions debris finds. Analytical parameters included select metals (antimony, copper, lead, manganese, nickel, and zinc) and select explosives (RDX, TNT, nitroglycerin, 2,4-dinitrotoluene, 2,6-dinitrotoluene, tetryl, and nitroguanidine (See RI Sections 3.3 and 3.4).

MC sampling results indicated one metal above background in soil, but the screen against project screening levels showed no MC releases, no risks to human health and the environment, and therefore, no HHRA or SLERA were conducted.

Description of Pathways for Human and Ecological Receptors:
The source of potential MC is primarily the result of historical military activities, including the firing of artillery, practice bombing, and small arms. Exposure to receptors by ingestion, inhalation, and dermal contact are potentially complete

pathways. Groundwater is not a pathway of concern unless MC soil sampling results indicate a possible impact to groundwater.

Potential for contact with MEC includes walking over surface MEC, handling/collecting MEC, or contact with subsurface MEC due to any intrusive activities (see RI Section 3.1.2).

Description of Receptors (Human and Ecological):
Potential receptors to MC in the Former Camp Wellfleet include human populations, animal species, or habitats that may be exposed to site-related MC in soil or groundwater. Human receptors include Recreational Users (including fishermen), Site Workers (including NPS Staff and Road/Utility Workers), and Construction Workers. Ecological receptors include various birds, mammals, invertebrates, flora, and fauna that occur within the Former Camp Wellfleet (see RI Section 3.3.1).

However, a complete pathway requires a source of contaminants, and based on site sampling results, no MC contaminant source was identified. The updated CSM (RI Figure 16) shows that there are no complete pathways for MC based on the sample results.

No MEC has been found. Only MD has been recovered, but not all targets were dug during previous investigations and it is possible that suspected hazards may remain. However, based on the MEC risk matrix methodology assessment of no unacceptable explosive risks (RI Section 5.1.1), this AOI has been given the **alternative rating of No Longer Required**.

There is no physical or historical evidence indicating that CWM was present at this AOI. Therefore, **the CHE module has been assigned the alternative rating of No Known or Suspected CWM Hazard**.

Screening of initial MC sampling results against the PSLs showed no exceedances and it was determined that there were no MC releases, no risks to human health and the environment, and therefore, no HHRA or SLERA were conducted; accordingly, **the HHE module has been assigned the alternative rating of No Known or Suspected MC Hazard.**

The overall Priority Rating for AOI-04 is ‘No Longer Required’, based on the EHE module.

Table 1

EHE Module: Munitions Type Data Element Table

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

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

Classification	Description	Score
Sensitive	◆ UXO that are considered most 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). ◆ 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)	◆ UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered "sensitive." ◆ 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)	◆ UXO containing a pyrotechnic filler other than white phosphorus (e.g., flares, signals, simulators, smoke grenades). ◆ DMM containing a pyrotechnic filler other than white phosphorus (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)	◆ 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	◆ UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ 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	◆ DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ DMM that are 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)	◆ DMM containing a pyrotechnic filler (i.e., red phosphorus), other than white phosphorus filler, that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	10
Practice	◆ UXO that are practice munitions that are not associated with a sensitive fuze. ◆ 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.	$\boxed{5}$
Riot control	◆ UXO or DMM containing a riot control agent filler (e.g., tear gas).	3
Small arms	◆ 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).	$\boxed{5}$

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

No MEC was found in AOI-04.

The following MD items were found in the surface and subsurface of AOI-04: Numerous items including abundant fuze shipping spacers, some small arms debris, one empty Dove Missile/1000-pound bomb, one empty 250-pound bomb, 186 M28A1 flash tubes from 106mm projectile cartridge cases, and fragments of grenade spoons (see RI Table 3-1). These were inert or practice rounds.

Table 2

EHE Module: Source of Hazard Data Element Table

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

Note: The terms *former range, practice munitions, small arms range, 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 and associated buffer and safety zones.	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.	$\boxed{6}$
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).	$\boxed{6}$

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

AOI-04 includes bomb target areas and a burial site. Limited previous removal actions (associated with single point anomaly excavations) conducted to physically remove subsurface MEC found only MD, primarily practice munitions (see RI Section 3.1.1).

Table 3

EHE Module: Location of Munitions Data Element Table

DIRECTIONS: Below are eight classifications of munitions locations and their descriptions. Circle the scores that correspond with **all** the locations where munitions are known or suspected to be present at the MRS.

Note: The terms *confirmed, surface, subsurface, small arms ammunition, 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 (i.e., a confirmed report such as an explosive ordnance disposal [EOD], police, or fire department report that an incident or accident that involved UXO or DMM occurred) 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 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 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 as 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.	$\boxed{10}$
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).	$\boxed{10}$

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

There is physical evidence of munitions in the form of the recovered MD. See RI Section 3.1.2.

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 the MRS. Circle the score that corresponds with the ease of access to the MRS.

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

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

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

While AOI-04 is accessible by park visitors, it contains unpaved trails and a paved road. The unpaved trails see moderate pedestrian traffic, and the paved road sees vehicle traffic. There is some semi-dense natural vegetation and rough terrain that acts as a natural barrier to limit pedestrian access, however there are no man-made barrier restrictions. See RI Figures 3 & 4, and Section 2.1.

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. ◆ The MRS is at a location that is owned by DoD, but that DoD has leased to another entity and for which DoD does not control access 24 hours per day.	$\boxed{5}$
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 Protocol is applied.	3
DoD control	◆ The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD. With respect to property that is leased or otherwise possessed, DoD must control access to the MRS 24 hours per day, every day of the calendar year.	0
STATUS OF PROPERTY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	**5**

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

This is a FUDS, owned and managed by the NPS, with a smaller portion owned and managed by the Town of Wellfleet (see RI Sections 1.2 and 1.3).

Table 6

EHE Module: Population Density Data Element Table

DIRECTIONS: Below are three classifications for population density and their descriptions. Determine the population density per square mile that most closely corresponds with the population of the MRS, including the area within a two-mile radius of the MRS's perimeter. Circle the most appropriate score.

Note: Use the U.S. Census Bureau tract data available to capture the **highest** population density within a two-mile radius of the perimeter of the MRS.

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

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

The population density per square mile in the county in which the Former Camp Wellfleet is located is approximately 548: https://www.census.gov/quickfacts/fact/table/barnstablecountymassachusetts/PST045217

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 potential population near the MRS. Determine the number of inhabited structures within two miles of the MRS boundary and circle the score that corresponds with the number of inhabited structures.

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.	$\boxed{5}$
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.

There are many more than 26 or more inhabited structures using Google Earth to calculate the total number of inhabited structures within the two-mile radius for this AOI. Inhabited structures include homes, commercial buildings, motels/hotels, and beach houses for use by recreational visitors.

Table 8

EHE Module: Types of Activities/Structures Data Element Table

DIRECTIONS: Below are five classifications of activities and/or inhabited structures 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 scores 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.	$\boxed{5}$
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.

Types of activities/structures within 2 miles include NPS buildings, homes, commercial buildings, motels/hotels, and beach houses for use by recreational visitors. See RI Figures 1 & 3, and Section 2.1.

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 resources present on 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.	$\boxed{3}$
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).	$\boxed{3}$

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

Ecological receptors include various birds, mammals, invertebrates, flora, and fauna that occur within the Former Camp Wellfleet. Wildlife species at the Cape Cod National Seashore include twelve species of amphibians, 370 species of birds, 59 species of mammals, five species of migratory marine turtles, and 13 species of land-based reptiles (NPS website, https://www.nps.gov/caco) (see RI Section 3.3.1).

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
Munitions Type	Table 1	5	11
Source of Hazard	Table 2	6	
Accessibility Factor Data Elements			
Location of Munitions	Table 3	10	23
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			**52**

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	**No Longer Required**

Based on the MEC risk matrix methodology assessment of no unacceptable explosive risks (RI Section 5.1.1) for this AOI, the Alternative Rating of No Longer Required has been given.

Table 11

CHE Module: CWM Configuration Data Element Table

DIRECTIONS: Below are seven classifications of CWM configuration and their descriptions. Circle the scores that correspond with **all** the 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, that are either UXO, or explosively configured damaged DMM	The CWM known or suspected of being present at the MRS are: ◆ 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 undamaged 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/DMM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS are: ◆ Nonexplosively configured CWM/DMM either damaged or undamaged ◆ Bulk CWM (e.g., ton container).	15
CAIS K941 and CAIS K942	◆ The CWM/DMM known or suspected of being present at the MRS are CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12
CAIS (chemical agent identification sets)	◆ 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.	$\boxed{0}$
CWM CONFIGURATION	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	$\boxed{0}$

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

There is no physical or historical evidence indicating that CWM was present at this AOI. See RI Section 1.5.

Tables 12 through 19 are intentionally omitted

Per Active Army Guidance (U.S. Army, 2009)

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

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

Table 21

HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's groundwater and their comparison values (from Appendix B of the Primer) 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 contaminant ratios together, including any additional groundwater 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.

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).		

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 the 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).	

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).	
	No Known or Suspected Groundwater MC Hazard	☐

Groundwater was not a pathway of concern for this AOI and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant ratios together, including any additional surface water 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 with human endpoints present in the surface water, select the box at the bottom of the table.

Contaminant	Maximum Concentration (μg/L)	Comparison Value (μg/L)	Ratios
CHF Scale	*CHF Value*	**Sum The Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$$

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

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 the 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).	

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).	

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

Surface water was not a pathway of concern and was not sampled (see RI Section 3.3.1).

Table 23

HHE Module: Sediment – Human 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 of the Primer) 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 contaminant ratios together, including any additional sediment 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 with human endpoints present in the sediment, select the box at the bottom of the table.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
CHF Scale	*CHF Value*	**Sum The Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$$

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

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 the 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).	

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).	

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

Sediment was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant ratios together, including any additional surface water 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 with ecological endpoints present in the surface water, select the box at the bottom of the table.

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).		

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 the 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).	

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).	

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

Surface water was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant ratios together, including any additional sediment 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 with ecological endpoints present in the sediment, select the box at the bottom of the table.*

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
CHF Scale	*CHF Value*	**Sum the Ratios**	
CHF > 100	**H (High)**		
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).		

$$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$$

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 the 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).	

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).	

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

Sediment was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant **ratios** together, including any additional surface soil contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record **CHF Value**. If there is no known or suspected MC hazard with present in the surface soil, select the box at the bottom of the table.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
Zinc	18.2	23,000	0.0008
CHF Scale	**CHF Value**	**Sum the Ratios**	0.0008
CHF > 100	**H (High)**	**CHF =** $\sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		L

Migratory Pathway Factor

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

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

Receptor Factor

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

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

No Known or Suspected Surface Soil MC Hazard ☐

Soil sampling included IS sampling of surface soil collected from five SUs and IS subsurface soil samples from one SU.

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 in any given medium present at the MRS. **This is a supplemental table designed to hold information about contaminants that do no 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 of the Primer) 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: **Do not 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 **HHE Ratings** 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)					NA
Surface Water/Human Endpoint (Table 22)					NA
Sediment/ Human Endpoint (Table 23)					NA
Surface Water/Ecological Endpoint (Table 24)					NA
Sediment/Ecological Endpoint (Table 25)					NA
Surface Soil (Table 26)	L	M	M	MML	**MML**

DIRECTIONS (cont.):

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

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.

HHE MODULE RATING	E

HHE Ratings (for reference only)

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

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

MC sampling results indicated one metal above background in soil, but the RI screen against project screening levels showed no MC releases, no risks to human health and the environment, and accordingly, **the HHE module has been assigned the alternative rating of 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 relative priority in the MRS Priority or Alternative MRS Rating 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 PRIORITY or ALTERNATIVE MRS RATING				**No Longer Required**	

Table A

MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from Service and DoD databases. 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 (e.g., benzene, trichloroethylene) found at the MRS, and any potentially exposed human and ecological receptors. If possible, include a map of the MRS.

Munitions Response Site Name: Area of Interest **(AOI)-05**
Component: U.S. Army Corps of Engineers Formerly Used Defense Site (FUDS) Program
Installation/Property Name: Former Camp Wellfleet
Location (City, County, State): Town of Wellfleet, Barnstable County, Massachusetts
Site Name/Project Name (Project No.): Former Camp Wellfleet FUDS

Date Information Entered/Updated: 08/13/2018
Point of Contact (Name/Phone): Gina Kaso, CENAE PM (978-318-8180)
Project Phase (check only one):

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

Media Evaluated (check all that apply):

☐ Groundwater	☐ Sediment (human receptor)
☑ Surface soil – Subsurface 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, or MC known or suspected to be present. When possible, identify munitions, CWM, and MC by type:

Camp Wellfleet training activities occurred from 1942 to 1961. It is currently owned and managed by the National Park Service (NPS) as part of the Cape Cod National Seashore.

AOI-05 is a former Rocket Range and Small Arms Range. The small arms range has been completely covered by the large paved parking lot. The southern portion includes a small 5-acre removal action area. Multiple pieces of frag from 3.5" rockets and 105mm projectiles found during the previous investigations or removal action are considered HE frag or MD indicative of MEC (see RI Section 3.1.1). As this AOI includes a shoreline portion, it may also see munition items washing ashore following storm events.

The following MD indicative of MEC items and MD items were found in the surface or subsurface of AOI-05:

MD Indicative of MEC: HE frag from 3.5" Rockets and 105mm projectiles.
MD: 50 cal bullet, miscellaneous scrap.

For MC characterization, Incremental Soil (IS) sampling of surface soil was conducted from three sampling units (SUs) and IS subsurface soil samples from one SU. As described in Table 3-9, SU locations were based on previous munitions debris finds. Analytical parameters included select metals (antimony, copper, lead, manganese, nickel, and zinc) and select explosives (RDX, TNT, nitroglycerin, 2,4-dinitrotoluene, 2,6-dinitrotoluene, tetryl, and nitroguanidine (See RI Sections 3.3 and 3.4).

MC sampling results determined that additional soil or groundwater sampling was not warranted. The RI screening indicated that there were no MC releases, no risks to human health and the environment, and therefore, no HHRA or SLERA were conducted.

Description of Pathways for Human and Ecological Receptors:
The source of potential MC is primarily the result of historical military activities, including the firing of artillery, practice bombing, and small arms. Exposure to receptors by ingestion, inhalation, and dermal contact are potentially complete

pathways. Groundwater is not a pathway of concern unless MC soil sampling results indicate a possible impact to groundwater.

Potential for contact with MEC includes walking over surface MEC, handling/collecting MEC, or contact with subsurface MEC due to any intrusive activities (see RI Section 3.1.2).

Description of Receptors (Human and Ecological):
Potential receptors to MC in the Former Camp Wellfleet include human populations, animal species, or habitats that may be exposed to site-related MC in soil or groundwater. Human receptors include Recreational Users (including fishermen), Site Workers (including NPS Staff and Road/Utility Workers), and Construction Workers. Ecological receptors include various birds, mammals, invertebrates, flora, and fauna that occur within the Former Camp Wellfleet (see RI Section 3.3.1).

However, a complete pathway requires a source of contaminants, and based on site sampling results, no MC contaminant source was identified. The updated CSM (RI Figure 16) shows that there are no complete pathways for MC based on the sample results.

MD Indicative of MEC (HE frag from 3.5" Rockets and 105mm projectiles) and MD (50 cal bullet, miscellaneous scrap) have been found. Based on this scenario, **the EHE module has been assigned a 'C' rating.**

There is no physical or historical evidence indicating that CWM was present at this AOI. Therefore, **the CHE module has been assigned the alternative rating of No Known or Suspected CWM Hazard**.

MC sampling results indicated metals above background in soil, but the RI screen against project screening levels showed no MC releases, no risks to human health and the environment, and accordingly, **the HHE module has been assigned the alternative rating of No Known or Suspected MC Hazard.**

The overall Priority Rating for AOI-05 is '4', based on the EHE module.

Table 1

EHE Module: Munitions Type Data Element Table

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

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

Classification	Description	Score
Sensitive	◆ UXO that are considered most 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). ◆ 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)	◆ UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered "sensitive." ◆ 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)	◆ UXO containing a pyrotechnic filler other than white phosphorus (e.g., flares, signals, simulators, smoke grenades). ◆ DMM containing a pyrotechnic filler other than white phosphorus (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)	◆ 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	◆ UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ 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	◆ DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ DMM that are 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)	◆ DMM containing a pyrotechnic filler (i.e., red phosphorus), other than white phosphorus filler, that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	10
Practice	◆ UXO that are practice munitions that are not associated with a sensitive fuze. ◆ 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	◆ UXO or DMM containing a riot control agent filler (e.g., tear gas).	3
Small arms	◆ 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).	25

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

MD Indicative of MEC (HE frag from 3.5" Rockets and 105mm projectiles) has been found (see RI Table 3-1).

Table 2

EHE Module: Source of Hazard Data Element Table

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

Note: The terms *former range, practice munitions, small arms range, 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 and associated buffer and safety zones.	$\boxed{10}$
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 **<u>the single highest score</u>** from above in the box to the right (maximum score = 10).	$\boxed{10}$

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

AOI-05 is a former Rocket Range (see RI Section 3.1.1).

Table 3

EHE Module: Location of Munitions Data Element Table

DIRECTIONS: Below are eight classifications of munitions locations and their descriptions. Circle the scores that correspond with **all** the locations where munitions are known or suspected to be present at the MRS.

Note: The terms *confirmed, surface, subsurface, small arms ammunition, 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 (i.e., a confirmed report such as an explosive ordnance disposal [EOD], police, or fire department report that an incident or accident that involved UXO or DMM occurred) 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 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 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 as 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.	$\boxed{10}$
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).	$\boxed{10}$

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

MD Indicative of MEC presence has been established with the HE frag (from 3.5" Rockets and 105mm projectiles) recovered from the subsurface (RI Section 3.1.2). This constitutes suspected classification.

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 the MRS. Circle the score that corresponds with the ease of access to the MRS.

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

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

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

AOI-05 is a high traffic beach access area. It contains unpaved and paved trails, a paved road and a large paved parking lot. While there is some semi-dense natural vegetation that limits pedestrian access, there are no man-made barrier restrictions. Access to the beach is open with daily use. See Figures 3 & 4, and Section 2.1.

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. ◆ The MRS is at a location that is owned by DoD, but that DoD has leased to another entity and for which DoD does not control access 24 hours per day.	$\boxed{5}$
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 Protocol is applied.	3
DoD control	◆ The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD. With respect to property that is leased or otherwise possessed, DoD must control access to the MRS 24 hours per day, every day of the calendar year.	0
STATUS OF PROPERTY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	$\boxed{5}$

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

This is a FUDS, owned and managed by the NPS, with a smaller portion owned and managed by the Town of Wellfleet (see RI Sections 1.2 and 1.3).

Table 6

EHE Module: Population Density Data Element Table

DIRECTIONS: Below are three classifications for population density and their descriptions. Determine the population density per square mile that most closely corresponds with the population of the MRS, including the area within a two-mile radius of the MRS's perimeter. Circle the most appropriate score.

Note: Use the U.S. Census Bureau tract data available to capture the **highest** population density within a two-mile radius of the perimeter of the MRS.

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

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

The population density per square mile in the county in which the Former Camp Wellfleet is located is approximately 548: https://www.census.gov/quickfacts/fact/table/barnstablecountymassachusetts/PST045217

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 potential population near the MRS. Determine the number of inhabited structures within two miles of the MRS boundary and circle the score that corresponds with the number of inhabited structures.

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.	$\boxed{5}$
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).	$\boxed{5}$

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

There are many more than 26 or more inhabited structures using Google Earth to calculate the total number of inhabited structures within the two-mile radius for this AOI. Inhabited structures include homes, commercial buildings, motels/hotels, and beach houses for use by recreational visitors.

Table 8

EHE Module: Types of Activities/Structures Data Element Table

DIRECTIONS: Below are five classifications of activities and/or inhabited structures 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 scores 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.	$\boxed{5}$
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).	$\boxed{5}$

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

Types of activities/structures within 2 miles include NPS buildings, homes, commercial buildings, motels/hotels, and beach houses for use by recreational visitors. See Figures 1 & 3, and Section 2.1.

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 resources present on 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.

Ecological receptors include various birds, mammals, invertebrates, flora, and fauna that occur within the Former Camp Wellfleet. Wildlife species at the Cape Cod National Seashore include twelve species of amphibians, 370 species of birds, 59 species of mammals, five species of migratory marine turtles, and 13 species of land-based reptiles (NPS website, https://www.nps.gov/caco) (see RI Section 3.3.1).

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
Munitions Type	Table 1	25	35
Source of Hazard	Table 2	10	
Accessibility Factor Data Elements			
Location of Munitions	Table 3	10	25
Ease of Access	Table 4	10	
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			78

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 scores that correspond with **all** the 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, that are either UXO, or explosively configured damaged DMM	The CWM known or suspected of being present at the MRS are: ◆ 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 undamaged 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/DMM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS are: ◆ Nonexplosively configured CWM/DMM either damaged or undamaged ◆ Bulk CWM (e.g., ton container).	15
CAIS K941 and CAIS K942	◆ The CWM/DMM known or suspected of being present at the MRS are CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12
CAIS (chemical agent identification sets)	◆ 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.

There is no physical or historical evidence indicating that CWM was present at this AOI. See RI Section 1.5.

Tables 12 through 19 are intentionally omitted

Per Active Army Guidance (U.S. Army, 2009)

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

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

Table 21

HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's groundwater and their comparison values (from Appendix B of the Primer) 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 contaminant ratios together, including any additional groundwater 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.

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).		

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 the 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).	

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).	

No Known or Suspected Groundwater MC Hazard ☐

Groundwater was not a pathway of concern for this AOI (see RI Section 3.3.1).

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 of the Primer) 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 contaminant ratios together, including any additional surface water 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 with human endpoints present in the surface water, select the box at the bottom of the table.

Contaminant	Maximum Concentration (μg/L)	Comparison Value (μg/L)	Ratios
CHF Scale	*CHF Value*	**Sum The Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$$

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

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 the 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).	

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).	

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

Surface water was not a pathway of concern and was not sampled (see RI Section 3.3.1).

Table 23

HHE Module: Sediment – Human 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 of the Primer) 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 contaminant ratios together, including any additional sediment 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 with human endpoints present in the sediment, select the box at the bottom of the table.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
CHF Scale	*CHF Value*	**Sum The Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$$

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

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 the 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).	

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).	

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

Sediment was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant ratios together, including any additional surface water 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 with ecological endpoints present in the surface water, select the box at the bottom of the table.

Contaminant	Maximum Concentration (μg/L)	Comparison Value (μg/L)	Ratios
CHF Scale	*CHF Value*	**Sum the Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$$

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

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 the 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).	

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).	

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

Surface water was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant ratios together, including any additional sediment 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 with ecological endpoints present in the sediment, select the box at the bottom of the table.*

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).		

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 the 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).	

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).	

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

Sediment was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant **ratios** together, including any additional surface soil contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record **CHF Value**. If there is no known or suspected MC hazard with present in the surface soil, select the box at the bottom of the table.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
Copper	5.90	3,100	0.002
Zinc	13.9	23,000	0.003
CHF Scale	**CHF Value**	**Sum the Ratios**	0.005
CHF > 100	**H (High)**	**CHF** = $\sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		L

Migratory Pathway Factor

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

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

Receptor Factor

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

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

No Known or Suspected Surface Soil MC Hazard ☐

Soil sampling included IS sampling of surface soil collected from three sampling units SUs and IS subsurface soil from one SU.

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 in any given medium present at the MRS. **This is a supplemental table designed to hold information about contaminants that do no 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 of the Primer) 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: **Do not 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 **HHE Ratings** 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)					NA
Surface Water/Human Endpoint (Table 22)					NA
Sediment/ Human Endpoint (Table 23)					NA
Surface Water/Ecological Endpoint (Table 24)					NA
Sediment/Ecological Endpoint (Table 25)					NA
Surface Soil (Table 26)	L	M	M	MML	**E**

DIRECTIONS (cont.):

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

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.

HHE MODULE RATING	E

HHE Ratings (for reference only)

Combination	Rating
HHH	A
HHM	B
HHL	C
HMM	C
HML	D
MMM	D
HLL	E
MML	E
MLL	F
LLL	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected MC Hazard

MC sampling results indicated metals above background in soil, but the RI screen against project screening levels showed no MC releases, no risks to human health and the environment, and accordingly, **the HHE module has been assigned the alternative rating of 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 relative priority in the MRS Priority or Alternative MRS Rating 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 PRIORITY or ALTERNATIVE MRS RATING				**4**	

Table A

MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from Service and DoD databases. 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 (e.g., benzene, trichloroethylene) found at the MRS, and any potentially exposed human and ecological receptors. If possible, include a map of the MRS.

Munitions Response Site Name: Area of Interest **(AOI)-06**
Component: U.S. Army Corps of Engineers Formerly Used Defense Site (FUDS) Program
Installation/Property Name: Former Camp Wellfleet
Location (City, County, State): Town of Wellfleet, Barnstable County, Massachusetts
Site Name/Project Name (Project No.): Former Camp Wellfleet FUDS

Date Information Entered/Updated: 08/13/2018
Point of Contact (Name/Phone): Gina Kaso, CENAE PM (978-318-8180)
Project Phase (check only one):

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

Media Evaluated (check all that apply):

☐ Groundwater	☐ Sediment (human receptor)
☐ Surface soil – Subsurface 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, or MC known or suspected to be present. When possible, identify munitions, CWM, and MC by type:

Camp Wellfleet training activities occurred from 1942 to 1961. It is currently owned and managed by the National Park Service (NPS) as part of the Cape Cod National Seashore.

AOI-06 is the Range Fan of Artillery Targets in Ocean. MEC presence is suspected based on past use as an ocean range fan with anti-aircraft and rocket firing at targets over the ocean conducted for approximately 20 years. This AOI could also be a source of MEC/MD to AOI-02 and AOI-05 if munition items wash ashore following storm events (see RI Section 3.1.1), although documented occurrence of this is rare.

The following MEC items might conservatively be expected to be in the ocean range fan: 76mm anti-aircraft artillery, 90mm and 105mm projectiles, 3.5" rockets.

No MC sampling was conducted for the RI.

Description of Pathways for Human and Ecological Receptors:
The source of potential MC is primarily the result of historical military activities, including the firing of artillery, practice bombing, and small arms. Exposure to marine receptors by ingestion and dermal contact are potentially complete pathways.

Potential for contact with MEC includes recreational diving, swimming/wading, fishing, or contact with subsurface MEC due to any intrusive activities such as maintenance in the shallow shore waters.

Description of Receptors (Human and Ecological):
Potential receptors to MC in the Former Camp Wellfleet include human populations, marine animal species, or habitats that may be exposed to site-related MC in surface water. Human receptors include Recreational Users (including swimmers, divers, fishermen), and Site Workers (including NPS Staff and Maintenance Workers). Ecological receptors include marine flora and fauna that occur within the ocean range fan (see RI Section 3.3.1).

The following MEC items might conservatively be expected to be in the ocean range fan: 76mm anti-aircraft artillery, 90mm and 105mm projectiles, 3.5” rockets. Based on this scenario, **the EHE module has been assigned a ‘C’ rating.**

There is no physical or historical evidence indicating that CWM was present at this AOI. Therefore, **the CHE module has been assigned the alternative rating of No Known or Suspected CWM Hazard**.

No MC sampling was conducted in the open ocean or sediment, and **the HHE module has been assigned the alternative rating of No Known or Suspected MC Hazard.**

The overall Priority Rating for AOI-06 is ‘4’, based on the EHE module.

Table 1

EHE Module: Munitions Type Data Element Table

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

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

Classification	Description	Score
Sensitive	◆ UXO that are considered most 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). ◆ 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)	◆ UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered "sensitive." ◆ DMM containing a high-explosive filler that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	$\boxed{25}$
Pyrotechnic (used or damaged)	◆ UXO containing a pyrotechnic filler other than white phosphorus (e.g., flares, signals, simulators, smoke grenades). ◆ DMM containing a pyrotechnic filler other than white phosphorus (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)	◆ 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	◆ UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ 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	◆ DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ DMM that are 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)	◆ DMM containing a pyrotechnic filler (i.e., red phosphorus), other than white phosphorus filler, that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	10
Practice	◆ UXO that are practice munitions that are not associated with a sensitive fuze. ◆ 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	◆ UXO or DMM containing a riot control agent filler (e.g., tear gas).	3
Small arms	◆ 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).	$\boxed{25}$

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

The following MEC items might conservatively be expected to be in the ocean range fan: 76mm anti-aircraft artillery, 90mm and 105mm projectiles, 3.5" rockets. See RI Table 3-1.

Table 2

EHE Module: Source of Hazard Data Element Table

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

Note: The terms *former range, practice munitions, small arms range, 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 and associated buffer and safety zones.	$\boxed{10}$
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 **<u>the single highest score</u>** from above in the box to the right (maximum score = 10).	$\boxed{10}$

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

AOI-06 is the Range Fan of Artillery Targets in Ocean (see RI Section 3.1.1).

Table 3

EHE Module: Location of Munitions Data Element Table

DIRECTIONS: Below are eight classifications of munitions locations and their descriptions. Circle the scores that correspond with **all** the locations where munitions are known or suspected to be present at the MRS.

Note: The terms *confirmed, surface, subsurface, small arms ammunition, 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 (i.e., a confirmed report such as an explosive ordnance disposal [EOD], police, or fire department report that an incident or accident that involved UXO or DMM occurred) 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 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 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 as 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).	**5**

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

Suspected munitions with historical evidence indicating that UXO or DMM may be present in this AOI since anti-aircraft and rocket firing at targets over the ocean was conducted for approximately 20 years. See RI Section 3.1.2.

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

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

AOI-06 is the open ocean with no physical barriers, although ocean depth eventually becomes a practical barrier. See Figures 3, and Section 2.1.

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. ◆ The MRS is at a location that is owned by DoD, but that DoD has leased to another entity and for which DoD does not control access 24 hours per day.	$\boxed{5}$
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 Protocol 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).	$\boxed{\mathbf{5}}$

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

Portions of the ocean range fan are controlled by local government or the state of Massachusetts. See RI Sections 1.2 and 1.3.

Table 6

EHE Module: Population Density Data Element Table

DIRECTIONS: Below are three classifications for population density and their descriptions. Determine the population density per square mile that most closely corresponds with the population of the MRS, including the area within a two-mile radius of the MRS's perimeter. Circle the most appropriate score.

Note: Use the U.S. Census Bureau tract data available to capture the **highest** population density within a two-mile radius of the perimeter of the MRS.

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

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

The population density per square mile in the county in which the AOI ocean range abuts land is located is approximately 548: https://www.census.gov/quickfacts/fact/table/barnstablecountymassachusetts/PST045217

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 potential population near the MRS. Determine the number of inhabited structures within two miles of the MRS boundary and circle the score that corresponds with the number of inhabited structures.

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.	$\boxed{5}$
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).	$\boxed{5}$

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

There are many more than 26 or more inhabited structures using Google Earth to calculate the total number of inhabited structures within the two-mile radius of the western-most reaches of this AOI. Inhabited structures include homes, commercial buildings, motels/hotels, and beach houses for use by recreational visitors.

Table 8

EHE Module: Types of Activities/Structures Data Element Table

DIRECTIONS: Below are five classifications of activities and/or inhabited structures 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 scores 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.	$\boxed{5}$
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).	$\boxed{5}$

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

Types of activities/structures within 2 miles of the western-most reaches of this AOI include NPS buildings, homes, commercial buildings, motels/hotels, and beach houses for use by recreational visitors. See Figures 1 & 3, and Section 2.1.

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 resources present on 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.	$\boxed{3}$
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).	$\boxed{3}$

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

Ecological receptors include marine flora and fauna that occur within the ocean. Wildlife species at the Cape Cod National Seashore include five species of migratory marine turtles (NPS website, https://www.nps.gov/caco) (see RI Section 3.3.1).

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
Munitions Type	Table 1	25	35
Source of Hazard	Table 2	10	
Accessibility Factor Data Elements			
Location of Munitions	Table 3	5	20
Ease of Access	Table 4	10	
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			73

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 scores that correspond with **all** the 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, that are either UXO, or explosively configured damaged DMM	The CWM known or suspected of being present at the MRS are: ◆ 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 undamaged 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/DMM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS are: ◆ Nonexplosively configured CWM/DMM either damaged or undamaged ◆ Bulk CWM (e.g., ton container).	15
CAIS K941 and CAIS K942	◆ The CWM/DMM known or suspected of being present at the MRS are CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12
CAIS (chemical agent identification sets)	◆ 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.

There is no physical or historical evidence indicating that CWM was present at this AOI. See RI Section 1.5.

Tables 12 through 19 are intentionally omitted

Per Active Army Guidance (U.S. Army, 2009)

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

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

Table 21

HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the maximum concentrations of all contaminants in the MRS's groundwater and their comparison values (from Appendix B of the Primer) 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 contaminant ratios together, including any additional groundwater 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.

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).		

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 the 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).	

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).	
	No Known or Suspected Groundwater MC Hazard	☐

Groundwater was not a pathway of concern and was not sampled (see RI Section 3.3).

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 of the Primer) 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 contaminant ratios together, including any additional surface water 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 with human endpoints present in the surface water, select the box at the bottom of the table.

Contaminant	Maximum Concentration (μg/L)	Comparison Value (μg/L)	Ratios
CHF Scale	*CHF Value*	**Sum The Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$$

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

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 the 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).	

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).	

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

Surface water was not a pathway of concern and was not sampled (see RI Section 3.3.1).

Table 23

HHE Module: Sediment – Human 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 of the Primer) 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 contaminant ratios together, including any additional sediment 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 with human endpoints present in the sediment, select the box at the bottom of the table.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
CHF Scale	*CHF Value*	**Sum The Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$$

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

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 the 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).	

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).	

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

Sediment was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant ratios together, including any additional surface water 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 with ecological endpoints present in the surface water, select the box at the bottom of the table.

Contaminant	Maximum Concentration (μg/L)	Comparison Value (μg/L)	Ratios
CHF Scale	*CHF Value*	**Sum the Ratios**	
CHF > 100	**H (High)**		
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		

$$CHF = \sum \frac{[\text{Maximum Concentration of Contaminant}]}{[\text{Comparison Value for Contaminant}]}$$

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

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 the 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).	

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).	

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

Surface water was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant ratios together, including any additional sediment 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 with ecological endpoints present in the sediment, select the box at the bottom of the table.*

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).		

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 the 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).	

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).	

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

Sediment was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 of the Primer) 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 contaminant **ratios** together, including any additional surface soil contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record **CHF Value**. If there is no known or suspected MC hazard with present in the surface soil, select the box at the bottom of the table.

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).		

Migratory Pathway Factor

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

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

Receptor Factor

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

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

No Known or Suspected Surface Soil MC Hazard ☐

Soil was not a pathway of concern and was not sampled (see RI Section 3.3.1).

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 in any given medium present at the MRS. **This is a supplemental table designed to hold information about contaminants that do no 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 of the Primer) 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: **Do not 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 **HHE Ratings** 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)					NA
Surface Water/Human Endpoint (Table 22)					NA
Sediment/ Human Endpoint (Table 23)					NA
Surface Water/Ecological Endpoint (Table 24)					NA
Sediment/Ecological Endpoint (Table 25)					NA
Surface Soil (Table 26)					NA

DIRECTIONS (cont.):

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

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.

HHE MODULE RATING	NA
HHE Ratings (for reference only)	
Combination	**Rating**
HHH	A
HHM	B
HHL	C
HMM	C
HML	D
MMM	D
HLL	E
MML	E
MLL	F
LLL	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected MC Hazard

No MC sampling was conducted in the open ocean or the sediment and therefore, the HHE module has been assigned an overall rating of No Known or Suspected 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 relative priority in the MRS Priority or Alternative MRS Rating 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 PRIORITY or ALTERNATIVE MRS RATING				**4**	

APPENDIX G: PHOTO DOCUMENTATION

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Photo 01 – Forested area comprising the background soil sampling locations.
Date: 10 April 2018

Photo 02 – UXO team and field personnel using step probes to collect soil samples. *Date*: 13 April 2018

Photo 03 – UXO team performing sweep of surface soils with a Schonstedt before sampling. Field personnel using RTK rover to validate location. *Date*: 12 April 2018

Photo 04 – Field personnel performing RTK base station check to ensure accuracy. *Date*: 12 April 2018

Photo 05 – RTK base station setup for southern locations data collection. *Date*: 11 April 2018

Photo 06 – UXO field personnel using hand auger in AOI-01 to collect discrete samples. *Date:* 14 April 2018

Photo: 07- Field team decontaminating step probes and labeling samples. *Date:* 14 April 2018

Photo 08 – The Well House containing Supply Well B. *Date:* 13 April 2018

APPENDIX H: FIELD DOCUMENTATION

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ERT DAILY FIELD REPORT

Project: Camp Wellfleet	**Date: 04/09/2018**
Report Number: 001	Prepared By: Robert Koroncai
Time of Arrival at Site: 1605	Time of Departure from Site: 1715
Time of Safety Brief: 1605	
Weather/Site Conditions:	
Weather: Sunny, 45 degrees	
Personnel On-Site:	
Robert Koroncai (ERT)	
Lee Lucas (ERT)	
Equipment Quality Control:	
GPS Morning: N/A	Anomaly Avoidance Morning: N/A
GPS Afternoon: N/A	Anomaly Avoidance Afternoon: N/A
Site Activities Conducted:	
Arrive at Cape Cod National Seashore. Met with D. Crary at the Fire Cache. Crary shows ERT GPS control points, fire roads to access AOIs, and equipment and drum staging area. ERT discusses plan for completing sampling.	
Issues Encountered and Resolutions:	
None.	
Planned Activities:	
Begin sample collection in Background Area tomorrow.	

Table 1. Sample Collection

Sample	Date	Sample	Date	Sample	Date
None					

ERT DAILY FIELD REPORT

Project: Camp Wellfleet	**Date: 04/10/2018**
Report Number: 002	Prepared By: Robert Koroncai
Time of Arrival at Site: 0700	Time of Departure from Site: 1700
Time of Safety Brief: 0715	
Weather/Site Conditions:	
Weather: Overcast, light precipitation, 35 degrees	
Personnel On-Site:	
Robert Koroncai (ERT)	**Mike Watson (ERT)**
Lee Lucas (ERT)	**Lee Peterson (ERT)**
Equipment Quality Control:	
GPS Morning: Pass	Anomaly Avoidance Morning: Pass
GPS Afternoon: Pass	Anomaly Avoidance Afternoon: Pass
Site Activities Conducted:	
ERT arrives onsite and meets with NPS staff (D. Crary, N. Taylor, and N. Tallent) at Fire Cache for morning briefing. ERT set-up control points at Marconi Beach Parking Lot. ERT established Schondstedt verification area and conducted morning instrument verification. ERT began soil sample collection at Background Area. ERT conducted afternoon instrument verification. ERT meet with D. Crary at Fire Cache for afternoon briefing. ERT offsite.	
Issues Encountered and Resolutions:	
None.	
Planned Activities:	
Continue sample collection in Background Area.	

Table 1. Sample Collection

Sample	Date	Sample	Date	Sample	Date
BKG-SU1-SA	4/10	BKG-SU2-SA	4/10	BKG-SU2-SA-Rep2	4/10
BKG-SU2-SA-Rep3	4/10	BKG-SU3-SA	4/10	BKG-SU4-SA	4/10
BKG-SU5-SA	4/10	BKG-SU6-SA	4/10	BKG-SU7-SA	4/10
SA = Surface Soil (ISM)					

ERT DAILY FIELD REPORT

Project: Camp Wellfleet	**Date: 04/11/2018**
Report Number: 003	Prepared By: Robert Koroncai
Time of Arrival at Site: 0700	Time of Departure from Site: 1715
Time of Safety Brief: 0715	
Weather/Site Conditions:	
Weather: Sunny, 48 degrees	
Personnel On-Site:	
Robert Koroncai (ERT – Team Leader)	**Mike Watson (ERT – UXO Tech Lead)**
Lee Lucas (ERT)	**Lee Peterson (ERT)**
Equipment Quality Control:	
GPS Morning: Pass	Anomaly Avoidance Morning: Pass
GPS Afternoon: Pass	Anomaly Avoidance Afternoon: Pass
Site Activities Conducted:	
ERT arrives onsite and meets with NPS staff (D. Crary) at Fire Cache for morning briefing. ERT conducted morning instrument verification. ERT continued soil sample collection at Background Area. ERT conducted afternoon instrument verification. ERT meets with D. Crary at Fire Cache for afternoon briefing. ERT offsite.	
Visitors:	
None	
Issues Encountered and Resolutions:	
None.	
Planned Activities:	
Continue sample collection in Background Area, begin sample collection in AOI5.	

Table 1. Sample Collection

Sample	Date	Sample	Date	Sample	Date
BKG-SU2-SB	4/11	BKG-SU2-SB-Rep2	4/11	BKG-SU2-SB-Rep3	4/11
BKG-SU3-SB	4/11	BKG-SU5-SB	4/11	BKG-SU6-SB	4/11
BKG-SU7-SB	4/11				
SB = Subsurface Soil (ISM)					

ERT DAILY FIELD REPORT

Project: Camp Wellfleet	**Date: 04/12/2018**
Report Number: 004	Prepared By: Robert Koroncai
Time of Arrival at Site: 0700	Time of Departure from Site: 1700
Time of Safety Brief: 0715	
Weather/Site Conditions:	
Weather: Sunny, 48 degrees	
Personnel On-Site:	
Robert Koroncai (ERT – Team Leader)	**Mike Watson (ERT – UXO Tech Lead)**
Lee Lucas (ERT)	**Lee Peterson (ERT)**
Equipment Quality Control:	
GPS Morning: Pass	Anomaly Avoidance Morning: Pass
GPS Afternoon: Not Conducted	Anomaly Avoidance Afternoon: Pass
Site Activities Conducted:	
ERT arrives onsite and meets with NPS staff (D. Crary) at Fire Cache for morning briefing. ERT conducted morning instrument verification. ERT continued soil sample collection at Background Area, AOI3, and AOI5. ERT conducted afternoon instrument verification. ERT meets with D. Crary at Fire Cache for afternoon briefing. ERT offsite.	
Visitors:	
None	
Issues Encountered and Resolutions:	
Afternoon GPS verification not completed due to base station antennae loss of power. An extra external battery has been obtained to avoid this potential issue going forward.	
Planned Activities:	
Continue sample collection; sample collection to be completed in AOI3 and AOI4.	

Table 1. Sample Collection

Sample	Date	Sample	Date	Sample	Date
BKG-SU1-SB	4/12	BKG-SU4-SB	4/12	AOI3-SU3-SA-Rep1	4/12
AOI3-SU3-SA-Rep2	4/12	AOI3-SU3-SA-Rep3	4/12	AOI5-SU1-SA-Rep1	4/12
AOI5-SU1-SA-Rep2	4/12	AOI5-SU1-SA-Rep3	4/12	AOI5-SU2-SA-Rep1	4/12
AOI5-SU2-SA-Rep2	4/12	AOI5-SU2-SA-Rep3	4/12		
SA = Surface Soil (ISM) SB = Subsurface Soil (ISM)					

ERT DAILY FIELD REPORT

Project: Camp Wellfleet	**Date: 04/13/2018**
Report Number: 005	Prepared By: Robert Koroncai
Time of Arrival at Site: 0700	Time of Departure from Site: 1645
Time of Safety Brief: 0715	
Weather/Site Conditions:	
Weather: Cloudy, 50 degrees	
Personnel On-Site:	
Robert Koroncai (ERT – Team Leader)	**Mike Watson (ERT – UXO Tech Lead)**
Lee Lucas (ERT)	**Lee Peterson (ERT)**
Equipment Quality Control:	
GPS Morning: Pass	Anomaly Avoidance Morning: Pass
GPS Afternoon: Pass	Anomaly Avoidance Afternoon: Pass
Site Activities Conducted:	
ERT arrives onsite and meets with NPS staff (D. Crary) at Fire Cache for morning briefing. ERT conducted morning instrument verification. ERT collected groundwater sample from Well B. ERT continued soil sample collection at AOI3, and AOI4. ERT conducted afternoon instrument verification. ERT meets with D. Crary at Fire Cache for afternoon briefing. ERT offsite.	
Visitors:	
Patrick (PJ) Mion (USACE-CENAE)	
Issues Encountered and Resolutions:	
None	
Planned Activities:	
Continue sample collection; sample collection to be conducted in AOI3 and AOI4.	

Table 1. Sample Collection

Sample	Date	Sample	Date	Sample	Date
WellB-GW-1	4/13	AOI4-SU5-SA-Rep1	4/13	AOI4-SU5-SA-Rep2	4/13
AOI4-SU5-SA-Rep3	4/13	AOI3-SU1-SA-Rep1	4/13	AOI3-SU1-SA-Rep2	4/13
AOI3-SU1-SA-Rep3	4/13	AOI3-SU1-SB-Rep1	4/13	AOI3-SU1-SB-Rep2	4/13
AOI3-SU1-SB-Rep3	4/13				

SA = Surface Soil (ISM)
SB = Subsurface Soil (ISM)

ERT DAILY FIELD REPORT

Project: Camp Wellfleet	**Date: 04/14/2018**
Report Number: 006	Prepared By: Robert Koroncai
Time of Arrival at Site: 0700	Time of Departure from Site: 1645
Time of Safety Brief: 0705	
Weather/Site Conditions:	
Weather: Sunny, 55 degrees	
Personnel On-Site:	
Robert Koroncai (ERT – Team Leader)	**Mike Watson (ERT – UXO Tech Lead)**
Lee Lucas (ERT)	**Lee Peterson (ERT)**
Equipment Quality Control:	
GPS Morning: Pass	Anomaly Avoidance Morning: Pass
GPS Afternoon: Pass	Anomaly Avoidance Afternoon: Pass
Site Activities Conducted:	
ERT arrived onsite and conducted health and safety brief. ERT conducted morning instrument verification. ERT continued soil sample collection at AOI3, and AOI4. ERT conducted afternoon instrument verification. ERT offsite.	
Visitors:	
Partrick (PJ) Mion (USACE-CENAE)	
Issues Encountered and Resolutions:	
No issues encountered.	
Planned Activities:	
Continue sample collection in AOI3 and AOI4.	

Table 1. Sample Collection

Sample	Date	Sample	Date	Sample	Date
AOI4-SU3-SA-Rep1	4/14	AOI4-SU3-SA-Rep2	4/14	AOI4-SU3-SA-Rep3	4/14
AOI4-SU3-SB-Rep1	4/14	AOI4-SU3-SB-Rep2	4/14	AOI4-SU3-SB-Rep3	4/14
AOI3-SU2-SA-Rep1	4/14	AOI3-SU2-SA-Rep2	4/14	AOI3-SU2-SA-Rep3	4/14
AOI4-SU1-SA-Rep1	4/14	AOI4-SU1-SA-Rep2	4/14	AOI4-SU1-SA-Rep3	4/14
AOI4-SU3-SA-Rep1	4/14	AOI4-SU3-SA-Rep2	4/14	AOI4-SU3-SA-Rep3	4/14
AOI4-SU4-SA-Rep1	4/14	AOI4-SU4-SA-Rep2	4/14	AOI4-SU4-SA-Rep3	4/14

SA = Surface Soil (ISM)
SB = Subsurface Soil (ISM)

ERT DAILY FIELD REPORT

Project: Camp Wellfleet	**Date: 04/16/2018**
Report Number: 007	Prepared By: Robert Koroncai
Time of Arrival at Site: NA	Time of Departure from Site: NA
Time of Safety Brief: NA	
Weather/Site Conditions:	
Weather: Heavy rain, strong winds	
Personnel On-Site:	
Robert Koroncai (ERT – Team Leader)	**Mike Watson (ERT – UXO Tech Lead)**
Lee Lucas (ERT)	**Lee Peterson (ERT)**
Equipment Quality Control:	
GPS Morning: NA	Anomaly Avoidance Morning: NA
GPS Afternoon: NA	Anomaly Avoidance Afternoon: NA
Site Activities Conducted:	
No site work conducted due to heavy rain and strong winds. Logistics and planning for upcoming sampling events was conducted.	
Visitors:	
None	
Issues Encountered and Resolutions:	
No issues encountered.	
Planned Activities:	
Continue sample collection; sample collection to be conducted in AOI3 and AOI4.	

Table 1. Sample Collection					
Sample	**Date**	**Sample**	**Date**	**Sample**	**Date**
SA = Surface Soil (ISM) SB = Subsurface Soil (ISM)					

ERT DAILY FIELD REPORT

Project: Camp Wellfleet	**Date: 04/17/2018**
Report Number: 008	Prepared By: Robert Koroncai
Time of Arrival at Site: 0700	Time of Departure from Site: 1600
Time of Safety Brief: 0715	
Weather/Site Conditions:	
Weather: Sunny, 55 degrees	
Personnel On-Site:	
Robert Koroncai (ERT – Team Leader)	**Mike Watson (ERT – UXO Tech Lead)**
Lee Lucas (ERT)	**Lee Peterson (ERT)**
Equipment Quality Control:	
GPS Morning: Pass	Anomaly Avoidance Morning: Pass
GPS Afternoon: Pass	Anomaly Avoidance Afternoon: Pass
Site Activities Conducted:	
ERT arrived onsite and conducted health and safety brief. ERT conducted morning instrument verification. ERT continued soil sample collection at AOI1. ERT conducted afternoon instrument verification. ERT offsite.	
Visitors:	
None	
Issues Encountered and Resolutions:	
No issues encountered.	
Planned Activities:	
Continue sample collection; sample collection to be conducted in AOI2 and AOI5 with MassDEP oversight.	

Table 1. Sample Collection

Sample	Date	Sample	Date	Sample	Date
AOI1-SU1-SA-Rep1	4/17	AOI1-SU1-SA-Rep2	4/17	AOI1-SU1-SA-Rep3	4/17
AOI1-SU2-SA-Rep1	4/17	AOI1-SU2-SA-Rep2	4/17	AOI1-SU2-SA-Rep3	4/17
AOI1-SU2-SO01-8-10	4/17	AOI1-SU2-SO02-8-10	4/17	AOI1-SU2-SO03-8-10	4/17
AOI1-SU2-SO04-8-10	4/17	Wellfleet-FD1	4/17	AOI1-SU3-SA-Rep1	4/17
AOI1-SU3-SA-Rep2	4/17	AOI1-SU3-SA-Rep3	4/17	AOI1-SU3-SO01-8-10	4/17
AOI1-SU3-SO01-8-10-MS/MSD	4/17	AOI1-SU3-SO02-8-10	4/17	AOI1-SU3-SO03-8-10	4/17
AOI1-SU3-SO04-8-10	4/17				

SA = Surface Soil (ISM)
SO = Subsurface Soil (Discrete)

ERT DAILY FIELD REPORT

Project: Camp Wellfleet	**Date: 04/18/2018**
Report Number: 009	Prepared By: Robert Koroncai
Time of Arrival at Site: 0700	Time of Departure from Site: 1530
Time of Safety Brief: 0715	
Weather/Site Conditions:	
Weather: Sunny, 55 degrees, light winds	
Personnel On-Site:	
Robert Koroncai (ERT – Team Leader)	**Mike Watson (ERT – UXO Tech Lead)**
Lee Lucas (ERT)	**Lee Peterson (ERT)**
Equipment Quality Control:	
GPS Morning: Pass	Anomaly Avoidance Morning: Pass
GPS Afternoon: Pass	Anomaly Avoidance Afternoon: Pass
Site Activities Conducted:	
ERT arrived onsite and conducted health and safety brief. ERT conducted morning instrument verification. ERT continued soil sample collection at AOI2 and AOI5. ERT completed all soil sampling. ERT conducted afternoon instrument verification. ERT offsite.	
Visitors:	
Performing oversight: PJ Mion (USACE) Kendall Walker (MassDEP)	
Issues Encountered and Resolutions:	
No issues encountered. Oversight personnel seemed pleased with observed activities.	
Planned Activities:	
Collect IDW sample, recover ISOs, final site check, and demobilize.	

Table 1. Sample Collection

Sample	Date	Sample	Date	Sample	Date
AOI2-SU1-SA-Rep1	4/18	AOI2-SU1-SA-Rep2	4/18	AOI2-SU1-SA-Rep3	4/18
AOI2-SU2-SA-Rep1	4/18	AOI2-SU2-SA-Rep2	4/18	AOI2-SU2-SA-Rep3	4/18
AOI2-SU3-SA-Rep1	4/18	AOI2-SU3-SA-Rep2	4/18	AOI2-SU3-SA-Rep3	4/18
AOI5-SU3-SA-Rep1	4/18	AOI5-SU3-SA-Rep2	4/18	AOI5-SU3-SA-Rep3	4/18
AOI5-SU3-SB-Rep1	4/18	AOI5-SU3-SB-Rep2	4/18	AOI5-SU3-SB-Rep3	4/18
SA = Surface Soil (ISM) SB = Subsurface Soil (ISM)					

ERT DAILY FIELD REPORT

Project: Camp Wellfleet	**Date: 04/19/2018**
Report Number: 010	Prepared By: Robert Koroncai
Time of Arrival at Site: 0800	Time of Departure from Site: 0900
Time of Safety Brief: 0805	
Weather/Site Conditions:	
Weather: Cloudy, 50 degrees, light rain	
Personnel On-Site:	
Robert Koroncai (ERT – Team Leader)	**Mike Watson (ERT – UXO Tech Lead)**
Lee Lucas (ERT)	
Equipment Quality Control:	
GPS Morning: NA	Anomaly Avoidance Morning: NA
GPS Afternoon: NA	Anomaly Avoidance Afternoon: NA
Site Activities Conducted:	
ERT arrived onsite and conducted health and safety brief. ERT collected IDW sample of equip decon water. ERT removed two ISOs used for instrument verification. ERT offsite. ERT Demobilized.	
Visitors:	
None.	
Issues Encountered and Resolutions:	
No issues encountered.	
Planned Activities:	
None.	

Table 1. Sample Collection

Sample	Date	Sample	Date	Sample	Date
Wellfleet-IDW1	4/19				
IDW = Investigative Derived Waste (equipment decontamination fluid)					

CONTENTS

PAGE	REFERENCE	DATE

TEAM 1
FIELD NOTES

Date: 4/9/18

0700 - Leave ERT office, mob to
Cape COD National Seashore

1605 - Arrive at CCNS Maintenance yard,
meet w/ D. Crary

1615 - Drive around site w/ Crary, go
to GPS control point by Maint off,
go to Haz mat storage area, Marconi
beach parking lot, Background area
and control point by park entrance.

1715 - ERT offsite, mob to hotel

Date: 4/10/18

0700 - ERT arrives onsite at Maint office Fire lane
meet w/ D Gray
Nicole
Nita

0705 - go over introductions, NPS discuss our access to the AOI's, go over safety, ensure no disturbance to the environment

0710 - ERT conducts daily H&S brief and go over the days plan

0715 - mob to Haz Mat area and place drum in storage

0720 - mob to control point (CP14) by maint office, set-up base station

0725 - mob to control point (CP6) by entrance and confirm coordinates

0730 - mob to bone yard area and setup Schonstedt QC, bury two #50's at ~~0.5~~ 0.5 ft bgs

0745 - mob to marconi beach parking lot to set-up control point

0800 - set first point at "PL Corner"

0820 - mob to CP14 to get base station

0840 - set-up base at PL corner

0900 - mob to background area

0920 - Clean equipment, pack gear, head to BKG-SU4

0940 - out at SU4, oriented team within grid

1000 - begin collecting samples

1130 - Samples collected
- BKG-SU4-SA
- BKG-SU4-SA-Rep2 - not needed
- BKG-SU4-SA-Rep3

1145 - mob to trucks, decon equipment, put samples in cooler

1200 - Lunch

1230 - mob to SU7. and begin sample collection

1345 - Collect SU7 BKG-SU7-SA

1400 - decon equipment, place sample in cooler

1410 - mob to SU6, begin sample collection

1530 - Sample collection complete
- BKG-SU6-SA

1545 - decon equipment and place sample in cooler

1600 - begin collecting SU3

1640 - Sample collection complete
- BKG-SU3-SA

1645 - Mob to Marconi Beach parking lot, conduct instrument verification

Rite in the Rain

1655 - mob to Fire Cache, discuss work accomplished and planned activities for tomorrow

1700 - ERT offsite

Date: 4/11/18

0700 - meet at Fire Cache, ERT + Gray. Discuss plan for the day, no issues to be discussed

0725 - Watson ERT conduct H+S brief

0740 - Watson + Petersen mob to boneyard area and conduct QC. Kobonai and Lucas mob to Marconi beach parking lot, set up base station and conduct QC

0755 - Watson + Petersen arrive at marconi beach parking lot

0800 - pack / organize equipment

0830 - mob to background area

0850 - Kobonai + Watson ~~mob to~~ (Team 2) mob to BKG-SU6

0905 - begin collecting sample at SU-6

1115 - Sample collection complete.

$\boxed{\text{• BKG-SU6-SB}}$

1125 - Lunch

1145 - decon step probe

1155 - mob to SU 5

1215 - begin Sample collection

1330 - Sample collection complete

$\boxed{\text{• BKG-SU5-SB}}$

Rite in the Rain

1345- Pack sample, decon step probe
1400- Team 1+2 mob to SU-2 to begin soil sample collection
1535- Sample collected
- BKG-SU2-~~Rep 1~~ SB-Rep1
- BKG-SU2-SB-Rep2

1545- Decon probe, pack cooler
~~1405~~ 1605 ATK - Team 2 mob ~~to~~ ATK offsite to ship samples. Team 1 begin sample collection at BKG-SU2
~~1450~~ 1650 ATK - Sample collected
- BKG-SU2-SB-Rep3

~~1455~~ 1655 - decon probe
~~1500~~ 1700 - conduct afternoon instrument verification
~~1510~~ 1710 - meet w/ Crary at fire cache
~~1515~~ 1715 - ERT offsite

Date: 4/12/18
0700- ERT + Crary meet at Fire cache and discuss plan for day
0715- Conduct H&S brief
0730- Conduct Schonstedt verification, set-up base station
0735- Conduct GPS verification
0740- pack truck, ~~move~~ mob to Background Area
0800- Arrive at BKG Area
0815- Team 1 mob to BKG-SU4
Team 2 mob to BKG-SU1
0945- Sample collected
- BKG-SU4-SB

0955- decon equipment, mob to AOI3-SU3
1015- Lunch
1030- begin sample collection
1215- sample collection complete
- ~~B~~ AOI3-SU3-SA-Rep1
- AOI3-SU3-SA-Rep2
- AOI3-SU3-SA-Rep3

1230- mob to NPS HQ for break
1250- mob to AOI5-SU1

1300 - begin sample collection at
AOI5-SU1
1400 - sample collected
- AOI5-SU1-SA-Rep1
- AOI5-SU1-SA-Rep2
- AOI5-SU1-SA-Rep3

1405 - decon equipment, pack samples
1410 - begin sample collection at
AOI5-SU2
1500 - Sample collection complete
- AOI5-SU2-SA-Rep1
- AOI5-SU2-SA-Rep2
- AOI5-SU2-SA-Rep3

1515 - pack cooler
1535 - Team 2 offsite, mob to
ship cooler, Team 1 mob
to establish control points
by AOI3/AOI4
1545 - Base station battery has no power,
unable to establish control points
1600 - conduct afternoon instrument verification
no GPS verification possible
1605 - mob to fire cache to unload IDW
1620 - unload IDW, go to meet w/ Crary
1630 - afternoon brief w/ Crary
1700 - offsite

Date: 4/13/18
0700 - ERT onsite, arrive at
Fire cache for morning brief
w/ Crary & Richard Murphy
720 - mob to control point 14 to
set-up base station
725 - Team 1 (Komancai & Watson) mob
to Well B to meet with
R. Murphy
~~0735~~ 0725 - Team 2 to survey two new
control points at the end of
Hunters Road to use for
AOI3 & AOI4
0735 - Team 1 meet w/ R. Murphy
to over water system, Well B
located inside well house. Sample
to be taken from tap in the
water line w/in well house,
no filter or conditioning between
well and tap.
0740 - begin purging line
0800 - 15 gallons purged.
0805 - collect GW sample
- WellB-GW-1

0810 - mob to Marconi Station Site (AOI1)

Rite in the Rain

0815 - meet w/ Team 2, Team 2
set-up additional control points
to use for AOI 1 / AOI 2
0835 - Team 1 & Team 2 mob to
Marconi beach parking lot. Stop
at Control Point 14 to get
base station. ~~set up~~ new
0850 - set-up base station at
Marconi beach parking lot.
~~0900 - mob to AOI 4-SU5~~ AKs
Iborancu & Lucas perform GPS
QC, Watson & Peterson perform
Schoendstadt QC
0900 - mob to AOI 4-SU5. GPS Rover
in autonomus status, mob back to
base station to determine Rover status
issue. Lucas trouble shoot w/ Stuby.
Lucas reconfigure base and
rover
1030 - mob to AOI 4-SU5
1045 - begin sample
1115 - P.J. Mion onsite, Isoboncu
mob to Marconi Beach
gate.
1130 - Conduct H&S brief
1145 - mob ovr to SU

1220 - Sample collected
- AOI 4-SU5-SA-Rep1
- AOI 4-SU5-SA-Rep2
- AOI 4-SU5-SA-Rep3

1230 - Lunch
1300 - mob to Marconi Beach Parking lot
to pick up base station
1310 - mob to Hunter Road
1315 - set-up base station, verify rover
1330 - mob to AOI 3-SU1
1415 - collected surface sample
- AOI 3-SU1-SA-Rep1
- AOI 3-SU1-SA-Rep2
- AOI 3-SU1-SA-Rep3

1420 - begin subsurface collection
1545 - Sample collection complete
- AOI 3-SU1-SB-Rep1
- AOI 3-SU1-SB-Rep2
- AOI 3-SU1-SB-Rep3

1550 - Decon equipment. Meet Cory
for Afternoon brief at Hunter Road
1600 - Afternoon GPS verification.
Team 2 pack cooler and mob
offsite to UPS.
1630 - Team 1 mob to bone yard

1635 - Conduct sundown/shelf verification
1645 - ERT ~~dUSACE~~ offsite

Date: 4/14/18
0700 - ERT onsite, mob directly to Hunters Road
0705 - Conduct H&S brief, go over plan for the day
0715 - conduct instrument verification
0725 - get equipment prepped
0730 - PJ Mion onsite
0735 - mob to AOI 4-SU3
0750 - begin collecting surface soil
0835 - Sample collection complete
0845 -
- AOI4-SU2-SA-Rep1
- AOI4-SU2-SA-Rep2
- AOI4-SU2-SA-Rep3

0845 - begin collecting subsurface
1000 - Subsurface sample collection complete
- AOI4-SU2-SB-Rep1
- AOI4-SU2-SB-Rep2
- AOI4-SU2-SB-Rep3

1015 - return to trucks, pack cooler, decon equipment
1030 - take lunch
1050 - mob to AOI3-SU2
1100 - begin sample collection
1140 - Sample collection complete

Rite in the Rain

• A0I3-SU2-SA-Rep1
• A0I3-SU2-SA-Rep2
• A0I3-SU2-SA-Rep3

1200 - decon equipment
1210 - mob to ~~X~~ A304-SU1, begin sample collection
1300 - sample collection complete

• A0I4-SU1-SA-Rep1
• A0I4-SU1-SA-Rep2
• A0I4-SU1-SA-Rep3

1305 - mob to truck, pack cooler, decon equipment
1315 - mob to A0I4-SU3
1325 - begin collecting sample
1420 - sample collection complete

• A0I4-SU3-SA-Rep1
• A0I4-SU3-SA-Rep2
• A0I4-SU3-SA-Rep3

1425 - decon equipment
1430 - mob to A0I4-SU4
1445 - begin collecting sample
1530 - sample collection complete

• A0I4-SU4-SA-Rep1
• A0I4-SU4-SA-Rep2
• A0I4-SU4-SA-Rep3

1540 - mob to truck

1555 - Decon equipment, pack coolers
1605 - ~~pack coo~~ ners conduct afternoon instrument verification
1630 - pack equipment
1645 - off site

Rite in the Rain

Date: 4/17/18

0700 - ERT Arrive onsite at Fire Cache. Meet w/ D. Leary.

0715 - Conduct H&S brief and discuss plan for the day

0720 - mob to AOI 1

0730 - arrive at parking lot near AOI 1 set-up base station. Conduct instrument verification

0745 - front left tire on ERT truck observed to be losing air. drive to nearby gas station to find repair kit and add air

0820 - tire repaired, mob back to AOI 1

0835 - ~~arrive~~ drive down maintenance road. Park near AOI 1-SU3

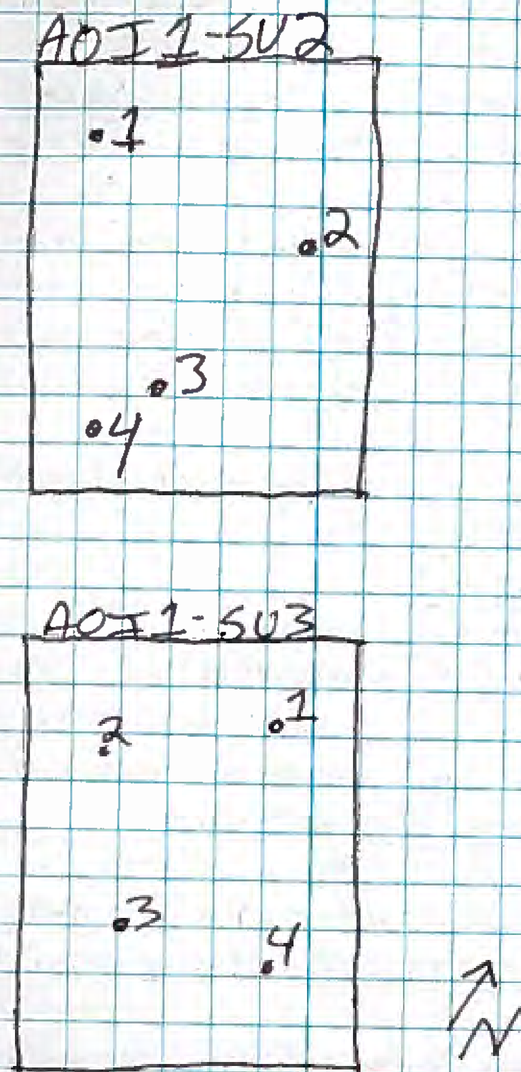
0845 - mob to AOI 1-SU3 to begin sample collection
- team 1 (Koconcar, watson) begin collecting discrete samples. Team 2 (Lucas, Peterson) begin collection of surface sample

0915 - begin collecting subsurface sample

0945 - Sample collection complete

$\boxed{\text{• AOI 1-SU2-S001-6-10}}$

0950 - decon auger



Not to Scale

0955 - mob to AOI 1-SU2-SB02
1000 - begin sample collection
1015 - sample collection complete
• AOI 1-SU2-SO02-8-10
1020 - decon auger
1025 - begin collecting sample at AOI 1-SU2-SB03
1040 - sample collection complete
• AOI-SU2-SO03-8-10
1045 - decon auger
1050 - begin collecting at AOI 1-SU2-SB04
1105 - sample collected
• AOI 1-SU2-SO04-8-10
1106 - collect field dup from AOI 1-SU2-SB04
• wellfleet-FD1
1110 - decon auger, mob to AOI 1-SU3
1115 - begin collecting sample at AOI 1-SU3-SB01
1130 - sample collected, MS/MSD collected
• AOI 1-SU3-SO01-8-10
• AOI 1-SU3-SO01-8-10-MS1
• AOI 1-SU3-SO01-8-10-MSD1
1135 - decon auger
1140 - begin sample collection at AOI 1-SU3-SB02
1200 - sample collection complete
• AOI 1-SU3-SO02-8-10
1205 - decon equipment

1210 - begin sample collection at AOI 1-SU3-SB03
1230 - sample collected
• AOI 1-SU3-SO03-8-10
small metal fragments and glass observed from 2-6 ft bgs
1235 - decon auger
1240 - begin sample collection at AOI 1-SU3-SB04
1300 - sample collection complete
• AOI 1-SU3-SO04-8-10
small metal fragments observed between 3 and 10 ft bgs
1305 - decon equipment
1310 - mob back to truck
1315 - take lunch
1345 - mob to AOI 1-SU1
1400 - begin collecting sample
1445 - sample collection complete
• AOI 1-SU1-SA-Rep1
• AOI 1-SU1-SA-Rep2
• AOI 1-SU1-SA-Rep3
1450 - mob to truck, mob to parking lot
1500 - mob to NPS HQ to pick up coolers
1510 - mob to parking lot

Rite in the Rain

1515 - Conduct instrument verification
1530- pack-up base station
1545- Call Crary and discuss what was accomplished
1600- mob offsite to pack & ship coolers

Date: 4/18/18
0700- ERT onsite, meet Crary at Fire Cache. Discuss plan for the day
0715- Conduct H&S brief.
0725- Conduct instrument verification Base station set-up at parking lot near AOI 1/2.
0745 - mob to AOI 2-SU1
0800 - begin sample collection
0845 - Sample collection complete
- AOI2-SU1-SA-Rep1
- AOI2-SU1-SA-Rep2
- AOI2-SU1-SA-Rep3

0850- Mob to parking lot to get base station. Decon equipment
0900- mob to end of Hunter road, set-up base station
0910- mob to AOI 2-SU2, park along road
0920- begin sample collection
1000- samples collected
- AOI2-SU2-SA-Rep1
- AOI2-SU2-SA-Rep2
- AOI2-SU2-SA-Rep3

1010- mob to Hunter road

Rite in the Rain

1015 - decon equipment, [illegible]
1020 - mob to AOI2-SU3
1030 - begin collecting sample
1100 - sample collection complete

- AOI2-SU3-SA-Rep1
- AOI2-SU3-SA-Rep2
- AOI2-SU3-SA-Rep3

1105 - mob to trucks, pack up base station
1115 - mob to NPS HQ to meet PJ Mion (USACE) and Kendall Walker (MassDEP)
1130 - mob to Marconi Beach parking lot
1135 - set up base station, verify rover, decon equipment
1145 - begin collecting sample
1230 - sample collected

- AOI5-SU3-SA-Rep1
- AOI5-SU3-SA-Rep2
- AOI5-SU3-SA-Rep3

1245 - mob to truck, pack samples, decon equipment
Note: during collection of surface samples at AOI5-SU3, the two (2) easternmost lines were close/over the bluff.

Due to safety concerns and inability to access those sample increments, 2 lines were relocated to the western edge of the SU. USACE and MassDEP agreed with this action as the appropriate action to take. Additionally the easternmost one (1) subsurface line of incremental points were agreed to be moved, offset from the western edge of the SU. Again concurrence was reached between ERT, USACE, and MassDEP.

1300 - begin sample collection at AOI5-SU3
1440 - sample collection complete

- AOI5-SU3-SB-Rep1
- AOI5-SU3-SB-Rep2
- AOI5-SU3-SB-Rep3

1450 - pack cooler, decon equipment
1500 - ERT mob to fire cach, USACE and MassDEP offsite
1510 - Conduct instrument verification
1530 - ERT offsite

Date: 4/19/18
0800 – ERT onsite
0805 – conduct H&S brief. Go over plan
w/ Crary
0820 – mob to bone yard to remove
JSO's
0835 – mob to Maintenance yard, collect
IDW sample
0850 – mob to Fire lane. Final
brief w/ Crary
0900 – ERT offsite. ERT demob.

Rite in the Rain

CONTENTS

PAGE	REFERENCE	DATE

TEAM 2
FIELD NOTES

Date: 4/10/18 Lee Lucas

0700 - ERT arrives onsite
0715: place drum in storage
0720. mob to control point M in parking lot (CP M)
0730: mob to control point 6 for quality control, test successful
0745: mob to beach parking to install new base station point
0815: save new point on middle corner of parking lot median, named PLcorner
0840: setup new base station at PLcorner
0900 - Mob to background sample area
0920 - Start setup for field work
0940 - Walked to SU-4 (background)
1000 - Started work on Bkg SU-4
1130 - finished sampling Bkg SU-4
1145 - returned to truck and decon equipment
1200 - Took lunch
1230 - Mob to SU5 (Bkg), perform sample
1330 - Collect (finish) samples, move to decon equipment at truck
1345 - Mob to SU1 to collect sample
1500 - finish collecting SU1, move to decon. at truck
1515 - mob to SU 2, start collecting

1630 - finish collecting SU2, move to truck for decon. of equipment

1645 - pack up truck, take down GPS base station

1700 - Talk to Dave / end-of-day brief, leave site

4/11/18 Lee Lucas

0700 - Assemble at Fire Cache, ERT personnel & Dave Crump

0725 - ERT safety brief

0740 - UXO personnel conducts QC at boneyard. Lucas / Koranda set up GPS base in Marcon P.L., conduct Q.C.

0800 - mob / organize equipment

0830 - mob to background area

0850 - Bob / Mike = SU6
Lee / Lee - SU3

0900 - experience issues with Allegro files

0930 - Solve issue, encounter another problem

0950 - call Jim, reset and re-enter data setting

1000 - Start work at SU3

1145 - Finish work at SU3, return to truck

1200 - Lunch

1230 - Start work on SU7

1330 - Finish SU7, return to truck

1345 - decon equipment

1415 - Start work on ~~SU4~~ SU2

1535 - Finish at SU2, return to truck
Decon equipment

1600 - leave site, head for UPS

4/12/18 Lea Lucas

0700 - Safety brief with Dave & ERT
0730 - Mike & Lea P. mob to boneyard for QC. Bob & Leah set-up base station & QC GPS
0800 - mob to background area
0815 - Start sampling of $\boxed{\text{Bkg-SU1-SB}}$
0950 - Finish Bkg-SU1-SB, return to truck to ~~decon~~ decon
~~1010 - finish decon/break~~
1015 - mob to AOI3-SU3-SA
1035 - depart for grid
1215 - sample (finish) $\boxed{\text{AOI3 SU3-SA}}$
1220 - decon equipment, clean, pack-up lunch
1300 - mob to $\boxed{\text{AOI 5 - SU1 - SA}}$
~~1400~~ 1345 - finish AOI 5-SU1-SA
~~1500~~ 1400 - Start sampling $\boxed{\text{AOI5-SU2-SA (rep 1-3)}}$
1500 - finish & collect sample, prepare labels, decon, pack up truck.
1530 - depart for hotel to get ice, then go to UPS for sample shipment
1645 - ship samples, done for day

4/17/18 Leelucas

0700 - meet on site, safety brief with Dave Crery and Mike N, Lee L, Lee P, Bob K

0720 - mob to AOI1 area, setup base station using "NPS POST" control point and "NPS POST 1" to QC

0745 - discover truck has flat tire, off site to Shell station to patch tire, get air.

0825 - arrive back on site

0930 - Start sampling $\boxed{\text{AOI1-SU2-SA}}$

1120 - Finish sampling $\boxed{\text{AOI1-SU2-SA}}$

1125 - Start $\boxed{\text{AOI1-SU3-SA}}$

1250 - Finish $\boxed{\text{AOI1-SU3-SA}}$

1310 - Finish decon / move to truck

1330 - Take Lunch

1400 - Mob to $\boxed{\text{AOI1-SU1-SA}}$

1445 - Finish sampling $\boxed{\text{AOI1-SU1-SA}}$

1450 - mob to truck, leave site

~~1330~~ 1530 - grab ice, start packing of coolers. Write COCs

1630 - Leave for UPS,

1650 - arrive at UPS, drop off samples, return to hotel

1505 - arrive at hotel