FINAL

Site Inspection Report
Fort Pickens

Escambia County, Florida

U.S. Army Corps of Engineers
Southeast and Pacific IMA Region

FUDS Project No. I04FL006301
Contract: W912DY-04-D-0005
Task Order: 0008

Prepared For:
U.S. Army Corps of Engineers, Jacksonville District
701 San Marco Boulevard
Jacksonville, Florida 32207
and
U.S. Army Engineering & Support Center, Huntsville
4820 University Square
Huntsville, Alabama 35816-1822

The views, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

March 4, 2011

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Parsons Infrastructure and Technology Group (Parsons) has completed the Final Site Inspection report for Fort Pickens, Escambia County, Florida. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project, as defined in the Quality Control Plan. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions was verified. This included review of assumptions; methods, procedures, and material used in analyses; alternatives evaluated; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing Corps policy.

Jeff Hall Kathleen A. Rowland

Karen Bowlware

March 4, 2011

Study/Design Team Leader and Team Members

Jim L. Davis Carol Moore

March 4, 2011

Independent Technical Review Team Leader

Significant concerns and the explanation of the resolution are as follows:

None

As noted above, all concerns resulting from independent technical review of the project have been considered.

Don Laura Kelley

March 4, 2011

Parsons Program Manager(s)

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March 4, 2011

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Subject: Contract W912DY-04-D-0005, Delivery Order 0008
MMRP SI for SE and Pacific IMA Region –Final SI Report,
Fort Pickens, Escambia County, Florida

Dear Ms. Terry:

Parsons Infrastructure and Technology Group (Parsons) has prepared this Final Site Inspection (SI) Report in accordance with the Performance Work Statement (PWS) to include the completed Munitions Response Site Prioritization Protocol (MRSPP). Two copies have been provided for your records.

We have provided five copies of the document to Mr. William Spence of the Jacksonville District for distribution to stakeholders and CESAJ records. We have also submitted a single copy of this document to CX-MM. Electronic copies have also been provided, including one to CX-EG and one to CEMVS-EC-P.

If you have any questions or comments, please contact me at (678) 969-2437 or (404) 934-1266 (cell).

Sincerely,

PARSONS

Laura Kelley

Laura Kelley
MMRP SI SE Program Manager

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U.S. Army Corps of Engineers
Southeast and Pacific IMA Region

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March 4, 2011

In Support of

FUDS MMRP Site Inspections Project

Prepared for:
U.S. Army Corps of Engineers, Jacksonville District
701 San Marco Boulevard
Jacksonville, Florida 32207

and

U.S. Army Engineering and Support Center, Huntsville
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TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY ES-1

CHAPTER 1 INTRODUCTION 1-1
1.1 Background 1-1
1.2 Project Objectives 1-2
1.3 Project Scope 1-3

CHAPTER 2 PROPERTY DESCRIPTION AND HISTORY 2-1
2.1 Site Description 2-1
2.2 Site Location and Setting 2-1
2.2.1 Topography and Vegetation 2-1
2.2.2 Geology and Soils 2-1
2.2.3 Climate 2-3
2.2.4 Hydrology 2-3
2.2.5 Groundwater 2-3
2.2.6 Significant Structures 2-4
2.2.7 Demographics 2-4
2.2.8 Current and Future Land Use 2-5
2.2.9 Site Ownership and History 2-5
2.2.10 Cultural and Archeological Resources 2-6
2.3 Site Operations and Waste Characteristics 2-7
2.3.1 Munitions Response Site-Specific Descriptions/Operations 2-7
2.3.2 Regulatory Compliance 2-7
2.4 Previous Investigations 2-7
2.4.1 1984 Environmental Restoration Defense Account (ERDA) 2-7
2.4.2 1990 Inventory Project Report 2-7
2.4.3 2007 Preliminary Assessment 2-7
2.4.4 2008 Archives Search Report Supplement 2-8
2.4.5 2009 Summary Report for Gulf Island National Seashore 2-8
2.4.6 Technical Project Planning Memorandum 2-8

CHAPTER 3 SITE INSPECTION TASKS 3-1
3.1 Historical Record Review 3-1
3.2 Technical Project Planning Summary 3-1
3.3 Nonmeasurement Data Collection 3-4
3.4 Site-Specific Work Plan Addendum 3-5
3.5 Departures From Planning Documents 3-6

TABLE OF CONTENTS
(CONTINUED)

Page

CHAPTER 4 MUNITIONS AND EXPLOSIVES OF CONCERN FINDINGS 4-1
4.1 General Information 4-1
4.1.1 Qualitative Reconnisaince 4-1
4.2 Data Quality Objectives 4-16
4.2.1 Introduction 4-16
4.2.2 Munitions and Explosives of Concern Data Quality Objective 4-17
4.2.3 Munitions Constituents Data Quality Objective 4-17
4.2.4 Munitions Response Site Prioritization Protocol Data Quality Objective 4-17
4.2.5 Hazard Ranking System Data Quality Objective 4-18
4.3 MRS01 – Range Complex 4-18
4.3.1 Historical Munitions and Explosives of Concern 4-18
4.3.2 Inspection Activities 4-18

CHAPTER 5 EXPOSURE / EXPOSURE PATHWAYS AND RECEPTORS 5-1
5.1 Introduction 5-1
5.2 General Information 5-1
5.2.1 Regional Geologic Setting 5-1
5.2.2 Regional Hydrogeologic Setting 5-2
5.2.3 Regional Groundwater Use 5-3
5.2.4 Regional Hydrologic Setting 5-3
5.2.5 Regional Sensitive Ecological Resources 5-3
5.2.6 Sample Locations/Methods 5-17
5.2.7 Ambient Metals Concentrations 5-24
5.2.8 MC Source Source Evaluation 5-24
5.3 MRS01 - Range Complex 5-24
5.3.1 Historical MC Information 5-24
5.3.2 Groundwater Exposure Pathway 5-25
5.3.2.1 Geologic and Hydrogeologic Setting 5-25
5.3.2.2 Releases and Potential Releases to Groundwater 5-25
5.3.2.3 Groundwater Exposure Pathways and Receptors 5-25
5.3.2.4 Groundwater Sample Locations and Methods 5-25
5.3.2.5 Groundwater Analytical Results 5-25
5.3.2.6 Groundwater Exposure Pathway Conclusions 5-26
5.3.3 Surface Water and Sediment Exposure Pathways 5-28
5.3.3.1 Hydrologic Setting 5-28

TABLE OF CONTENTS
(CONTINUED)

Page

5.3.3.2 Releases and Potential Releases to Surface Water and Sediment 5-28
5.3.3.3 Surface Water and Sediment Exposure Pathways and Receptors 5-28
5.3.3.4 Surface Water and Sediment Sample Locations and Methods 5-29
5.3.3.5 Surface Water and Sediment Analytical Results 5-30
5.3.3.6 Surface Water and Sediment Exposure Pathway Conclusions 5-35
5.3.4 Soil Exposure Pathway 5-36
5.3.4.1 Physical Source Access Conditions 5-36
5.3.4.2 Actual or Potential Contamination Areas 5-36
5.3.4.3 Soil Exposure Pathways and Receptors 5-36
5.3.4.4 Soil Sample Locations and Methods 5-37
5.3.4.5 Soil Analytical Results 5-37
5.3.4.6 Soil Exposure Pathway Conclusions 5-37
5.3.5 Air Exposure Pathway 5-39
5.3.5.1 Climate 5-39
5.3.5.2 Releases and Potential Releases to Air 5-39
5.3.5.3 Air Exposure Pathway and Receptors 5-39
5.3.5.4 Air Sample/Monitoring Locations and Methods 5-39
5.3.5.5 Air Analytical Results 5-39
5.3.5.6 Air Exposure Pathway Conclusions 5-39

CHAPTER 6 SCREENING-LEVEL RISK ASSESSMENT 6-1
6.1 Munitions and Explosives of Concern Screening-Level Risk Assessment 6-1
6.1.1 Conceptual Site Model 6-1
6.1.2 Introduction 6-1
6.1.3 Qualitative Risk Evaluation 6-1
6.1.4 Munitions and Explosives of Concern Risk Assessment – MRS01 – Range Complex 6-4
6.1.5 Risk Summary 6-4
6.2 Munitions Constituent Human Health Screening Level Risk Assessment 6-5
6.2.1 Conceptual Site Exposure Model 6-5
6.2.2 Affected Media 6-6
6.2.3 Human Health Screening Values 6-6
6.2.4 Risk Characterization 6-7
6.2.5 MRS01 – Range Complex 6-7
6.2.6 Discussion 6-14
6.3 Munitions Constituent Screening Level Ecological Risk Assessment 6-14
6.3.1 Conceptual Site Model 6-14
6.3.2 Affected Media 6-15
6.3.3 Ecological Screening Values 6-15

TABLE OF CONTENTS
(CONTINUED)

Page

6.3.4 Ecological Risk Characterization 6-16
6.3.5 MRS01 – Range Complex 6-16
6.3.6 Discussion 6-23

CHAPTER 7 SUMMARY AND CONCLUSIONS 7-1
7.1 Summary 7-1
7.2 Munitions and Explosives of Concern Exposure Pathways 7-1
7.3 Conclusions Regarding Potential Munitions Constituents Exposure Pathways 7-2
7.4 Overall Conclusions 7-3
7.4.1 MRS01 – Range Complex 7-3

CHAPTER 8 RECOMMENDATIONS 8-1

CHAPTER 9 REFERENCES 9-1

LIST OF APPENDICES

Appendix A Performance Work Statement (Electronic Only)
Appendix B TPP Session Documentation/Meeting Minutes (Electronic Only)
Appendix C Interview Documentation (Not Applicable)
Appendix D Field Notes and Field Forms
Appendix E Photo-documentation Log
Appendix F Analytical Data
Appendix G Analytical Data QA/QC Report
Appendix H Geographic Information Systems Data (Electronic Only)
Appendix I Geophysical Data (Not Applicable)
Appendix J Conceptual Site Model/Conceptual Site Exposure Model
Appendix K Munitions Response Site Prioritization Protocol Evaluations
Appendix L Reference Copies

LIST OF TABLES

No.	Title	Page
ES.1	Summary of Site Investigation Results	ES-5
1.1	MRS01-Range Complex Coordinates	1-1
2.1	Population within 4-Mile Buffer of the Site	2-5
3.1	Sampling Rationale	3-7
4.1	Chemical Composition of MEC and Potential Munitions Constituents	4-2
4.2	Summary of Qualitative Reconnaissance Observations	4-16
4.3	MEC Data Quality Objective Worksheet	4-21
4.4	MC Data Quality Objective Worksheet	4-22
4.5	MRSPP Data Quality Objective Worksheet	4-26
4.6	HRS Data Quality Objective Worksheet	4-27
5.1	Registered Groundwater Wells within a 4-Mile Radius of the MRS01 – Range Complex	5-3
5.2	Federally and State Listed Threatened and Endangered Species Potentially within Fort Pickens, Escambia County, Florida	5-5
5.3	Summary of Validated Analytical Results for Fort Pickens, Escambia County, Florida MMRP Water Samples Collected in September 2010	5-19
5.4	Summary of Validated Analytical Results for Fort Pickens, Escambia County, Florida MMRP Sediment Samples Collected in September 2010	5-20
5.5	Summary of Validated Analytical Results for Fort Pickens, Escambia County, Florida MMRP Soil Samples Collected in September 2010	5-21
5.6	Groundwater Source Evaluation, MRS01 – Range Complex	5-27
5.7	Surface Water Source Evaluation, MRS01 – Range Complex	5-31
5.8	Sediment Source Evaluation, MRS01 - Range Complex	5-32
5.9	Brackish Surface Water Source Evaluation, MRS01- Range Complex	5-33
5.10	Brackish Sediment Source Evaluation, MRS01-Range Complex	5-34
5.11	Soil Source Evaluation, MRS01-Range Complex	5-38
6.1	Categories of MEC Presence	6-2
6.2	Categories of MEC Type	6-3
6.3	Categories of Site Accessibility	6-3
6.4	MEC Risk Evaluation	6-5

LIST OF TABLES
(CONTINUED)

No.	Title	Page
6.5	MRS01 – Range Complex Groundwater r Screening Level Human Health Risk Assessment	6-8
6.6	MRS01 – Range Complex Fresh Surface Water Screening Level Human Health Risk Assessment	6-9
6.7	MRS01 – Range Complex Freshwater Sediment Screening Level Human Health Risk Assessment	6-10
6.8	MRS01 - Range Complex Brackish Surface Water Screening Level Human Health Risk Assessment	6-11
6.9	MRS01 - Range Complex Brackish Sediment Screening Level Human Health Risk Assessment	6-12
6.10	MRS01 - Range Complex Soil Screening Level Human Health Risk Assessment	6-13
6.11	MRS01 - Range Complex Fresh Surface Water Screening Level Ecological Risk Assessment	6-18
6.12	MRS01 - Range Complex Freshwater Sediment Screening Level Ecological Risk Assessment	6-19
6.13	MRS01 - Range Complex Brackish Surface Water Screening Level Ecological Risk Assessment	6-20
6.14	MRS01 - Range Complex Brackish Sediment Screening Level Ecological Risk Assessment	6-21
6.15	MRS01- Range Complex Soil Screening Level Ecological Risk Assessment	6-22
8.1	Recommendations	8-2

LIST OF FIGURES

No.	Title	Page
ES.1	General Site Overview	ES-6
1.1	Site Location	1-4
2.1	Site Setting	2-9
2.2	2000 U.S. Census Data	2-10
4.1a	Qualitative Reconnaissance and Field Observations Locations	4-28
4.1b	Qualitative Reconnaissance and Field Observations Locations	4-29
5.1	Qualitative Reconnaissance and Sample Locations	5-40
5.2	Water Wells within a Four-mile Buffer of the Site	5-41
5.3	Wetlands	5-42

ACRONYMS AND ABBREVIATIONS

APP	Accident Prevention Plan
ASR	Archive Search Report
ATSDR	Agency for Toxic Substances and Disease Registry
bls	Below Land Surface
CEMVR	U.S. Army Corps of Engineers, Rock Island District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESAJ	U.S. Army Corps of Engineers, Jacksonville District
CFR	Code of Federal Regulations
CSEM	Conceptual Site Exposure Model
CSM	Conceptual Site Model
CZMP	Coastal Zone Management Program
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DOI	Department of the Interior
DQO	Data Quality Objective
ECOS	Environmental Conservation Online System
EOD	Explosive Ordnance Disposal
EPP	Environmental Protection Plan
ER	Engineer Regulation
ERDA	Environmental Restoration Defense Account
ESV	Ecological Screening Value
FAC	Florida Administrative Code
FDE	Findings and Determination of Eligibility
FDEP	Florida Department of Environmental Protection
FL SHPO	Florida State Historic Preservation Office
FMSF	Florida Master Site File
FNAI	Florida Natural Areas Inventory
FTL	Field Team Leader
FUDS	Formerly Used Defense Site
GINS	Gulf Islands National Seashore
GP	General Purpose
GPS	Global Positioning System
HE	High Explosives
HHE	Health Hazard Evaluation
HQ	Hazard Quotient
HRS	Hazard Ranking Score
HTW	Hazardous Toxic Waste
IGD	Interim Guidance Document
INPR	Inventory Project Report

ACRONYMS AND ABBREVIATIONS (CONTINUED)

MC	Munitions Constituents
MD	Munitions Debris
MEC	Munitions and Explosives of Concern
mg/kg	Milligrams Per Kilograms
MMRP	Military Munitions Response Program
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
msl	mean sea level
mya	million years ago
NAD	North American Datum
NCP	National Contingency Plan
NHA	National Heritage Areas
NHL	National Historic Landmarks
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRHD	National Register of Historic Districts
NRHP	National Register of Historic Places
NRIS	National Register Information System
NWI	National Wetlands Inventory
NWRS	National Wildlife Refuge System
OCHP	Office of Cultural and Historical Programs
PA	Preliminary Assessment
PAO	Public Affairs Office
Parsons	Parsons Infrastructure and Technology Group
PQL	Practical Quantitation Limit
PSAP	Programmatic Sampling and Analysis Plan
PWP	Programmatic Work Plan
PWS	Performance Work Statement
QA	Quality Assurance
QC	Quality Control
QR	Qualitative Reconnaissance
RAC	Risk Assessment Code
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
RI/FS	Remedial Investigation and Feasibility Study
RSL	Regional Screening Level

ACRONYMS AND ABBREVIATIONS (CONTINUED)

SAP	Sampling & Analysis Plan
SI	Site Inspection
SLERA	Screening Level Ecological Risk Assessment
SLRA	Screening Level Risk Assessment
SQAG	Sediment Quality Assessment Guidelines
SS-WP	Site-Specific Work Plan
SSL	Soil Screening Level
SVT	Site Visit Team
SWQS	Surface Water Quality Standards
T&E	Threatened and Endangered
TAG	Technical Advisory Group
TESS	Threatened and Endangered Species System
TPP	Technical Project Planning
USACE	U.S. Army Corps of Engineers
USAESCH	USACE, Engineering and Support Center, Huntsville
USC	United States Code
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USFWS	United States Fish and Wildlife Service
UTM	Universal Transverse Mercator
UXO	Unexploded Ordnance

GLOSSARY OF TERMS

Anomaly	Any item that deviates from the expected subsurface ferrous and non-ferrous material at a site (i.e., pipes, power lines, etc.).
Inhabited Structure	Permanent or temporary structure, other than military munitions-related structures, routinely occupied by one or more persons for any portion of the day.
Magnetometer	An instrument for measuring the strength of a magnetic field; used to detect buried ferrous objects.
Military Munitions	All ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the Department of Defense, the Coast Guard, the Department of Energy, and the National Guard. The term includes confined gaseous, liquid, and solid propellants; explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives and chemical warfare agents; chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges; and devices and components thereof.
Munitions and Explosives of Concern (MEC)	Military munitions that may pose unique explosives safety risks, including UXO, discarded military munitions, or munitions constituents present in high enough concentrations to pose an explosive or other health hazard.
Munitions Constituents (MC)	Any materials originating from unexploded ordnance, discarded military munitions, or other military munitions, including explosive and nonexplosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions.
Munitions Debris	Remnants of munitions (e.g., penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal.

GLOSSARY OF TERMS (CONTINUED)

Munitions Response	Response actions, including investigation, removal actions, and remedial actions, to address the explosive safety, human health, or environmental risks presented by unexploded ordnance, discarded military munitions, or munitions constituents, or to support a determination that no removal or remedial action is required.
Munitions Response Site (MRS)	A discrete location within an MRA that is known to require a munitions response.
Projectile	Object projected by an applied force and continuing in motion by its own inertia. This includes bullets, bombs, shells, grenades, guided missiles, and rockets.
Unexploded Ordnance (UXO)	Military munitions that have been primed, fuzed, armed, or otherwise prepared for action; that have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material; and that remain unexploded whether by malfunction, design, or any other cause.

EXECUTIVE SUMMARY

ES.1 The objective of this site inspection (SI) was to determine whether the former Fort Pickens, located in Escambia County, Florida, warrants further evaluation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) beyond the SI stage. Fort Pickens has been declared a Formerly Used Defense Site (FUDS) and assigned FUDS project # I04FL006301. The SI was performed to evaluate the evidence for the presence of munitions and explosives of concern (MEC) and munitions constituents (MC) at the site. To accomplish this objective, qualitative reconnaissance (QR) and MC sampling were performed. The work was performed under Contract No. W912DY-04-D-0005, Task Order No. 0008 from the United States Army Corps of Engineers (USACE), Engineering and Support Center, Huntsville (USAESCH).

ES.2 Fort Pickens was used as a coastal defense site from the Civil War through World War II. The FUDS property land acreage totals 1,168 acres and the offshore water acreage totals 137,297 acres. There is one MRS at the site, the MRS01-Range Complex. Located within the MRS01-Range Complex are nine concrete artillery batteries, two anti-aircraft batteries, an anti-motor torpedo boat battery, the rifle range, and fire control and searchlight structures. Munitions used at the FUDS over the years include a wide variety of light to heavy artillery ammunition (1830s era through World War II era), small arms, marine mines, hand grenades, and rifle grenades. It is also suspected that High Explosives (HE) were used and stored at the site. According to the 2007 PA, an August 1948 Preliminary and Fire Inspection Report provides indirect information indicating that the rifle range area within the MRS01-Range Complex was used by the Army and Navy for grenade practice. Presently, the FUDS property is used for historical preservation and recreation as part of the Gulf Islands National Seashore (GINS) National Park Service (NPS). The Fort Pickens FUDS is located within the GINS along the western tip of Santa Rosa Island. In April 2010, an oil spill took place in this region and as a result, oil and tar balls have been observed on the beaches and coastline near the FUDS. The SI was not affected by the oil and tar balls observed near the Fort Pickens FUDS.

ES.3 The Technical Project Planning (TPP) Team agreed that the SI data collection efforts would focus on screening for MC presence in surface soil, surface water, and sediment. Twenty-nine biased surface soil samples (FTP-MRS01-SS-02-01 - FTP-MRS01-SS-02-29) and three biased surface water/sediment sample couples (FTP-MRS01-SW/SD-01, FTP-MRS01-SW/SD-02, and FTP-MRS01-SW/SD-03) were collected from site locations with maximum bias for the presence of MC contamination within the MRS, along with the appropriate Quality Control (QC) samples and field duplicates that were collected from within the Fort Pickens boundaries. Two surface soil samples (FTP-AMB-SS-02-30 and FTP-AMB-SS-02-31) and one surface water/sediment sample couple (FTP-AMB-SW/SD-04) were collected from areas outside the MRS but within the FUDS boundary to serve as ambient metals data for comparison. In addition, two groundwater samples (FTP-MRS01-GW-01 and FTP-MRS01-GW-02) were

collected from groundwater wells within the MRS. All of the samples were analyzed for explosives, aluminum, antimony, copper, lead, and zinc. In addition, the pH was analyzed in the surface soil samples.

ES.4 The Site Visit Team (SVT) mobilized to the Fort Pickens FUDS on August 29, 2010. To assess the presence or absence of MD and MEC, the SVT conducted QR by walking approximately 15.23 miles throughout the MRS01-Range Complex on August 30, 2010 - September 2, 2010 (Figure ES.1). MD in the form of a 3.5-inch artillery casing was observed near Battery Van Swearingen within MRS01-Range Complex and a 40mm signal flare cartridge and numerous .30 Caliber bullet fragments were observed in the rifle range area. Also near the rifle range was visible evidence of the former firing line and target area downrange. Observed near the former firing line were an 8 to 10 foot high berm and remains of a brick walkway. Remnants of iron stakes in the ground at the end of the rifle range marked the former target area. Table ES.1 summarizes the results of the SI for Fort Pickens.

ES.5 Two predominant aquifers are found near the Fort Pickens FUDS; the Sand and Gravel aquifer and the Floridan aquifer. There are 232 reported groundwater wells within a 4-mile radius and two groundwater wells located on-site at the MRS01 - Range Complex (Figure 5.1). The surface water on-site ultimately drains to Pensacola Bay to the north and the Gulf of Mexico to the south. Surface water bodies such as ponds, marshes, and wetland areas are also present at the site. The predominant wetland areas within the FUDS and MRS01-Range Complex consist mainly of three wetland systems with various classes, subclasses, and modifiers. These wetlands areas also include habits for many of the Threatened and Endangered (T&E) species on-site. There are 12 federally listed T&E species for Escambia County and 11 of them may be within the FUDS or MRS01-Range Complex. In addition to the 11 federally listed T&E species, the federally delisted peregrine falcon was observed during SI field activities and is included on the Table 5.2. The Fort Pickens FUDS and MRS01-Range Complex are classified as important ecological places since they support wetland areas (Figure 5.3), critical habitat, are within a NPS unit of the Gulf Islands National Seashore and State Aquatic Preserve, and known T&E species are on-site.

ES.6 TestAmerica (Denver) analyzed the environmental samples for explosives, and selected metals (aluminum, antimony, copper, lead, and zinc). In addition, the pH in the surface soil samples was analyzed. Parsons did not collect “background” samples, but rather “ambient” samples to provide separation from the statistical-based and baseline risk assessment connotation. The ambient sample data will be used for comparison to the biased samples in the Munitions Response Site Prioritization Protocol (MRSPP) scoring. The analytes that are potential MC and were detected in the biased samples were retained for consideration in the screening level risk assessment (SLRA). Any detection of explosives is considered potential MC contamination and was evaluated in the SLRA. Two explosives, RDX (in freshwater sediment) and TNT (in the surface soil) were detected in the samples collected during this SI.

The analytical results were compared to the following criteria to determine the need to perform a SLRA for each particular analyte:

- Was the analyte a potential constituent of munitions known or suspected of being used on-site?
- Was the analyte detected in the sample?

ES.7 The air, surface soil, groundwater, surface water and sediment pathways are complete, as selected MC metals were detected in the samples collected from the site and these MC metals were retained for SLRA. Although air samples were not collected at this MRS, the air exposure pathway for human receptors is assessed through the soil exposure pathway because the screening values for human receptors include inhalation. Aluminum, antimony, copper, lead, and zinc were detected in the fresh surface water, fresh water sediment, brackish surface water, and the surface soil. Aluminum and lead were detected in the brackish sediment and copper was detected in the groundwater. Aluminum and lead were detected in the surface soils. Along with MC metals, RDX was detected in the fresh water sediment and 2,4,6-TNT was detected in the surface soil.

ES.8 The SLRA revealed the following results for the samples collected at MRS01 – Range Complex: Copper was detected at a concentration less than the human health screening value for groundwater. Aluminum was detected in the fresh surface water samples at a concentration greater than the human health screening value. RDX was detected in the fresh water sediment samples at a concentration greater than the human health screening value. Aluminum, antimony, copper, lead, and zinc were detected in the brackish surface water sample at concentrations less than their selected human health screening values. Aluminum and lead were detected in the brackish sediment sample at concentrations less than their selected human health screening values and 2,4,6-TNT, aluminum, antimony, copper, lead, and zinc were detected in the surface soil samples at concentrations less than their selected human health screening values. The human health screening values for copper in groundwater, aluminum in fresh surface water, and RDX in fresh water sediment were exceeded for the MRS01 – Range Complex. ***Therefore, based on the analytical results presented in this report, an unacceptable human health risk due to munitions-related activities may be present from exposure to aluminum in fresh surface water and from exposure to RDX in fresh water sediment at the MRS01-Range Complex.***

ES.9 The SLERA revealed the following results for the samples collected at MRS01 – Range Complex: aluminum and lead were detected in the fresh surface water samples at maximum concentrations that exceeded their selected ecological screening values (ESVs), resulting in HQ values greater than one. The HQ for aluminum was 2.5 and for lead was 1.4. Aluminum was detected in the fresh water sediment at a maximum concentration that exceeded the selected ESV, resulting in an HQ value of 15. Detections of aluminum, antimony, copper, lead, and zinc were less than their selected screening values for brackish surface water resulting in HQ values of less than 1. Aluminum and lead were detected in brackish sediment at a maximum concentration less than their selected ESVs, resulting in HQ values of less than 1. Aluminum and lead were detected in the surface soil samples at a maximum concentration greater than the selected ESV, resulting in HQ values of 120 and 4.2 respectively. The ESVs for aluminum and lead in

fresh surface water, aluminum in fresh water sediment, and aluminum and lead in surface soil were exceeded at the MRS01 – Range Complex. ***Therefore, based on the analytical results presented in this report, an unacceptable ecological risk due to munitions-related activities may be present from exposure to aluminum and lead in fresh surface water, from exposure to aluminum in fresh water sediment, and from exposure to aluminum and lead in surface soil at the MRS01 – Range Complex.***

ES.10 A qualitative risk assessment for MEC was conducted based on SI field observations and historical data regarding previous site visits and removal actions (Chapter 6). Based on the observations made during this investigation, as well as the MD items listed and munitions utilized and stored on-site in the past and identified during the 2010 SI field activities (as detailed in Chapter 4), it is possible that additional MEC may exist on portions of the Fort Pickens FUDS. Munitions used at this MRS contain compounds and/or components that may pose a safety hazard if any remain on-site intact. The large variety of munitions used or stored over the life of Fort Pickens presents a possible continuing hazard from MEC at this FUDS. The MEC exposure pathway for the MRS01 – Range Complex at Fort Pickens is potentially complete.

ES.11 As shown in Table ES.1, the MRS at Fort Pickens is recommended to proceed to Remedial Investigation and Feasibility Study (RI/FS) status, with no immediate removal action warranted at this time. ***Further surface soil, surface water, and sediment sampling may be warranted to confirm and define any potential impact from munitions at the MRS01 – Range Complex.***

Table ES.1
Summary of 2010 Site Inspection Results
Fort Pickens, Escambia County, Florida

MRS	Acreage	Munitions and Explosive of Concern and/or Munitions Debris Assessment (1)	Munitions Constituents Assessment (2)	Recommendation
MRS01 – Range Complex	138,465	***YES*** USACE documents issued since site closing confirm the use and storage of live munitions and high explosives at the site. Munitions used at the FUDS over the years include a wide variety of light to heavy artillery ammunition (1830s era through World War II era), small arms, marine mines, hand grenades, and rifle grenades. The munitions suspected to have been used at this MRS contain explosives that might present a residual hazard if they remain at the site intact. MD was found on-site during the field event for the 2010 SI.	***YES*** An unacceptable human health risk due to munitions-related activities may be present from exposure to aluminum in fresh surface water, and from exposure to RDX in fresh water sediment at the MRS01-Range Complex. An unacceptable ecological risk due to munitions-related activities may be present from exposure to aluminum and lead in fresh surface water, from exposure to aluminum in freshwater sediment, and from exposure to aluminum and lead in surface soil at the MRS01-Range Complex.	**RI/FS** Additional investigation for MEC may be warranted. Further surface soil, surface water, and sediment sampling may be warranted to confirm and define any potential impact from munitions at the MRS01- Range Complex.

Notes:
(1) "Yes" in this column indicates confirmed MEC or MD presence indicative of potential MEC presence, resulting in a RI/FS recommendation for the MRS. "No" in this column indicates no confirmed MEC or MD indicative of potential MEC presence.
(2) "Yes" in this column indicates the presence of MC at levels indicating a potential elevated risk to human health or ecological receptors, resulting in a recommendation for further MC sampling during a RI/FS. "No" in this column of the table indicates the absence of MC at levels indicating a potential risk to human health or ecological receptors, resulting in a recommendation for no further MC sampling for the MRS.

Figure ES.1

General Site Overview
Fort Pickens
FUDS Project No. I04FL006301

Escambia County, Florida

Legend

- 35 Munitions Constituent Location
- 44 Munitions Debris Location
- 40 Field Observation Location
- Biased Surface Soil Sample Location
- Ambient Surface Soil Sample Location
- Groundwater Sample Location
- Fresh Surface Water/Sediment Sample Location
- Ambient Surface Water/Sediment Sample Location
- Brackish Surface Water/Sediment Sample Location
- Qualitative Reconnaissance Track
- Range Complex
- FUDS Project Boundary

Note:
Observation #35 - Munitions constituent RDX location (MC was present in field duplicate sample FTP-MRS01-SD-05, which is field duplicate of FTP-MRS01-SD-01)

Image Source: 2007 Orthophto
Projection: UTM Zone 16 NAD83, Map Units in Meters

400 200 0 400 Meters

N

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DESIGNED BY	BT
DRAWN BY	BT
CHECKED BY	JH
SUBMITTED BY	TD

General Site Overview

SCALE	As Shown	PROJECT NUMBER	747140.86137
DATE	December 2010	PAGE NUMBER	
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CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

1.1.1 Parsons Corporation (Parsons) received Contract No. W912DY-04-D-0005, Task Order No. 0008, from the United States Army Corps of Engineers (USACE), Engineering and Support Center, Huntsville (USAESCH) to perform a Site Inspection (SI) at ***Fort Pickens located in Escambia County, Florida.*** Fort Pickens (Formerly Used Defense Site [FUDS] project number ***I04FL006301***) was used as a coastal defense site from the Civil War through World War II. The FUDS property land acreage totals 1,168 acres and the offshore water acreage totals 137,297 acres. There is one Munitions Response Site (MRS) at the FUDS, the MRS01-Range Complex. Located within the MRS01- Range Complex are nine concrete artillery batteries, two anti-aircraft batteries, an anti-motor torpedo boat battery, a rifle range, and fire control and searchlight structures. Munitions used at the FUDS over the years include a wide variety of light to heavy artillery ammunition (1830s era through World War II era), small arms, marine mines, hand grenades, and rifle grenades. It is also suspected that High Explosives (HE) were used and stored at the site. Presently, the FUDS property is used for historical preservation and recreation as part of the Gulf Islands National Seashore (GINS) National Park Service (NPS). The Fort Pickens FUDS is located within the GINS along the western tip of Santa Rosa Island. In April 2010, an oil spill took place in this region and, as a result, oil and tar balls have been observed on the beaches and coastline near the FUDS. The SI was not affected by the oil and tar balls observed near the Fort Pickens FUDS.

1.1.2 The Fort Pickens FUDS is comprised of one MRS, MRS01 - Range Complex. Figure 1.1 depicts the FUDS boundary for the overall site. The coordinates for the estimated center points of the MRS are listed in Table 1.1. The estimated coordinates are in meters (Universal Transverse Mercator [UTM] Zone 17 North American Datum [NAD] 83).

Table 1.1
MRS01-Range Complex Coordinates

MRS	X-Coordinate (meters)	Y-Coordinate (meters)
MRS01 – Range Complex	468817.65	3342029.69

1.2 PROJECT OBJECTIVES

1.2.1 The Department of Defense (DoD) has established the Military Munitions Response Program (MMRP) to address DoD sites suspected of containing munitions and explosives of concern (MEC) or munitions constituents (MC). Under the MMRP, the USACE is conducting environmental response activities at FUDS for the Army, DoD's Executive Agent for the FUDS program.

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

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

1.2.4 This report summarizes the work performed during the SI and presents an accounting of any MEC and MC contamination identified on the site. The SI was limited exclusively to MEC and MC contamination issues requiring collection of a sufficient and appropriate amount of information, but does not consider other unrelated hazardous and toxic waste (HTW) concerns the site may pose. Per ER 200-3-1, guidance for conducting a SI, Section 4-4.1.2:

> *The SI is not intended as a full-scale study of the nature and extent of contamination or explosive hazards. The objectives of the remedial SI are to: (i) Eliminate from further consideration those releases that pose no significant threat to public health or the environment; (ii) Determine the potential need for removal action; (iii) Collect or develop additional data, appropriate for HRS [Hazard Ranking Score] scoring by [US]EPA [United States Environmental Protection Agency]; and (iv) Collect data, as appropriate, to characterize the release for effective and rapid initiation of the RI/FS [Remedial Investigation/Feasibility Study].*

1.2.5 An additional objective of the SI is to collect the additional data necessary to complete the Munitions Response Site Prioritization Protocol (MRSPP).

1.2.6 The SI was performed as a result of findings identified in the 1984 Environmental Restoration Defense Account (ERDA), 1990 Inventory Project Report (INPR), 2007 Preliminary Assessment (PA) and the 2008 Archives Search Report (ASR) Supplement conducted and written by the USACE- Jacksonville District (CESAJ), the USACE- Rock Island District (CEMVR), and the US Army Defense Ammunition Center and School. Additional findings were identified in the 2009 Summary Report for GINS. All work adhered to the DERP for FUDS and relevant U.S. Army regulations and guidance for MEC programs. As specified in the task order, this report is prepared to summarize the SI sampling events and presents an accounting of the MEC/MC contamination identified on-site.

1.3 PROJECT SCOPE

1.3.1 Due to the potential for MEC contamination from the use and storage of live munitions and high explosives at the Fort Pickens FUDS, the Technical Project Planning (TPP) Team concurred on January 12, 2010, that the MRS01-Range Complex would proceed in a manner to support a RI/FS.

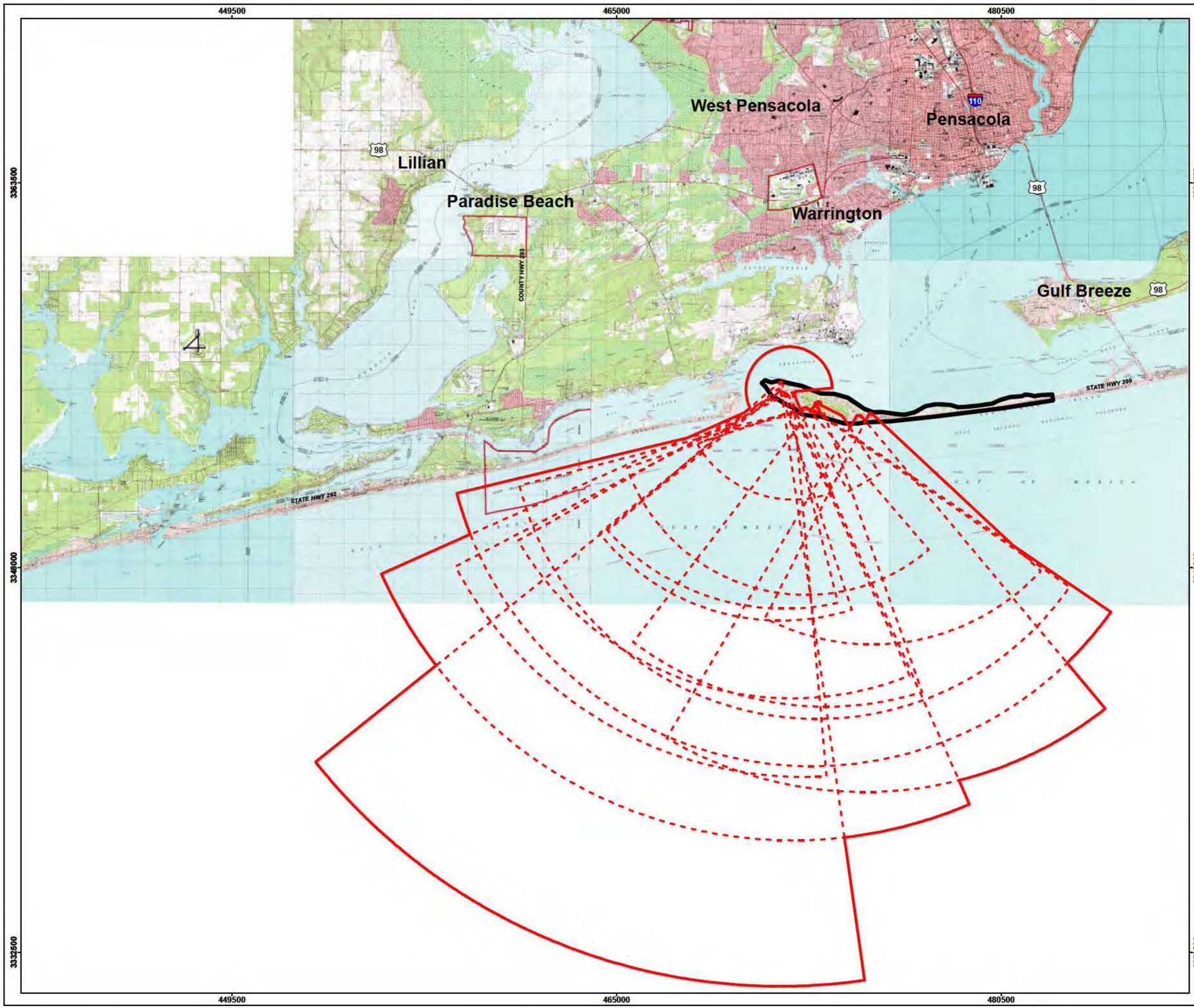
1.3.2 The TPP Team agreed that the SI data collection efforts would focus on screening for MC presence in surface soil, groundwater, surface water, sediment, and groundwater. Twenty-nine biased surface soil samples (FTP-MRS01-SS-02-01 - FTP-MRS01-SS-02-29) and three biased surface water/sediment sample couples (FTP-MRS01-SW/SD-01, FTP-MRS01-SW/SD-02, and FTP-MRS01-SW/SD-03) were collected from site locations with maximum bias for the presence of MC contamination within the MRS, along with the appropriate Quality Control (QC) samples and field duplicates that were collected from within the Fort Pickens boundaries. Two surface soil samples (FTP-AMB-SS-02-30 and FTP-AMB-SS-02-31) and one surface water/sediment sample couple (FTP-AMB-SW/SD-04) were collected from areas outside the MRS but within the FUDS boundary to serve as ambient metals data for comparison. In addition, two groundwater samples (FTP-MRS01-GW-01 and FTP-MRS01-GW-02) were collected from groundwater wells within the MRS. All of the samples were analyzed for explosives, aluminum, antimony, copper, lead, and zinc. In addition, the pH was analyzed in the surface soil samples.

1.3.3 The primary project planning documents used to perform the SI include the Site-Specific Work Plan (SS-WP) Addendum for Fort Pickens (Parsons, 2010b), the USAESCH Programmatic Work Plan (PWP) (Parsons, 2005), the Programmatic Sampling and Analysis Plan (PSAP) (USACE, 2005), and the PSAP Addendum (Parsons, 2006). The Performance Work Statement (PWS) for this project is in Appendix A.

Figure 1.1

Site Location Map
Fort Pickens
FUDS Project No. I04FL006301

Escambia County, Florida



Legend

- Range Complex
- FUDS Project Boundary

Image Source: USGS Topo Map, Date Unknown
Projection: UTM Zone 16 NAD83, Map Units in Meters

N

5 2.5 0 5 Kilometers

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DESIGNED BY BT	Site Location Map		
DRAWN BY BT			
CHECKED BY JH	SCALE As Shown		PROJECT NUMBER 747140.86137
SUBMITTED BY TD	DATE October 2010		PAGE NUMBER
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CHAPTER 2
PROPERTY DESCRIPTION AND HISTORY

2.1 SITE DESCRIPTION

2.1.1 Fort Pickens is located at the western end of Santa Rosa Island in Escambia County, Florida, approximately 7 miles south of Pensacola, Florida. The FUDS is located within the GINS along the western tip of Santa Rosa Island. The site location is shown on Figure 2.1.

2.1.2 The Fort Pickens FUDS property land acreage totals 1,168 acres and the offshore water acreage totals 137,297 acres. There is one MRS at the site, MRS01-Range Complex and within the MRS are nine concrete artillery batteries, two anti-aircraft batteries, an anti-motor torpedo boat battery, the rifle range, and fire control and searchlight structures. Presently, the FUDS property is used for historical preservation and recreation.

2.2 SITE LOCATION AND SETTING

2.2.1 Topography and Vegetation

The center portion of Santa Rosa Island (Santa Rosa County) is separated from the mainland by Santa Rosa Sound, while the eastern end of the island (Okaloosa County) faces Choctawhatchee Bay to the north. The Gulf of Mexico borders the southern side of the barrier island. According to topographic mapping, the ground elevation of Fort Pickens ranges from about 0-20 feet with much of the surface consisting of sand dunes. A small wooded area exists on a portion of the FUDS property (USACE, 2007).

2.2.2 Geology and Soils

2.2.2.1 Geologically, the area surrounding Escambia County, Florida is within the Floridian Section of the Coastal Plain Physiographic Province and is comprised of a thick sequence of sand, gravel, clay overlying a sequence of carbonate rocks that form the Floridan aquifer. Age of the sediments overlying the carbonate rocks range from recent day to Miocene.

2.2.2.2 The uppermost sediments in the Fort Pickens FUDS area consist of Holocene (recent day to 10,000 years ago) aged quartz sands, carbonate sands, muds, and organic materials. Undifferentiated sediments of Pleistocene (1.8 one million years ago [mya]) to Holocene lie near the surface for most of Florida and consist of siliclastic material, organic debris, and freshwater carbonates. The siliclastic material is made up of light gray, tan, brown to black unconsolidated to poorly consolidated, unfossiliferous, sands of varying clay content or sediments consisting of greenish, poorly to moderately consolidated, sandy, silty clays. Gravel is found sporadically along the Florida

panhandle. Organic debris is found as plant debris, roots, disseminated organic matrix, and peat beds. Freshwater carbonates also referred to as marls are scattered throughout the state. Underlying the undifferentiated sediments are sediments belonging to the Citronelle Formation that are comprised of unconsolidated very fine to very coarse, poorly sorted, clean to clayey sands. Thick clay units of Miocene age underlie the unconsolidated sediments with an observed thickness of about 980 feet at a well located about 4 miles west of Pensacola. The top of the upper clay unit in the area of the Fort Pickens FUDS occur at depths between 400 and 500 feet below mean sea level (msl) based on structural contours of the unit derived from well logs (Florida Geological Survey (FGS), 1965) and is noted to dip towards the southwest. A bed of sand that ranges from 20 to 160 feet in thickness separates the two clay units. The clay units contain much silt, very fine sand, and some gravel.

2.2.2.3 Carbonate rocks (limestone) and clays are found below the unconsolidated sediments. These geologic units are the framework of the Upper and Lower Floridan aquifer. The uppermost carbonate rock unit consists of remnants of the Tampa Limestone. The formation is described as a cream colored to light gray, soft to hard, sandy limestone containing shell fragments and abundant foraminifers. The maximum thickness of the Tampa Limestone in Escambia County is 270 feet. Some wells in the county draw water from this formation for use. The Chickasawhay Limestone of late Oligocene age unconformably underlies the Tampa Limestone. This formation ranges in thickness from about 30 to 130 feet. The surface of the Chickasawhay Limestone is an erosional unconformity that dips towards the southwest at about 23 feet per mile. The formation is typically a brown to light gray hard dolomitic limestone or dolomite with a distinctive spongy looking texture and contains abundant shell fragments. Several wells in the area obtain water from this formation. The Bucatunna Clay Member of the Byram Formation of middle Oligocene age separates the upper and lower limestones of the Floridan aquifer. This clay unit has a thickness of about 215 feet north of Escambia Bay. The lower carbonate rock units of the Floridan aquifer in the area consist of the Ocala Limestone and other limestones of Eocene age (FGS, 1965). The lower carbonate rocks units range in thickness from about 360 feet in central Escambia County to as much as 1,200 feet in northern Santa Rosa County to the east of the Fort Pickens FUDS.

2.2.2.4 The western tip of Santa Rosa Island where the Fort Pickens FUDS lies is predominated by Corolla-Duckston sands and Newhan-Corolla complex soils (Web Soil Survey, 2010). Corolla-Duckston sands consist of very deep, poorly drained soil found in undulating areas of low dunes and swale of coastal lowlands. Typically, the surface layer is grayish brown sand about 5 inches thick. The substratum extends to a depth of 80 inches. Properties of the Corolla soil include a high water table of 1.5 to 3 feet below surface with a very low available water capacity. Permeability is very rapid. Duckston soils are found in shallow depressions or swales between low dunes. Typically, the surface layer is a black muck about one-half inch thick overlying a layer of very dark gray sand about 3 inches thick. The substratum to a depth of 80 inches is light gray and white sand. Seasonable high water table for Duckston soils ranges from the surface to a depth of one-half foot throughout the year. Available water capacity is very low and permeability is very rapid. Newhan-Corolla complex soils consist of excessively drained Newhan soil and poorly drained Corolla soils. The Newhan soil generally is found on the

higher parts of dunes. The surface layer usually is gray sand about 3 inches thick. The substratum is a light gray to white sand. Depth to seasonal high water table is over 6 feet in Newhan soils with very low water capacity and very rapid permeability (USDA, 1964).

2.2.3 Climate

2.2.3.1 Santa Rosa Island is a long barrier island located in the Gulf of Mexico, just offshore and extending from Pensacola to Destin, Florida (approximately 50 miles). Santa Rosa Island separates Pensacola Bay from the Gulf of Mexico. Warm, wet weather predominates over and around the island.

2.2.3.2 The city of Pensacola is situated on a somewhat hilly, sandy slope that borders Pensacola Bay, an expanse of deep water several miles in width. The Gulf of Mexico, about 6 miles distant, moderates the climate of Pensacola by tempering the cold of winter and causing cool and refreshing sea breezes during the daytime in summer. The average temperature for the summer months is around 80 degrees Fahrenheit with an average daily range of 12.5 degrees Fahrenheit. Temperatures of 90 degrees Fahrenheit or higher occur on the average of 39 times yearly. A temperature of 100 degrees Fahrenheit or higher occurs occasionally. The average winter temperature is in the low to mid 50s with an average daily range of 15.7 degrees Fahrenheit. On the average, the temperature falls to freezing or below on only nine days of the year. The average occurrence of the last temperature as low as 32 degrees Fahrenheit in spring is mid-February, and the average earliest occurrence in autumn is early December, making the average growing season 292 days. Severe cold waves are rather infrequent. Rainfall is usually well distributed through the year with the greatest frequency normally being in July and August. The greatest monthly rainfall occurs, on average, in July and least in October. Much of the rainfall in summer occurs during the daylight hours and comes in the form of thunderstorms, often producing excessive amounts. Winter rains are frequently lighter, but extend over longer periods. Snow has occurred in about 30 percent of the winters but measurable amounts are less frequent (USACE, 2007).

2.2.4 Hydrology

In general, runoff from Fort Pickens will ultimately flow to the surrounding waters of the Gulf of Mexico. Ponds and marshes are scattered throughout Santa Rosa Island, predominantly on the north (Bay) side of the island. It is likely that much of the island is subject to inundation from storm tides. Development on Santa Rosa Island alternates with public lands, with roads traversing the island from end to end. Some roads remain closed to traffic due to hurricane damage. The island contains the communities of Pensacola Beach, Navarre Beach, and Okaloosa Island. Man-made drainage works associated with the roads and other development on Fort Pickens most likely redirect and channel runoff. The higher elevation portions of the western end of Santa Rosa Island, from Little Sabine Bay to the western edge, are located on the Gulf side of the island.

2.2.5 Groundwater

2.2.5.1 Two predominant aquifers are found near the Fort Pickens FUDS; the Sand and Gravel aquifer and the Floridan aquifer. The Sand and Gravel aquifer is made up of the upper layers of sand and gravel along the Florida Panhandle and southern

portion of the surrounding states of Mississippi and Alabama. The Floridan aquifer is comprised of the limestone formations found below the Sand and Gravel aquifer.

2.2.5.2 The Sand and Gravel aquifer can be divided into two high-permeability zones referred to as the upper or surficial zone and the lower main producing zone. The two zones are separated by thick clay units of Miocene age. The upper or surficial zone is made up of mostly fine to medium sand with some gravel beds or lenses mainly of the Citronella Formation and overlying terrace deposits. Water in this zone is for the most part under unconfined conditions. The zone is recharged directly by precipitation and groundwater flow is mostly lateral within the aquifer, along short flow paths, discharging at surface points along small streams. Some of the water percolated downwards and recharges the lower main producing zone. In the westernmost part of the Florida panhandle, the lower of the two high-permeable zones is called the main producing zone as most of the water used in Santa Rosa and Escambia Counties is drawn from this zone. The zone consists of Miocene aged sands and gravels and is under confined hydraulic conditions. Recharge to this zone is via downward leakage from the upper zone, discharge is to major streams and other large surface water bodies including bays and the Gulf of Mexico. At the base of the main producing zone is a thick clay layer. This clay layer separates the two aquifers hydraulically limiting hydraulic connection between them. Carbonate rock units, mainly limestones underlying the Sand and Gravel aquifer, make up the Floridan aquifer. The upper Floridan aquifer consists of the remnants of the Tampa Limestone found in the area as well as the Chickasawhay Limestone. In most places, it yields sufficient water for most purposes so that drilling deeper into the lower portions of the aquifer are not warranted. The Floridan aquifer is also divided into upper and lower aquifers that are also separated by series of clay layers including the Bucatunna Clay Member of the Byram Formation and relatively impermeable micritic limestone in places and is often referred to as the middle confining unit. The lower Floridan aquifer is also made up of a limestone framework. This lower aquifer is less used due to its depth and the presence of saltwater in portions of the aquifer (USGS, 1990).

2.2.6 Significant Structures

There are no private residences located within the FUDS boundary (Figure 2.2). However, remnants of the original pentagonal brick fort constructed in the 1800s and battery locations are still located on-site within the FUDS and MRS01-Range Complex boundaries. Additionally, there are park storage and administrative information offices located on site. There are greater than 26 inhabited structures within a two-mile radius of MRS01-Range Complex.

2.2.7 Demographics

2.2.7.1 The demographics information for Escambia County, Florida was obtained from the 2010 United States Census Bureau website and from the American Fact Finder Fast Access to Information link on the United States Census Bureau website (US Census Bureau, 2010).

2.2.7.2 In 2009, the population of Escambia County was estimated to be approximately 303,343. There were 116,212 occupied households with an average household size of 2.44. Population density for Escambia County was 444.7 persons per

square mile. See Figure 2.2 for a breakdown of population within a 4-mile buffer of the site. The segment of the population over the age of 18 was 77.5 percent, while 14.6 percent was over the age of 65. The median age was 37.8 years old. Approximately 70.9 percent of the population was Caucasian, 21.7 percent Black or African American, 2.6 percent Asian, 0.5 percent American Indian and Alaska Native, and 3.6 percent of the population were Hispanic or Latino of any race. The estimated occupational breakdown in Polk County was as follows:

- Management, professional, and related occupations – 31.2 percent
- Service occupations – 20.0 percent
- Sales and office occupations – 27.8 percent
- Farming, fishing, and forestry occupations – 0.2 percent
- Construction, extraction, and maintenance occupations – 11.3 percent
- Production, transportation, and material moving occupations – 9.5 percent

2.2.7.3 As noted in Table 2.1, approximately 401,919 individuals live within a 4-mile buffer of MRS01 – Range Complex. The estimate was derived from a combination of map examination, 2000 census population information, and information gathered during the SI.

Table 2.1
Population within 4-Mile Buffer of MRS01-Range Complex
Fort Pickens, Escambia County, Florida

On-Site	0 to 1/4 Mile	1/4 to 1/2 Mile	1/2 to 1 Mile	1 to 2 Miles	2 to 3 Miles	3 to 4 Miles	Total
MRS01-Range Complex	0	4,474	5,976	4,528	10,750	15,191	401,919

Source U.S. Census 2000 data. The population within the site, MRS, or within any buffer area is determined using a conservative approach to calculate the population of an area by including the total number of people for any census block that falls within or overlaps the site boundary, MRS boundaries, or buffer line.

2.2.8 Current and Future Land Use

2.2.8.1 Currently, the Fort Pickens FUDS is owned by the NPS and used for historical preservation and recreation as part of the GINS. It is located along the western tip of Santa Rosa Island. The future land use is expected to remain the same.

2.2.8.2 In April 2010, an oil spill took place in this region and, as a result, oil and tar balls have been observed on the beaches and coastline near the FUDS. The oil well that was responsible for the oil spill in the region was permanently capped on September 19, 2010. The current and future land use was not affected by the oil spill.

2.2.9 Site Ownership and History

Acquisition of property for Fort Pickens began on May 5, 1828, by purchase of 1,181 acres of land from a private landowner and continued through 1880 with ultimate acquisition of the entirety of Santa Rosa Island by the Department of Interior (DOI).

During July 1888, the DOI transferred all remaining Santa Rosa Island lands to the War Department. Between 1888 and the disposal of Fort Pickens in 1949, various portions of the land were leased, sold, licensed, or otherwise used by the Treasury Department (quarantine and life-saving station), U.S. Navy (Camp Saufley, a World War I airfield), Coast Guard, private business entities, and Escambia County. Presently, the FUDS property is owned by the NPS as described in subchapter 2.2.8.1 (USACE, 2007).

2.2.10 Cultural and Archeological Resources

2.2.10.1 The Fort Pickens FUDS is not within a NHA and does not contain a NRHD or a NHL. Fort Pickens is listed in the NRIS and the NRHP databases. The Fort Pickens Aquatic Preserve is rich with archeological history, varying from prehistoric (Native American) to historic (Spanish and American). No archeological sites within the Preserve were impacted by the SI field effort. The GINS contains approximately 121 known archeological and cultural sites, 12 of which are listed on the NRHP database (including Fort Pickens). According to the PA (USACE, 2007), the Florida Master Site File (FMSF) listed two resource groups and 18 recorded archeological sites within the FUDS.

2.2.10.2 A request for information regarding recorded cultural and archeological resources within the FUDS was submitted to the FMSF prior to the SI. Currently, according to the FMSF records, there are 20 previously recorded archeological sites, four resource groups, and 11 standing historical structures within the FUDS (Appendix L). Standing structures were not impacted in any way by the SI field effort. The four resource groups, which include the Fort Pickens site itself, an old railroad bed, and miscellaneous war related structures were not impacted in any way by the SI field effort. The 20 recorded archeological sites mainly consisted of areas where former buildings stood, the batteries, boat wrecks near or offshore, filled areas, and a Civil War period dump.

2.2.10.3 The Fort Pickens site has high potential for archeological and/or cultural resources; therefore, extreme care was taken when sampling was conducted. No known or potential archeological areas or archeological remnants discovered during sampling were impacted. Due to the shallow sampling method and planned sampling locations, the SI effort did not affect any potential archeological resources on-site. No known archeological remnant was discovered or suspected during the SI effort. It is Parsons' policy to note in the field log the location of any archeologically significant item found by the SVT; however, such finds and observations are not flagged. Parsons would also record the global positioning system (GPS) coordinates of any unknown or suspected item and notify the NPS, CESAJ, and FMSF. The GPS coordinates are not included in the SI Report since this is sensitive information. Photographs of any archeological or cultural item found are typically included in the SI Report. Archeological and cultural resources were not impacted by the Fort Pickens SI field effort.

2.3 SITE OPERATIONS AND WASTE CHARACTERISTICS

2.3.1 MRS-Specific Descriptions/Operations

The Fort Pickens FUDS is comprised of 1,167.7 land acres and 137,297 offshore water acres. MRS01-Range Complex is the only MRS at the site and is comprised of 14 sub-ranges (13 artillery sub-ranges and a single 600 YD Rifle Range). The ASR Supplement assigned the FUDS a Risk Assessment Code (RAC) score of 2 (high priority site).

2.3.2 Regulatory Compliance

The USACE is conducting the SI at Fort Pickens as part of FUDS response activities pursuant to and in accordance with the guidance, regulations, and legislation listed in Chapter 1.

2.4 PREVIOUS INVESTIGATIONS

2.4.1 1984 Environmental Restoration Defense Account (ERDA)

The 1984 ERDA site visit determined the property owners, inspected the property, and took photographic records of the former military site. According to the report, Fort Pickens consisted of 1,655 acres. Fort Pickens was identified as a part of the GINS, under the management of the NPS and was determined to be a well-kept historical ruin that had been preserved and required no restoration. Based upon the results of the property visit, it was the opinion of the property visit team that Fort Pickens did not qualify for restoration under the ERDA Program.

2.4.2 1990 Inventory Project Report

The 1990 INPR and Findings and Determination Eligibility (FDE) confirmed the location and historical use of the site and determined that the site was eligible for the FUDS program. According to the Site Survey Report (USACE 1990a), the current owner planned to continue utilizing the Fort Pickens as a unit of the GINS. The Fort and coastal defense batteries were entrusted to the NPS for protection and preservation. No munitions debris and/or residues from DoD use were observed during the site survey. The Site Survey Report determined that no further action was required for restoration. The Site Survey Report was reviewed several times subsequent to its production date of December 1990, including November 1991, June 1998, and finally July 2003. After the final review and production of the INPR, it was determined that coastal gun ammunition was received, stored, and utilized at Fort Pickens and that some could remain on-site. Based upon this, the site was ordered for more extensive research and the site was reassigned a new RAC score of 2 and an OE project was approved for the site.

2.4.3 2007 Preliminary Assessment

The PA was completed and a report finalized in September 2007. A site visit was conducted on May 7, 2007, in conjunction with the PA. The property visit team observed numerous concrete and asphalt foundations of former buildings and structures at the site. No MEC or munitions debris (MD) was observed. Prior to finalization of the PA, a Technical Advisory Group (TAG) review was completed that assessed the site with a RAC of 2 based upon the fact that munitions were encountered during construction and

repair work along the wharf area and the storage and use of live munitions that contain HE at the site. The PA identified nine concrete artillery batteries, along with two anti-aircraft batteries, an AMTB battery, the rifle range, and fire control and searchlight structures. No known public injury incidents have been reported since site closure.

2.4.4 2008 Archives Search Report Supplement

The 2008 ASR Supplement identified one MRS at the Fort Pickens FUDS: the MRS01- Range Complex. The MRS01- Range Complex is comprised of 14 sub-ranges (13 artillery sub-ranges and a single 600 YD Rifle Range). The ASR Supplement gives the FUDS a RAC score of 2 based upon the use and storage of live munitions at the site that contain HE.

2.4.5 2009 Summary Report for Gulf Islands National Seashore

The NPS initiated a surface soil investigation at the small arms firing ranges on Fort Pickens and Perdido Key during March 2008. There were 12 surface soil samples collected from locations adjacent to the rifle range target area by a NPS contractor. The analytical data for lead ranged from 1.2 mg/kg to 6,000 mg/kg. Most of the lead data was 10 mg/kg or less, with lead detected at 11mg/kg and 17 mg/kg on two surface soil samples (NPS May 2009). The report concluded that the 6,000 mg/kg result was an anomaly attributed to a piece of bullet remnant in the sample (NPS April 2009). A second NPS-initiated sampling event at the Fort Pickens rifle range occurred during March 2009. Three multi-increment samples were collected from the rifle range and analyzed for lead. The analytical results show lead detected at 4.0 mg/kg, 4.1 mg/kg, and 5.0 mg/kg. According to Mr. Dick Zani of GINS, in the past lead was used for covering the casemate arches at the site. More than 260,000 pounds of sheet lead was used in the construction of Fort Pickens (USACE, 2007). The May 2009 report concluded that there is not a lead issue on the rifle range at Fort Pickens (NPS May 2009).

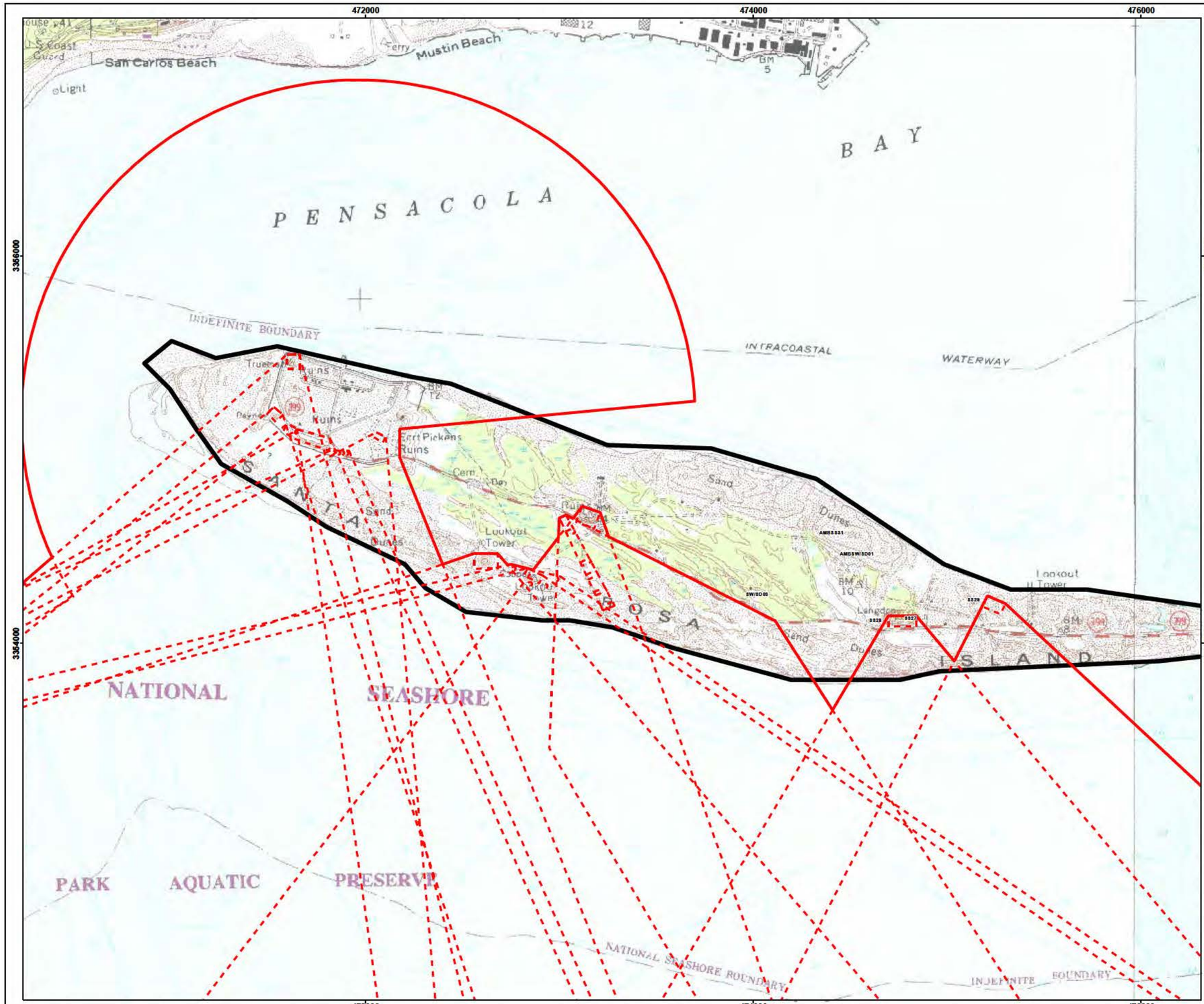
2.4.6 Technical Project Planning Memorandum

During the TPP Meeting on January 12, 2010, it was reported that the DOI conducted site investigations several years back on the area of the rifle range. The DOI findings are included in the 2009 Summary Report for GINS (Appendix L). It was also mentioned that spent ammunition was readily apparent at the former rifle range location and a bomb was found near the rifle range area in the past, Explosive Ordnance Disposal (EOD) personnel from Hurlburt Field responded and detonated the bomb, in place, leaving a 10-foot deep/wide crater. No injuries have been recorded or reported since site closure.

Figure 2.1

Site Setting
Fort Pickens
FUDS Project No. I04FL006301

Escambia County, Florida



Legend

- Range Complex
- FUDS Project Boundary

Site Location in Florida

Image Source: USGS Topo Map, Date Unknown
Projection: UTM Zone 16 NAD83, Map Units in Meters

600 300 0 600 Meters

N

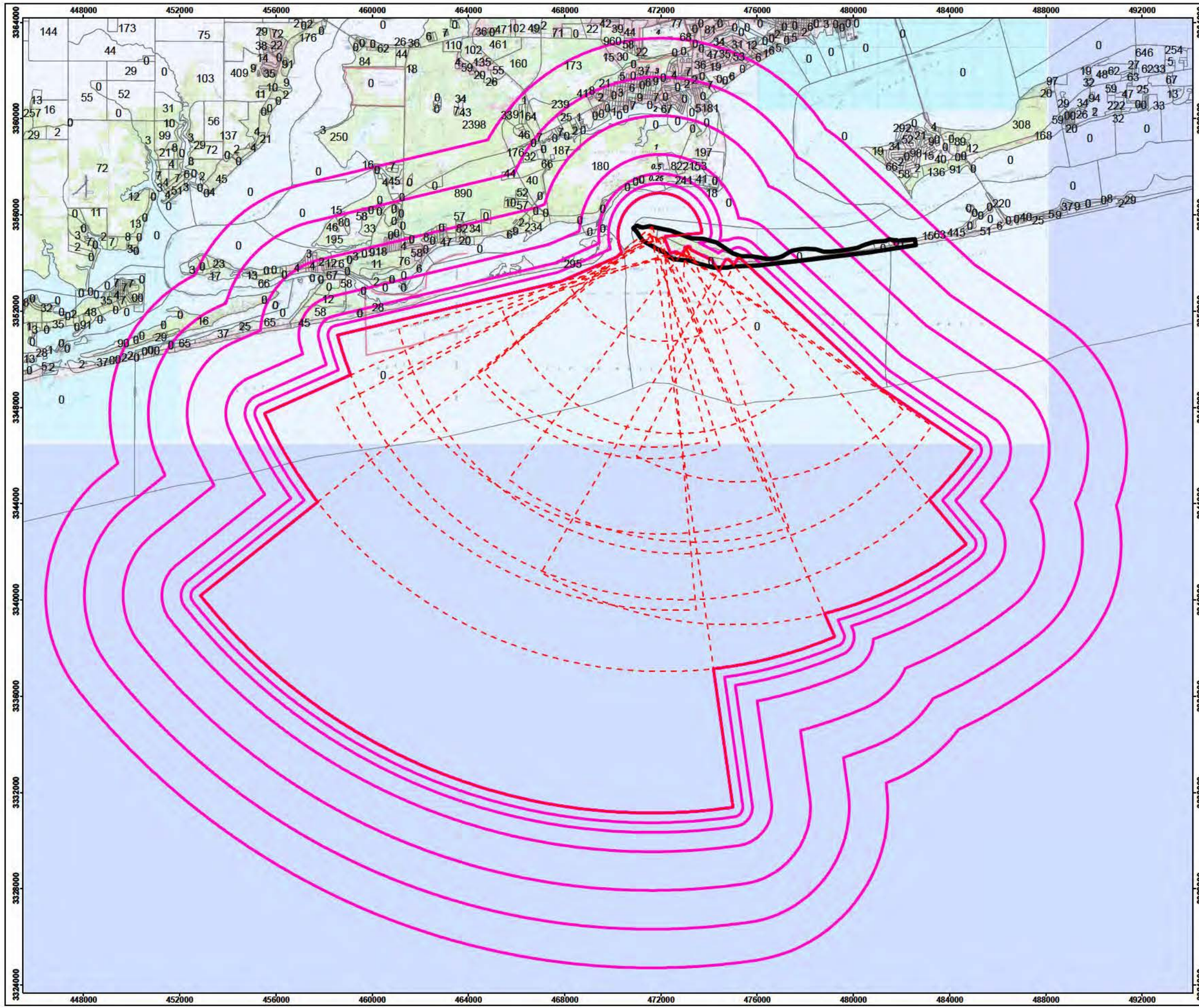
PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY BT	**Site Setting**		
DRAWN BY BT			
CHECKED BY JH	SCALE As Shown		PROJECT NUMBER 747140.86137
SUBMITTED BY TD	DATE October 2010		PAGE NUMBER
	FILE X:\GIS\Site_inspections_se\Maps\pickens_FL\Fig2_1.mxd		

Figure 2.2

2000 Census Data
Fort Pickens
FUDS Project No. I04FL006301

Escambia County, Florida



Legend

- 4 — 2000 Census Block Boundary with Total Population
- Range Complex
- FUDS Project Boundary
- Buffer (Mile)

Site Location in Florida

N

Image Source: USGS Topo Map, Date Unknown
Projection: UTM Zone 16 NAD83, Map Units in Meters

4 2 0 4 Kilometers

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER
DESIGNED BY BT	2000 Census Data
DRAWN BY BT	
CHECKED BY JH	SCALE As Shown — PROJECT NUMBER 747140.86137
SUBMITTED BY TD	DATE October 2010 — PAGE NUMBER
	FILE X:\GIS\Site_inspections_se\Maps\pickens_FL\Fig5_1.mxd

CHAPTER 3
SITE INSPECTION TASKS

3.1 HISTORICAL RECORD REVIEW

The existing body of information pertinent to the Fort Pickens FUDS was thoroughly reviewed in advance of the TPP Meeting on January 12, 2010, and summarized to the TPP Team as part of the development and acceptance of the selected Technical Approach for the site. Sampling locations and Qualitative Reconnaissance (QR) planning were the direct result of this review process. This information has been augmented with institutional knowledge and additional documentation provided by the CEMVR, the U.S. Army Defense Ammunition Center and School, or obtained by Parsons during coordination of the field effort.

3.2 TECHNICAL PROJECT PLANNING SUMMARY

Fort Pickens falls under the purview of the CESAJ. A TPP Meeting was facilitated by CESAJ on January 12, 2010, and included representatives of CESAJ, USAESCH, Parsons, the Florida Department of Environmental Protection (FDEP), and GINS NPS. Unanimous TPP Team concurrence with the Technical Approach presented in the Final TPP Memorandum issued on April 6, 2010, was achieved (see Appendix B). The SS-WP Addendum reflects the TPP Team decisions resulting from the meeting as well as those directly resulting from follow-up actions. Key TPP facts and decisions are summarized below:

- The TPP Team concurred with the Technical Approach presented and refined at the TPP Meeting on January 12, 2010, inclusive of number, type, and location of samples as well as sampling methodology.

- The TPP Team agreed to allow flexibility for the site visit team (SVT) to move samples or QR paths due to unknown physical or natural obstacles or MD findings.

- The SVT sampled in accordance with FDEP's request for discrete samples but, based on the sandy nature of the soils at this site, move sample locations as necessary to acquire samples with more organic matter that are more likely to hold contaminants. Samples were collected at the programmatic depth of 0 to 2 inches below ground surface, but depths up to 6 inches are approved by FDEP for this endeavor. Because this site is located on a barrier island comprised almost entirely of sand, there is an expected difficulty in collecting samples that are truly representative of historic DoD munitions use.

- Per agreement with FDEP, the TPP Team agreed that those analytes, including explosives, which are potential MC and are detected in the samples, were retained for consideration in the Screening Level Risk Assessment (SLRA).

- The human health screening levels for groundwater consist of the more stringent of USEPA regional screening levels (RSLs) for Chemical Contaminants at Superfund Sites for Tap Water, May 17, 2010, and FDEP Florida Administrative Code (FAC) 62-777 Groundwater and Surface Water Cleanup Target Levels, Groundwater Criteria and FDEP FAC 62-550 Primary or Secondary Groundwater Standards. The human health screening levels for fresh surface water consist of the more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Tapwater, May 17, 2010, and FDEP FAC 62-777 Groundwater and Surface Water Cleanup Target Levels, Freshwater Surface Water Criteria and FAC 62-302 Surface Water Quality Standards (SWQS; for Class I or Class III waters). The human health screening levels for freshwater sediment consist of the more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Residential Soil, May 17, 2010 and FDEP FAC 62-777 Soil Cleanup Target Levels more stringent of the Direct Exposure Residential, leachability based on Marine Surface Water Criteria, leachability based on Freshwater Surface Water Criteria and leachability based on Groundwater Criteria, February 2005. The human health screening levels for brackish surface water consist of the more stringent FDEP FAC 62-777 Groundwater and Surface Water Cleanup Target Levels, Marine Surface Water Criteria and FAC 62-302 SWQS (for Class III waters; predominantly marine waters). The human health screening levels for brackish sediment were the more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Residential Soil, May 17, 2010 and FAC 62-777 Soil Cleanup Target Levels, more stringent of the Direct Exposure Residential, leachability based on Marine Surface Water Criteria, leachability based on Freshwater Surface Water Criteria and leachability based on Groundwater Criteria, February 2005. The human health screening levels for surface soil consist of the more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Residential Soil, May 17, 2010, and FDEP FAC 62-777 Soil Cleanup Target Levels more stringent of the Direct Exposure Residential, leachability based on Marine Surface Water Criteria, leachability based on Freshwater Surface Water Criteria, and leachability based on Groundwater Criteria, February 2005.

- The ecological screening values (ESVs) for fresh surface water are the more stringent of FAC 62-302 SWQS (for Class III waters) and USEPA Region 4 ESVs for Freshwater Surface Water, November 2001. The ESVs for freshwater sediment are the more stringent of FDEP Sediment Quality Assessment Guidelines (SQAG), January 2003 and USEPA Region 4 ESVs for Sediment, November 2001. The ESVs for brackish surface water are the more stringent of FAC 62-302 SWQS (for Class III waters, predominantly marine waters), February 2005 and USEPA Region 4 ESVs for Marine Surface Water, November 2001. The ESVs for brackish sediment were the more stringent of FDEP SQAG,

January 2003 and USEPA Region 3 ESVs for Marine Sediment, March 2010, supplemented with ESVs obtained from sources identified in the 2005 PSAP, updated with most current values. The ESVs for surface soil were from USEPA Region 4 ESVs, November 2001.

- Any findings of an archeological nature or ecological nature were recorded, GPS points collected, and reported to USACE and the landowner.
- The TPP Team agreed an expedited review is not necessary at this time.
- Mr. Dick Zani of GINS stated that the DOI conducted Phase 1 and Phase 2 site investigations several years back on the area of the rifle range. The 2009 Summary Report for GINS stated that lead in the surface soil was found to be a concern at first, but later data indicated lead was below the human health risk levels. Mr. Zani was requested to provide copies of the investigations for this SI.
    - *Mr. Zani provided copies of the investigation to Parsons on February 26, 2010 and it is included in Appendix D.*
- Mr. Zani mentioned that the U.S. Navy conducted an investigation of an area of the FUDS, but the GINS never received a copy. Additional information was requested from Mr. Zani for follow-up by Parsons but he was unable to access the information from the U.S. Navy.
- Mr. Zani also mentioned that a bomb was found near the rifle range area in the past. EOD personnel from Hurlburt Field responded and blew the munitions in place, leaving a 10-foot deep/wide crater. Additional information was requested from Mr. Zani about the bomb disposal but he was unable to retrieve any additional information.
- Mr. Zani stated that spent ammunition was readily apparent at the former rifle range location.
- Mr. Zani asked how the public is notified of the SI information. Mr. Tim Davis (Parsons) stated that the stakeholders and USACE share a responsibility for notifying the public. USACE accomplishes this by posting information on their web site and working with the stakeholder to develop and disseminate public information. Mr. Eric Nuzie (FDEP) added that public notification is typically up to the landowner, but that USACE will assist. Mr. Bill Spence (CESAJ PM) stated that the Public Affairs Office (PAO) at the Jacksonville District will assist local stakeholders and mentioned the web site.
- Parsons asked if there were any issues with endangered species and nesting seasons. Mr. Zani stated that turtles nest on the island from approximately April through August. In addition, some shorebirds nest on the island, typically in April, but are further east on the island than the MRS. Parsons agreed to keep in contact with Mr. Zani as field work is planned to avoid the nesting seasons or reroute QR tracks to avoid nesting areas.

- Parsons asked whether drinking water wells were in use within the MRS. Mr. Zani stated that there are two water wells in use and both have depths greater than 300 feet below land surface (bls). Additional information on the well locations and conditions will be researched with the cooperation of Mr. Zani.
- Parsons asked if beach restoration has occurred on the island. Mr. Zani stated that there has been no beach restoration and none is planned.
- Mr. Zani suggested that Parsons contact the archeological and cultural specialist for the GINS, Mr. Jeff Halsted (850-934-2636).
    - *On April 19, 2010, Parsons contacted the cultural specialist for the GINS to discuss the Fort Pickens FUDS.*
- Mr. Garretson (USACE-Huntsville) asked what the safety procedure would be for the GINS if MEC were discovered. Mr. Zani stated that they would contact the EOD unit at either Hurlburt or Eglin.
- Mr. Zani stated that the park has a collection of reportedly inert cannonballs.
- As points of interest, Mr. Zani stated that dredge spoils were occasionally spread on the island east of the park, in the past. This practice has been discontinued. Parsons will seek further information on locations of dredge spoil.
    - *No further information was found pertaining to dredge operations at Fort Pickens.*

3.3 NONMEASUREMENT DATA COLLECTION

The following sources were consulted for identifying biological and cultural resources at the Fort Pickens site:

- Threatened and Endangered Species System (TESS) – Endangered Species Program, U.S. Fish and Wildlife Service (USFWS)
- Florida Natural Areas Inventory (FNAI) – Escambia County
- USFWS Northwest Florida Ecological Services – Panama City Field Office – Escambia County Federally Listed Species
- Environmental Conservation Online System (ECOS) – Endangered Species Program- Escambia County, FL, USFWS
- NatureServe Explorer Database
- National Wildlife Refuge System (NWRS) – USFWS
- National Park Service (NPS) – National Parks by State
- National Forest Service (FS) – National Forests and Grasslands
- State Parks of Florida
- Critical Habitat Portal Database and Mapper, Escambia County, Florida, USFWS
- Army Checklist for Important Ecological Places (Attachment 2), USACE 2006
- Wetlands Online Mapper – National Wetlands Inventory (NWI), USFWS

- National Register Information System (NRIS)
- National Register of Historic Places (NRHP)
- National Register of Historic Districts (NRHD)
- National Historic Landmarks (NHL)
- National Heritage Areas (NHA)
- Florida State Historic Preservation Office (FL SHPO) – Florida Office of Cultural and Historical Programs (OCHP) Florida Master Site File (FMSF)
- PA Fort Pickens Military Reservation, Pensacola, Escambia County, Florida, September 2007
- Topographic Map – U.S. Geological Survey (USGS)
- National Oceanic and Atmospheric Administration (NOAA) - Coastal Zone Management Program (CZMP): National Marine Sanctuaries (NMS), National Estuarine Research Reserve System (NERRS), and Marine Protected Areas (MPA)
- National Marine Fisheries Service (NMFS) – Essential Fish Habitats (EFH) Mapper
- Coastal Zone Management Act (CZMA)

3.4 SITE-SPECIFIC WORK PLAN ADDENDUM

3.4.1 The SS-WP Addendum (Parsons, 2010b) augments the PWP and PSAP, as warranted, to present pertinent site-specific information and procedural adjustments that could not be readily captured in the programmatic documents or that resulted from TPP Team agreements that required modifying the preliminary SI Technical Approach.

3.4.2 The PWP and PSAP are intended to be umbrella documents that set overall programmatic objectives and approaches, whereas the SS-WP Addendum provides site-specific details and action plans. The PWP, PSAP, and SS-WP Addendum were taken to the site for reference by the SVT during SI field activities.

3.4.3 The SS-WP Addendum included the project description, the Field Investigation Plan, the Sampling and Analysis Plan (SAP), the Environmental Protection Plan (EPP), and the health and safety plan specific to the Fort Pickens SI. The Field Investigation Plan presented the approved Technical Approach to guide sample documentation of MEC/MD as well as collection and analysis for MC to ensure that the results were sufficient to meet the project Data Quality Objectives (DQOs).

3.4.4 The MRS01 – Range Complex for Fort Pickens was anticipated to proceed to a RI/FS determination based on the potential munitions (live ammunition and HE) used and stored at the site. According to the 2007 PA, an August 1948 Preliminary and Fire Inspection Report provides indirect information indicating that the rifle range area within the MRS01-Range Complex was used by the Army and Navy for grenade practice. Interviews with GINS NPS personnel confirmed that a munition of unknown type was found near the rifle range area in the past and handled by EOD response. During the 2010 SI, MD in the form of an unknown type projectile fuze was observed near Battery Van Swearingen within MRS01-Range Complex. In addition, a signal-flare cartridge

case and numerous .30 Caliber projectile fragments were observed in the rifle range area. No known public injury incidents have been reported since site closure. The SS-WP Addendum included a sampling rationale for each planned sample location and the latitude and longitude of the planned samples. The sampling rationale has been updated to include the location coordinates for the actual sample locations and is included in this report as Table 3.1.

3.4.5 The SAP discusses procedures for sample acquisition from locations biased toward the highest potential for MC contamination, QC for the sampling process, sample shipment to an approved, independent laboratory, and analysis of the samples by the laboratory. The collected samples were packaged and shipped to TestAmerica Denver for analysis. TestAmerica-Denver is accredited under the state of Florida acceding authority for the National Environmental Laboratory Accreditation Program (NELAP). The EPP evaluates compliance with Army Regulation 200-2 by presenting procedures for avoiding, minimizing, and mitigating potential impacts to environmental and cultural resources during site field activities. The Accident Prevention Plan (APP) supplements the programmatic accident prevention plan with site-specific emergency contact information and directions to the nearest hospital.

3.4.6 Twenty-nine biased surface soil samples, three biased surface water/sediment sample couples, two groundwater samples, two ambient surface soil samples and one ambient surface water/sediment sample couple were collected from the site.

3.5 DEPARTURES FROM PLANNING DOCUMENTS

The following departure from planning documents occurred during the SI:

- The human health and ecological screening criteria for surface water and sediment were changed to accommodate for the freshwater and marine water at the site. The water samples revealed that saltwater intrusion was affecting the groundwater and freshwater bodies at the site. Screening criteria for brackish surface water and brackish sediment was added to this SI.
- A field duplicate sample was inadvertently missed on sample FTP MRS01-SS-02-29, but instead was taken on sample FTP-MRS01-SS-02-26.

Table 3.1
Sampling Rationale
Fort Pickens, Escambia County, Florida

Sample ID	Sample Coordinates		Media	Analysis	Historical Use of Munitions in Area	Rationale
	Latitude	Longitude				
FTP- MRS01-SS-02-01	30.33059	-87.29550	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	Cartridge, .22 Caliber, Small Arms; Cartridge, .30 Caliber; Cartridge, .45 Caliber, Small Arms; Cartridge, .50 Caliber, Machine Gun; Shell, 37mm, Fixed, High Explosive (HE); Cartridge, 37mm, High Explosive-Tracer, Self Destruct (HE-T, SD); Cartridge, 37mm, Practice with Tracer; Cartridge, 37mm, Target Practice (TP); Cartridge, 40mm, HE-T, SD; Cartridge, 40mm, High Explosive Incendiary-Tracer, Self Destruct (HEI-T, SD); Cartridge, 40mm, Armor Piercing-Tracer (AP-T); Cartridge, 40mm, Target Practice-Tracer (TP-T); Shell, 3-inch, Fixed, Shrapnel; Shell, 3-inch, Fixed, HE; Shell, 3-inch, Fixed, Practice; Cartridge, 3 inch, Armor Piercing Capped (APC); Cartridge, 3 inch, Armor Piercing (AP); Shell, 3 inch, HE; Cartridge, 90mm, Practice; Cartridge, 90mm, HE-T; Shell, 90mm, AP-T; Cartridge, 90mm, Armor Piercing Capped-Tracer (APC-T); Shell, 4.7 inch, Common; Shell, 4.7 inch, Shrapnel; Shell, 6-inch, HE; Shell, 6-inch, AP; Shell, 155mm, Shrapnel; Projectile, 155mm, HE; Projectile, 155mm, AP; Shell, 10 inch, HE; Shell, 12-inch, AP; Shell, 12-inch, High Capacity (HC); Shell, 12-inch, Target; Shell, 12 inch, Deck Piercing; Smoothbore, Solid Shot; Common Shell, 32 Pounder; Grape Shot; Shell, Parrot; Brooke Shell (Ratchet Sabot); Case Shot, Smooth Bore; Common Shot, Smooth Bore; Mine, Antitank, HE; Grenade , Hand, Fragmentation; Pot, Tear Gas	Sample was collected near sub- range Battery Trueman
FTP- MRS01-SS-02-02	30.33065	-87.29523	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected near sub- range Battery Trueman
FTP- MRS01-SS-02-03	30.32813	-87.29609	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected near sub- range Battery Payne
FTP- MRS01-SS-02-04	30.32832	-87.29607	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected near sub- range Battery Payne
FTP- MRS01-SS-02-05	30.32855	-87.29330	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected near sub- range Anti AircraFTP Battery
FTP- MRS01-SS-02-06	30.32930	-87.29483	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected near sub- range Anti AircraFTP Battery
FTP- MRS01-SS-02-07	30.32917	-87.29331	Surface Soil	Explosives, aluminum, antimony, copper, lead, and zinc	See Above	Sample was collected near sub- range Anti AircraFTP Battery
FTP- MRS01-SS-02-08	30.32718	-87.29580	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected near sub- range Battery Van Swearigen
FTP- MRS01-SS-02-09	30.32701	-87.29470	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected near sub- range Battery Cullum and Battery Sevier
FTP- MRS01-SS-02-10	30.32684	-87.29420	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected near sub- range Battery Cullum and Battery Sevier

Table 3.1
Sampling Rationale
Fort Pickens, Escambia County, Florida

Sample ID	Sample Coordinates		Media	Analysis	Historical Use of Munitions in Area	Rationale
	Latitude	Longitude				
FTP- MRS01-SS-02-11	30.32659	-87.29371	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected near sub- range Battery Cullum and Battery Sevier
FTP- MRS01-SS-02-12	30.32765	-87.28935	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected from soils within the Ft. Pickens moat
FTP- MRS01-SS-02-13	30.32647	-87.28958	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected from soils within the Ft. Pickens moat
FTP- MRS01-SS-02-14	30.32675	-87.29087	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected from the escarpment in front of Battery Pensacola located within Ft. Pickens
FTP- MRS01-SS-02-15	30.32085	-87.28526	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected near sub- range Battery 234
FTP- MRS01-SS-02-16	30.32093	-87.28444	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected near sub- range Battery 234
FTP- MRS01-SS-02-17	30.32041	-87.28258	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected near sub- range Battery Cooper
FTP- MRS01-SS-02-18	30.32031	-87.28210	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected near sub- range Battery Cooper
FTP- MRS01-SS-02-19	30.31901	-87.27822	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected from target area of the 600 yard Rifle Range
FTP- MRS01-SS-02-20	30.31928	-87.27787	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected from target area of the 600 yard Rifle Range
FTP- MRS01-SS-02-21	30.31927	-87.27803	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected between the rifle range target and the 200-yd firing point
FTP- MRS01-SS-02-22	30.31977	-87.27836	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected between the rifle range target and the 200-yd firing point
FTP- MRS01-SS-02-23	30.32284	-87.28019	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected near the 500-yd firing point of the rifle range
FTP- MRS01-SS-02-24	30.32327	-87.27959	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected from the front slope of Battery Worth
FTP- MRS01-SS-02-25	30.32363	--87.27947	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected within the Battery Worth firing position
FTP- MRS01-SS-02-26	30.32358	-87.27911	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected within the Battery Worth firing position
FTP- MRS01-SS-02-27	30.31868	-87.26250	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected near sub- range Battery Langdon
FTP- MRS01-SS-02-28	30.31875	-87.26294	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	See Above	Sample was collected near sub- range Battery Langdon
FTP- MRS01-SS-02-29	30.31962	-87.25909	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	None	Sample was collected near Battery Fixed

Table 3.1
Sampling Rationale
Fort Pickens, Escambia County, Florida

Sample ID	Sample Coordinates		Media	Analysis	Historical Use of Munitions in Area	Rationale
	Latitude	Longitude				
FTP- AMB-SS-02-30	30.32559	-87.27814	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	None	Sample was collected from area NNW of Battery Worth
FTP-AMB-SS-02-31	30.32269	-87.26719	Surface Soil	Explosives, aluminum, antimony, copper, lead, zinc and pH.	None	Sample was collected from area on north side of island, west of Battery Fixed
FTP- MRS01-SW-01	30.32746	-87.29680	Surface Water	Explosives, aluminum, antimony, copper, lead, and zinc	Cartridge, .22 Caliber, Small Arms; Cartridge, .30 Caliber; Cartridge, .45 Caliber, Small Arms; Cartridge, .50 Caliber, Machine Gun; Shell, 37mm, Fixed, High Explosive (HE); Cartridge, 37mm, High Explosive-Tracer, Self Destruct (HE-T, SD); Cartridge, 37mm, Practice with Tracer; Cartridge, 37mm, Target Practice (TP); Cartridge, 40mm, HE-T, SD; Cartridge, 40mm, High Explosive Incendiary-Tracer, Self Destruct (HEI-T, SD); Cartridge, 40mm, Armor Piercing-Tracer (AP-T); Cartridge, 40mm, Target Practice-Tracer (TP-T); Shell, 3-inch, Fixed, Shrapnel; Shell, 3-inch, Fixed, HE; Shell, 3-inch, Fixed, Practice; Cartridge, 3 inch, Armor Piercing Capped (APC); Cartridge, 3 inch, Armor Piercing (AP); Shell, 3 inch, HE; Cartridge, 90mm, Practice; Cartridge, 90mm, HE-T; Shell, 90mm, AP-T; Cartridge, 90mm, Armor Piercing Capped-Tracer (APC-T); Shell, 4.7 inch, Common; Shell, 4.7 inch, Shrapnel; Shell, 6-inch, HE; Shell, 6-inch, AP; Shell, 155mm, Shrapnel; Projectile, 155mm, HE; Projectile, 155mm, AP; Shell, 10 inch, HE; Shell, 12-inch, AP; Shell, 12-inch, High Capacity (HC); Shell, 12-inch, Target; Shell, 12 inch, Deck Piercing; Smoothbore, Solid Shot; Common Shell, 32 Pounder; Grape Shot; Shell, Parrot; Brooke Shell (Ratchet Sabot); Case Shot, Smooth Bore; Common Shot, Smooth Bore; Mine, Antitank, HE; Grenade , Hand, Fragmentation; Pot, Tear Gas	Sample was collected south of sub-range Battery Payne
FTP- MRS01-SD-01	30.32746	-87.29680	Sediment	Explosives, aluminum, antimony, copper, lead, and zinc	See Above	Sample was collected south of sub- range Battery Payne
FTP- MRS01-SW-02	30.32168	-87.28121	Surface Water	Explosives, aluminum, antimony, copper, lead, and zinc	See Above	Sample was collected from water feature between Battery Cooper and the 600 Yard Rifle Range
FTP- MRS01-SD-02	30.32167	-87.28121	Sediment	Explosives, aluminum, antimony, copper, lead, and zinc	See Above	Sample was collected from water feature between Battery Cooper and the 600 Yard Rifle Range
FTP- MRS01-SW-03	30.31993	-87.27105	Surface Water	Explosives, aluminum, antimony, copper, lead, and zinc	See Above	Sample was collected from water feature located between Battery Worth and Battery Langdon
FTP- MRS01-SD-03	30.31994	-87.27104	Sediment	Explosives, aluminum, antimony, copper, lead, and zinc	See Above	Sample was collected from water feature located between Battery Worth and Battery Langdon
FTP-AMB-SW-04	30.32166	-87.26626	Surface Water	Explosives, aluminum, antimony, copper, lead, and zinc	None	Sample collection was from surface water feature located west of Battery Fixed
FTP-AMB-SD-04	30.32166	-87.26626	Sediment	Explosives, aluminum, antimony, copper, lead, and zinc	None	Sample collection was from surface water feature located west of Battery Fixed

Table 3.1
Sampling Rationale
Fort Pickens, Escambia County, Florida

Sample ID	Sample Coordinates		Media	Analysis	Historical Use of Munitions in Area	Rationale
	Latitude	Longitude				
FTP-MRS01-GW-01	30.32917	-87.28990	Groundwater	Explosives, aluminum, antimony, copper, lead, and zinc	Cartridge, .22 Caliber, Small Arms; Cartridge, .30 Caliber; Cartridge, .45 Caliber, Small Arms; Cartridge, .50 Caliber, Machine Gun; Shell, 37mm, Fixed, High Explosive (HE); Cartridge, 37mm, High Explosive-Tracer, Self Destruct (HE-T, SD); Cartridge, 37mm, Practice with Tracer; Cartridge, 37mm, Target Practice (TP); Cartridge, 40mm, HE-T, SD; Cartridge, 40mm, High Explosive Incendiary-Tracer, Self Destruct (HEI-T, SD); Cartridge, 40mm, Armor Piercing-Tracer (AP-T); Cartridge, 40mm, Target Practice-Tracer (TP-T); Shell, 3-inch, Fixed, Shrapnel; Shell, 3-inch, Fixed, HE; Shell, 3-inch, Fixed, Practice; Cartridge, 3 inch, Armor Piercing Capped (APC); Cartridge, 3 inch, Armor Piercing (AP); Shell, 3 inch, HE; Cartridge, 90mm, Practice; Cartridge, 90mm, HE-T; Shell, 90mm, AP-T; Cartridge, 90mm, Armor Piercing Capped-Tracer (APC-T); Shell, 4.7 inch, Common; Shell, 4.7 inch, Shrapnel; Shell, 6-inch, HE; Shell, 6-inch, AP; Shell, 155mm, Shrapnel; Projectile, 155mm, HE; Projectile, 155mm, AP; Shell, 10 inch, HE; Shell, 12-inch, AP; Shell, 12-inch, High Capacity (HC); Shell, 12-inch, Target; Shell, 12 inch, Deck Piercing; Smoothbore, Solid Shot; Common Shell, 32 Pounder; Grape Shot; Shell, Parrot; Brooke Shell (Ratchet Sabot); Case Shot, Smooth Bore; Common Shot, Smooth Bore; Mine, Antitank, HE; Grenade , Hand, Fragmentation; Pot, Tear Gas	Sample was collected from groundwater well within the MRS if a well is located
FTP-MRS01-GW-02	30.32948	-87.28965	Groundwater	Explosives, aluminum, antimony, copper, lead, and zinc	See above	Sample was collected from groundwater well within the MRS if a well is located

CHAPTER 4
MUNITIONS AND EXPLOSIVES OF CONCERN FINDINGS

4.1 GENERAL INFORMATION

4.1.1 Qualitative Reconnaissance

4.1.1.1 The primary task of the SI is to assess the absence or presence of MEC and MD. The SVT mobilized to the Fort Pickens FUDS on August 29, 2010. To assess the presence or absence of MD and MEC, the SVT conducted QR by walking approximately 15.23 miles throughout the MRS01-Range Complex on August 30, 2010 - September 2, 2010.

4.1.1.2 The QR consisted of visual reconnaissance of the site surface to identify indicators of suspect areas including earthen berms, distressed vegetation, craters, target remnants, and visible metallic debris.

4.1.1.3 The QR involved a three-person SVT walking single file at a nominal 3- to 5-foot separation distance along the QR track shown on Figure 4.1. An Unexploded Ordnance (UXO) Technician III/Safety Officer (UXOSO) Technician walked in front of the FTL and sampling technician using a Schonstedt GA-92Td*i* magnetometer primarily for anomaly avoidance. The SVT stopped occasionally to note field observations and/or to collect samples. Sampling results are presented in Chapter 5.

4.1.1.4 Figure 4.1 shows the observation locations. The SVT stopped at locations throughout the MRS01-Range Complex to take photographs and to note field conditions, vegetation, or other features of interest. As discussed in the SS-WP Addendum (Parsons, 2010b), the QR route was not limited to the proposed path, but was determined in the field by the Field Team Leader (FTL) based on the baseline QC procedures described in Chapter 3 of the PWP (Parsons, 2005), visual observations, and areas of predetermined focus. The proposed QR path was modified in the field based on conditions at the site. Figures 4.1a and 4.1b display the actual QR path followed by the SVT. Table 4.1 presents the potential MEC anticipated to be present at the site based on the ASR and ASR Supplement. The MEC Conceptual Site Exposure Model (CSEM) is included in Appendix J.

Table 4.1
Chemical Composition of MEC and Potential Munitions Constituents, Fort Pickens
Santa Rosa Island (Escambia County), Florida

MRS	Munitions Type/Model	Composition (Case and Filler)[1]	MC Analysis[2]
MRS 01 – Range Complex **Battery Van Swearingen, Battery Air,** **Battery Langdon,** **Battery GPF,** **Battery Pensacola,** **Battery Copper,** **Battery Cullum,** **Battery Servier,** **Battery Worth,** **Battery Fixed,** **Battery Paine,** **Battery Trueman,** **1800's Batteries,** **Battery 234,** **600 Yard Rifle Range**	Small Arms General: **Cartridge, .22 Caliber**	**Cartridge case: Copper Alloy** – Copper, Iron, Lead, Zinc **Propellant:** Dibutylphthalate, Diphenylamine, Nitrocellulose[5], Nitroglycerin **Primer:** Antimony Sulfide, Barium Nitrate, Calcium Silicide, Copper, Iron, Lead, Lead Styphnate, Nitrocellulose[5], Pentaerythritol Tetranitrate (PETN), Tetrazene, Zinc **Projectile**: Antimony, Copper, Iron, Lead, Zinc	**Metals[3]** Antimony, Copper, Lead **Explosives [4]** A full explosives panel will be analyzed for from media collected at the firing lines of this MRS.
	Small Arms General: **Cartridge, .30 Caliber (includes carbine)**	**Cartridge case: Copper Alloy** – Copper, Iron, Lead, Zinc **Propellant:** Calcium Carbonate, Copper, Dibutylphthalate, Diphenylamine, Dinitrotoluene[6], Ethyl Centralite, Lead, Iron, Nitrocellulose[5], Nitroglycerin, Potassium Nitrate, Sodium Sulfate, Zinc **Primer:** Aluminum Powder, Antimony Sulfide, Barium Nitrate, Copper, Iron, Lead, Lead Styphnate, Pentaerythritol Tetranitrate (PETN), Tetrazene, Zinc **Projectile**: Antimony, Carbon, Copper, Iron, Lead, Manganese, Silicon, Sulfur, Zinc **Tracer:** Barium Peroxide, Calcium Resinate, Magnesium Powder, Polyvinyl Chloride, Strontium Nitrate, Strontium Oxalate, Strontium Peroxide, Zinc Stearate	**Metals[3]** Antimony, Copper, Lead **Explosives [4]** A full explosives panel will be analyzed for from media collected at the firing lines of this MRS
	Small Arms General: **Cartridge, .45 Caliber**	**Cartridge case: Copper Alloy** – Copper, Iron, Lead, Zinc **Propellant:** Diphenylamine, Dinitrotoluene[6], Nitrocellulose[5], Nitroglycerin, Potassium Nitrate, Potassium Sulfate **Primer:** Antimony Sulfide, Barium Nitrate, Calcium Silicide, Copper, Iron, Lead Styphnate, Lead Thiocyanate, Nitrocellulose[5], Pentaerythritol Tetranitrate (PETN), Potassium Chlorate, Tetrazene, Trinitrotoluene (TNT), Zinc **Projectile**: Antimony, Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Silicon, Sulfur, Zinc **Tracer:** Barium Peroxide, Calcium Resinate, Magnesium, Strontium Nitrate, Strontium Oxalate, Strontium Peroxide, Zinc Stearate	**Metals[3]** Antimony, Copper, Lead **Explosives [4]** A full explosives panel will be analyzed for from media collected at the firing lines of this MRS.
	Small Arms General: **Cartridge , .50 Caliber, Machine Gun**	**Cartridge case: Brass** – Copper, Zinc **Propellant:** Calcium Carbonate, Dibutylphthalate, Diphenylamine, Dinitrotoluene[6], Nitrocellulose[5], Nitroglycerin, Potassium Nitrate, Potassium Sulfate, Sodium Sulfate **Primer:** Aluminum Powder, Antimony Sulfide, Barium Nitrate, Calcium Silicide, Copper, Iron, Lead, Lead Styphnate, Lead Thiocyanate, Potassium Chlorate, Pentaerythritol Tetranitrate (PETN), Tetrazene, Zinc **Projectile**: Antimony, Carbon, Copper, Iron, Lead, Manganese, Molybdenum, Sodium Carbonate Monohydrate, Silicon, Sulfur, Zinc **Tracer:** Barium Peroxide, Calcium Resinate, Magnesium Powder, Polyvinyl Chloride, Potassium Perchlorate, Strontium Nitrate, Strontium Oxalate, Strontium Peroxide, Zinc Stearate	**Metals[3]** Antimony, Copper, Lead **Explosives [4]** A full explosives panel will be analyzed for from media collected at the firing lines of this MRS. **Miscellaneous** Perchlorate[7]

Table 4.1
Chemical Composition of MEC and Potential Munitions Constituents, Fort Pickens
Santa Rosa Island (Escambia County), Florida

MRS	Munitions Type/Model	Composition (Case and Filler)[1]	MC Analysis[2]
MRS 01 – Range Complex **Battery Van Swearingen,** **Battery Air,** **Battery Langdon,** **Battery GPF,** **Battery Pensacola,** **Battery Copper,** **Battery Cullum,** **Battery Servier,** **Battery Worth,** **Battery Fixed,** **Battery Paine,** **Battery Trueman,** **1800's Batteries,** **Battery 234,** **600 Yard Rifle Range**	**Shell, 37mm, Fixed, High Explosive (HE), Mk II**	**Cartridge case: Copper Alloy -** Copper, Iron, Lead, Zinc **Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine Nitrocellulose[5], Nitroglycerin, Potassium Chlorate, Potassium Nitrate, Sulfur **Primer[8]:** Antimony Sulfide, Barium Nitrate, Lead Thiocyanate, Trinitrotoluene (TNT) **Projectile: Steel** (Carbon, Iron, Phosphorus, Manganese, Sulfur) **Projectile Filler:** Trinitrotoluene (TNT) **Fuze, Projectile, Base Detonation, M38A1:** Carbon, Iron, Manganese, Phosphorus, Sulfur, Tetryl **Fuze Primer[8]:** Antimony Sulfide, Lead Azide, Potassium Chlorate	**Metals** Copper, Manganese, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Cartridge, 37mm, High Explosive-Tracer, Self Destruct (HE-T, SD), M54	**Cartridge case: Brass -** Copper, Iron, Lead, Zinc **Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5] **Primer[8]:** Antimony Sulfide, Lead Thiocyanate, Potassium Chlorate, Trinitrotoluene (TNT) **Projectile/Rotating Band: Steel -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler:** Barium Peroxide, Calcium Resinate, Cyclotrimethylenetrinitramine (RDX), Magnesium Powder, Potassium Nitrate, Sulfur, Tetryl **Fuze, Projectile, Point Detonating, M56: Aluminum Alloy** - Aluminum, Chromium, Copper, Iron, Magnesium, Manganese, Titanium, Zinc **Fuze Filler: Tetryl** **Fuze Primer[8]:** Antimony Sulfide, Carborundum, Lead Azide, Potassium Chlorate **Tracer[9]:** Aluminum Powder, Magnesium Powder, Polyvinyl Chloride, Strontium Nitrate	**Metals** Aluminum, Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Cartridge, 37mm, Practice with Tracer, M55	**Cartridge case: Brass** - Copper, Iron, Lead, Zinc **Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[6] **Primer[8]:** Antimony Sulfide, Lead Thiocyanate, Potassium Chlorate, Trinitrotoluene (TNT) **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler:** Solid **Tracer[9]:** Aluminum Powder, Magnesium Powder, Polyvinyl Chloride, Strontium Nitrate	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.

Table 4.1
Chemical Composition of MEC and Potential Munitions Constituents, Fort Pickens
Santa Rosa Island (Escambia County), Florida

MRS	Munitions Type/Model	Composition (Case and Filler)[1]	MC Analysis[2]
MRS 01 – Range Complex **Battery Van Swearingen,** **Battery Air,** **Battery Langdon,** **Battery GPF,** **Battery Pensacola,** **Battery Copper,** **Battery Cullum,** **Battery Servier,** **Battery Worth,** **Battery Fixed,** **Battery Paine,** **Battery Trueman,** **1800's Batteries,** **Battery 234,** **600 Yard Rifle Range**	**Cartridge, 37mm, Target Practice (TP), M63Mod 1, Sub Caliber for 155mm guns**	**Cartridge case: Brass** - Copper, Iron, Lead, Zinc **Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5], Nitroglycerin, Potassium Nitrate, Sulfur **Primer[8]:** Antimony Sulfide, Barium Nitrate, Lead Thiocyanate, Potassium Chlorate, Trinitrotoluene (TNT) **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: Black Powder -** Potassium Nitrate, Sodium Nitrate, Sulfur **Fuze:** Iron, Manganese, Phosphorus, Sulfur, Tetryl **Fuze Primer[8]:** Antimony Sulfide, Carborundum, Copper, Iron, Lead, Lead Azide, Potassium Chlorate, Zinc	**Metals** Copper, Manganese, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Cartridge, 37mm, Target Practice (TP), M92, Sub Caliber for 155mm guns	**Cartridge case: Brass -** Copper, Iron, Lead, Zinc **Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5], Nitroglycerin, Potassium Nitrate, Sulfur **Primer[8]:** Antimony Sulfide, Barium Nitrate, Lead Thiocyanate, Potassium Chlorate, Trinitrotoluene (TNT) **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: Black Powder -** Potassium Nitrate, Sulfur **Fuze: Aluminum Alloy** - Aluminum, Chromium, Copper, Iron, Lead Azide, Magnesium, Manganese, Phosphorus, Silicon, Tetryl, Titanium, Zinc **Fuze Primer[8]:** Antimony Sulfide, Carborundum, Potassium Chlorate	**Metals** Aluminum, Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Cartridge, 40mm, High Explosive-Tracer Self Destruct (HE-T, SD), MkII	**Cartridge case: Copper Alloy** - Copper, Iron, Lead, Zinc **Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5] **Primer[8]:** Aluminum, Antimony Sulfide, Barium Nitrate, Lead Styphnate, Lead Thiocyanate, Nitrocellulose[5], Pentaerythritol Tetranitrate (PETN), Potassium Chlorate, Tetrazene, Trinitrotoluene (TNT) **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler:** Trinitrotoluene (TNT) **Fuze, Projectile, Point Detonating, Mk27: Aluminum Alloy** – Aluminum, Copper, Iron, Manganese, Magnesium, Nickel, Silicon, Tetryl, Tin, Zinc **Fuze Filler:** Tetryl **Fuze Primer[8]:** Antimony Sulfide, Carborundum, Copper, Iron, Lead, Lead Azide, Potassium Chlorate, Zinc **Tracer[9]:** Aluminum Powder, Ammonium Perchlorate, Barium Peroxide, Magnesium, Sodium Nitrate, Strontium Nitrate, Sulfur	**Metals** Aluminum, Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.

Table 4.1
Chemical Composition of MEC and Potential Munitions Constituents, Fort Pickens
Santa Rosa Island (Escambia County), Florida

MRS	Munitions Type/Model	Composition (Case and Filler)[1]	MC Analysis[2]
MRS 01 – Range Complex **Battery Van Swearingen,** **Battery Air,** **Battery Langdon,** **Battery GPF,** **Battery Pensacola,** **Battery Copper,** **Battery Cullum,** **Battery Servier,** **Battery Worth,** **Battery Fixed,** **Battery Paine,** **Battery Trueman,** **1800's Batteries,** **Battery 234,** **600 Yard Rifle Range**	**Cartridge, 40mm, High Explosive Incendiary-Tracer, Self Destruct (HEI-T, SD), MkII**	**Cartridge case: Copper Alloy** - Copper, Iron, Lead, Zinc **Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5] **Primer[8]:** Aluminum, Antimony Sulfide, Barium Nitrate, Lead Styphnate, Lead Thiocyanate, Nitrocellulose[5], Pentaerythritol Tetranitrate (PETN), Potassium Chlorate, Tetrazene, Trinitrotoluene (TNT) **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: TNT, Incendiary Mixture** - Aluminum, Barium Nitrate, Magnesium, Trinitrotoluene (TNT) **Fuze, Projectile, Point Detonating, Mk27: Aluminum Alloy** – Aluminum, Copper, Iron, Manganese, Magnesium, Nickel, Silicon, Tetryl, Tin, Zinc **Fuze Filler:** Tetryl **Fuze Primer[8]:** Antimony Sulfide, Carborundum, Copper, Iron, Lead, Lead Azide, Potassium Chlorate, Zinc **Tracer[9]:** Aluminum Powder, Ammonium Perchlorate, Barium Peroxide, Magnesium, Sodium Nitrate, Strontium Nitrate, Sulfur	**Metals** Aluminum, Barium, Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Cartridge, 40mm, Armor Piercing-Tracer (AP-T), M8	**Cartridge case: Brass** - Copper, Iron, Lead, Zinc **Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5], Nitroglycerin, Potassium Nitrate, Sulfur **Primer[8]:** Antimony Sulfide, Lead Thiocyanate, Potassium Chlorate, Potassium Nitrate, Sodium Nitrate, Sulfur, Trinitrotoluene (TNT) **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: Solid steel** **Tracer[9]:** Aluminum, Barium Peroxide, Calcium Resinate, Magnesium, Polyvinyl Chloride, Strontium Nitrate	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Cartridge, 40mm, Target Practice-Tracer (TP-T), M91	**Cartridge case: Brass** - Copper, Iron, Lead, Zinc **Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5], Nitroglycerin, Potassium Nitrate, Sulfur **Primer[8]:** Antimony Sulfide, Lead Thiocyanate, Potassium Chlorate, Potassium Nitrate, Sodium Nitrate, Sulfur, Trinitrotoluene (TNT) **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: Solid steel** **Tracer[9]:** Aluminum, Barium Peroxide, Calcium Resinate, Magnesium, Polyvinyl Chloride, StrontiumNitrate, Toluidine Red Toner, Zinc stearate	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.

Table 4.1
Chemical Composition of MEC and Potential Munitions Constituents, Fort Pickens
Santa Rosa Island (Escambia County), Florida

MRS	Munitions Type/Model	Composition (Case and Filler)[1]	MC Analysis[2]
MRS 01 – Range Complex **Battery Van Swearingen,** **Battery Air,** **Battery Langdon,** **Battery GPF,** **Battery Pensacola,** **Battery Copper,** **Battery Cullum,** **Battery Servier,** **Battery Worth,** **Battery Fixed,** **Battery Paine,** **Battery Trueman,** **1800's Batteries,** **Battery 234,** **600 Yard Rifle Range**	**Shell, 3-inch, Fixed, Shrapnel, MkI**	**Cartridge Case: Brass or Copper Alloy** - Copper, Iron, Lead, Zinc **Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5] **Primer[8]:** Antimony Sulfide, Lead Thiocyanate, Potassium Chlorate, Potassium Nitrate, Sulfur, Trinitrotoluene (TNT) **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler:** Antimony, Lead, Potassium Nitrate, Sulfur **Fuze, Projectile, Time, M1907: Brass -** Copper, Iron, Lead, Zinc **Fuze Filler: Black Powder** - Potassium Nitrate, Sodium Nitrate, Sulfur **Fuze Primer[8]:** Antimony Sulfide, Copper, Iron, Lead, Mercury Fulminate, Potassium Chlorate, Zinc	**Metals** Antimony, Lead, Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Shell, 3-inch, Fixed, High Explosive (HE), MkIX	**Cartridge Case: Brass** - Copper, Iron, Lead, Zinc **Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5] **Primer[8]:** Antimony Sulfide, Lead Thiocyanate, Potassium Chlorate, Potassium Nitrate, Trinitrotoluene (TNT) **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler:** Trinitrotoluene (TNT) **Fuze, Projectile, Time, M43: Brass -** Copper, Iron, Lead, Zinc **Fuze Filler:** Potassium Nitrate, Sodium Nitrate, Sulfur, Tetryl, Zinc **Fuze Primer[8]:** Antimony Sulfide, Copper, Iron, Lead, Mercury Fulminate, Potassium Chlorate, Zinc	**Metals** Antimony, Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Shell, 3-inch, Fixed, High Explosive (HE), M42, M42A1	**Cartridge Case: Brass or Copper Alloy** - Copper, Iron, Lead, Zinc **Propellant:** Diphenylamine, Nitrocellulose[5], Potassium Nitrate **Primer[8]:** Antimony Sulfide, Lead Thiocyanate, Potassium Chlorate, Potassium Nitrate, Trinitrotoluene (TNT) **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler:** Trinitrotoluene (TNT) **Fuze, Projectile, Time, MkIII: Brass -** Copper, Iron, Lead, Zinc **Fuze Filler: Black Powder** - Potassium Nitrate, Sodium Nitrate, Sulfur **Fuze Primer[8]:** Antimony Sulfide, Copper, Iron, Lead, Mercury Fulminate, Potassium Chlorate, Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.

Table 4.1
Chemical Composition of MEC and Potential Munitions Constituents, Fort Pickens
Santa Rosa Island (Escambia County), Florida

MRS	Munitions Type/Model	Composition (Case and Filler)[1]	MC Analysis[2]
MRS 01 – Range Complex **Battery Van Swearingen,** **Battery Air,** **Battery Langdon,** **Battery GPF,** **Battery Pensacola,** **Battery Copper,** **Battery Cullum,** **Battery Servier,** **Battery Worth,** **Battery Fixed,** **Battery Paine,** **Battery Trueman,** **1800's Batteries,** **Battery 234,** **600 Yard Rifle Range**	**Shell, 3-inch, Fixed, Practice, M42B2**	**Cartridge Case: Brass or Copper Alloy** - Copper, Iron, Lead, Zinc **Propellant:** Diphenylamine, Nitrocellulose[5], Potassium Nitrate **Primer[8]:** Antimony Sulfide, Lead Thiocyanate, Potassium Chlorate, Potassium Nitrate, Trinitrotoluene (TNT) **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: Spotting Charge, Black Powder** - Potassium Nitrate, Sodium Nitrate, Sulfur **Fuze, Projectile, Time, M43: Brass -** Copper, Iron, Lead, Zinc **Fuze Filler:** Potassium Nitrate, Sodium Nitrate, Sulfur, Tetryl, Zinc **Fuze Primer[8]:** Antimony Sulfide, Copper, Iron, Lead, Mercury Fulminate, Potassium Chlorate, Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Cartridge, 3 inch, Armor Piercing Capped (APC), M62, M62A1	**Cartridge Case: Brass** - Copper, Iron, Lead, Zinc **Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5] **Primer[8]:** Antimony Sulfide, Lead Thiocyanate, Potassium Chlorate, Potassium Nitrate, Trinitrotoluene (TNT) **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: Explosive D (**Ammonium Picrate) – Ammonia, Picric Acid **Fuze, Projectile, Base Detonating, M66A1: Steel -** Carbon, Iron, Manganese, Phosphorus, Sulfur **Fuze Filler:** Potassium Nitrate, Tetryl, **Fuze Primer[8]:** Antimony Sulfide, Copper, Iron, Lead, Lead Azide, Lead Thiocyanate, Potassium Chlorate, Trinitrotoluene (TNT), Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Cartridge, 3 inch, Armor Piercing (AP), M79	**Cartridge Case: Brass** - Copper, Iron, Lead, Zinc **Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5] **Primer[8]:** Antimony Sulfide, Lead Thiocyanate, Potassium Chlorate, Potassium Nitrate, Trinitrotoluene (TNT) **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Tracer[9]:** Aluminum, Barium Peroxide, Copper, Lead, Magnesium, Strontium Nitrate, Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.

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Santa Rosa Island (Escambia County), Florida

MRS	Munitions Type/Model	Composition (Case and Filler)[1]	MC Analysis[2]
MRS 01 – Range Complex **Battery Van Swearingen,** **Battery Air,** **Battery Langdon,** **Battery GPF,** **Battery Pensacola,** **Battery Copper,** **Battery Cullum,** **Battery Servier,** **Battery Worth,** **Battery Fixed,** **Battery Paine,** **Battery Trueman,** **1800's Batteries,** **Battery 234,** **600 Yard Rifle Range**	**Shell, 3 inch, HE, M1915**	**Cartridge Case: Brass** - Copper, Iron, Lead, Zinc **Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5] **Primer[8]:** Antimony Sulfide, Lead Thiocyanate, Potassium Chlorate, Potassium Nitrate, Trinitrotoluene (TNT) **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler:** Ammonium Picrate **Fuze, Projectile, Base Detonating, MkV: Brass** - Copper, Iron, Lead, Zinc **Fuze Filler:** Tetryl **Fuze Primer[8]:** Copper, Iron, Lead, Mercury Fulminate, Potassium Nitrate, Sulfur, Trinitrotoluene (TNT), Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Cartridge, 90mm, Practice, M58 (1957 – 1964)	**Cartridge Case: Steel -** Carbon, Iron, Manganese, Phosphorus, Sulfur **Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Ethyl Centralite, Iron, Nitrocellulose[5], Nitroglycerin, Nitroguanidine, Potassium Nitrate **Primer[8]:** Antimony Sulfide, Lead Thiocyanate, Potassium Chlorate, Potassium Nitrate, Trinitrotoluene (TNT) **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler:** Potassium Nitrate, Sulfur, Tetryl **Fuze, Projectile, Time, M43: Brass -** Copper, Iron, Lead, Zinc **Fuze Filler:** Potassium Nitrate, Sodium Nitrate, Sulfur, Tetryl, Zinc **Fuze Primer[8]:** Antimony Sulfide, Copper, Iron, Lead, Mercury Fulminate, Potassium Chlorate, Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Cartridge, 90mm, High Explosive-Tracer (HE-T), M71A1	**Cartridge Case: Steel -** Carbon, Iron, Manganese, Phosphorus, Sulfur **Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Ethyl Centralite, Iron, Nitrocellulose[5], Nitroglycerin, Nitroguanidine, Potassium Nitrate **Primer[8]:** Antimony Sulfide, Lead Thiocyanate, Potassium Chlorate, Potassium Nitrate, Trinitrotoluene (TNT) **Projectile/ Rotating Band: Forged Steel/Copper Alloy** – Aluminum, Carbon, Chromium, Cobalt, Copper, Iron, Lead, Manganese, Molybdenum, Nickel, Phosphorus, Silicone, Sulfur, Vanadium, Zinc **Projectile Filler: Amatol (50/50) Mix or Comp B or TNT** – Ammonium Nitrate, Barium Stearate, Cyclotrimethylenetrinitramine (RDX), Trinitrotoluene (TNT) **Tracer[13]:** Aluminum, Barium Peroxide, Calcium Resinate, Magnesium, Polyvinyl Chloride **Fuze, Point Detonating (PD), M557: Steel -** Carbon, Iron, Manganese, Phosphorus, Sulfur **Fuze Filler:** Tetryl **Fuze Primer[8]:** Antimony Sulfide, Carborundum, Copper, Iron, Lead Azide, Lead Thiocyanate, Potassium Chlorate, Trinitrotoluene (TNT), Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.

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Chemical Composition of MEC and Potential Munitions Constituents, Fort Pickens
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MRS	Munitions Type/Model	Composition (Case and Filler)[1]	MC Analysis[2]
MRS 01 – Range Complex **Battery Van Swearingen,** **Battery Air,** **Battery Langdon,** **Battery GPF,** **Battery Pensacola,** **Battery Copper,** **Battery Cullum,** **Battery Servier,** **Battery Worth,** **Battery Fixed,** **Battery Paine,** **Battery Trueman,** **1800's Batteries,** **Battery 234,** **600 Yard Rifle Range**	**Shell, 90mm, Armor Piercing-Tracer (AP-T), M77**	**Cartridge Case: Steel -** Carbon, Iron, Manganese, Phosphorus, Sulfur **Propellant: Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Ethyl Centralite, Iron, Nitrocellulose[5], Nitroglycerin, Nitroguanidine, Potassium Nitrate **Primer[8]:** Antimony Sulfide, Lead Thiocyanate, Potassium Chlorate, Potassium Nitrate, Trinitrotoluene (TNT) **Projectile/Rotating Band: Steel, Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur. Zinc **Tracer[9]:** Aluminum Powder, Barium Peroxide, Magnesium Powder, Strontium Nitrate	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Shell, 4.7 inch, Common, M1905	**Cartridge Case: Brass** - Copper, Iron, Lead, Zinc **Propellant:** Diphenylamine, Nitrocellulose[5], Potassium Nitrate, Sulfur **Primer[8]:** Antimony Sulfide, Potassium Chlorate **Projectile/Rotating Band: Steel, Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur. Zinc **Projectile Filler:** Trinitrotoluene (TNT) **Fuze, Base Detonating, Medium Caliber: Steel** - Carbon, Iron, Manganese, Phosphorus, Sulfur **Fuze Filler:** Trinitrotoluene (TNT) **Fuze Primer[8]:** Antimony Sulfide, Mercury Fulminate, Nitrocellulose[5], Potassium Chlorate	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS
	Shell, 4.7 inch, Shrapnel	**Cartridge Case: Brass** - Copper, Iron, Lead, Zinc **Propellant:** Diphenylamine, Nitrocellulose[5], Potassium Nitrate, Sulfur **Primer[8]:** Antimony Sulfide, Potassium Chlorate, **Projectile/Rotating Band: Steel, Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur. Zinc **Projectile Filler:** Lead, Trinitrotoluene (TNT) **Fuze, Frankfort Arsenal, Combination: Brass** - Copper, Iron, Lead., Zinc **Fuze Filler:** Potassium Nitrate, Sulfur **Fuze Primer[8]:** Antimony Sulfide, Mercury Fulminate, Nitrocellulose[5], Potassium Chlorate,	**Metals** Copper, Lead, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Shell, 6 inch, High Explosive (HE), MkII	**Propellant:** Diphenylamine, Nitrocellulose[5] **Primer[8]:** Copper, Lead, Nitrocellulose[5], Potassium Nitrate, Sodium Nitrate, Sulfur, Zinc **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler:** Trinitrotoluene (TNT) **Fuze, Projectile, Point Detonating, MkIV:** **Brass-** Copper, Iron, Sulfur, Zinc **Fuze Filler:** Tetryl **Fuze Primer[8]:** Copper, Lead, Mercury Fulminate, Potassium Nitrate, Sodium Nitrate, Sulfur, Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.

Table 4.1
Chemical Composition of MEC and Potential Munitions Constituents, Fort Pickens
Santa Rosa Island (Escambia County), Florida

MRS	Munitions Type/Model	Composition (Case and Filler)[1]	MC Analysis[2]
MRS 01 – Range Complex **Battery Van Swearingen,** **Battery Air,** **Battery Langdon,** **Battery GPF,** **Battery Pensacola,** **Battery Copper,** **Battery Cullum,** **Battery Servier,** **Battery Worth,** **Battery Fixed,** **Battery Paine,** **Battery Trueman,** **1800's Batteries,** **Battery 234,** **600 Yard Rifle Range**	**Shell, 6 inch, Armor Piercing (AP), M1911**	**Propellant:** Diphenylamine, Nitrocellulose[5] **Primer[8]:** Copper, Lead, Nitrocellulose[5], Potassium Nitrate, Sodium Nitrate, Sulfur, Zinc **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: Explosive D -** Ammonium Picrate **Fuze, Projectile, Base Detonating, MkV: Steel -** Carbon, Iron, Manganese, Phosphorus, Sulfur **Fuze Filler:** Tetryl **Fuze Primer[8]:** Copper, Lead, Mercury Fulminate, Potassium Nitrate, Sodium Nitrate, Sulfur, Trinitrotoluene (TNT), Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Shell, 155mm, Shrapnel, MkI	**Propelling Charge:** Diphenylamine, Nitrocellulose[5] **Primer[8]:** Antimony Sulfide, Mercury Fulminate, Potassium Chlorate, Potassium Nitrate, Sulfur **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler:** Antimony, Lead, Potassium Nitrate, Sulfur **Fuze, Projectile, Time, M1907: Brass -** Copper, Iron, Lead, Zinc **Fuze Filler: Black Powder** - Potassium Nitrate, Sodium Nitrate, Sulfur **Fuze Primer[8]:** Antimony Sulfide, Copper, Iron, Lead, Mercury Fulminate, Potassium Chlorate, Zinc	**Metals** Antimony, Copper, Lead, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Shell, 155mm, High Explosive (HE), MkIII	**Propellant:** Diphenylamine, Nitrocellulose[5] **Primer[8]:** Aluminum, Antimony Sulfide, Barium Nitrate, Calcium Silicide, Copper, Lead Dioxide, Lead Styphnate, Nitrocellulose, Potassium Chlorate, Pentaerythritol Tetranitrate (PETN),Potassium Nitrate, Sodium Nitrate, Sulfur, Tetrazene, Trinitrotoluene (TNT), Zinc, Zirconium **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: TNT or Amatol -** Ammonium Nitrate, Trinitrotoluene (TNT) **Booster:** Lead Azide, Tetryl, Trinitrotoluene (TNT) **Fuze, Projectile, Point Detonating, MkIV: Brass-** Copper, Iron, Sulfur, Zinc **Fuze Filler:** Tetryl **Fuze Primer[8]:** Copper, Lead, Mercury Fulminate, Potassium Nitrate, Sodium Nitrate, Sulfur, Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.

Table 4.1
Chemical Composition of MEC and Potential Munitions Constituents, Fort Pickens
Santa Rosa Island (Escambia County), Florida

MRS	Munitions Type/Model	Composition (Case and Filler)[1]	MC Analysis[2]
MRS 01 – Range Complex **Battery Van Swearingen,** **Battery Air,** **Battery Langdon,** **Battery GPF,** **Battery Pensacola,** **Battery Copper,** **Battery Cullum,** **Battery Servier,** **Battery Worth,** **Battery Fixed,** **Battery Paine,** **Battery Trueman,** **1800's Batteries,** **Battery 234,** **600 Yard Rifle Range**	**Projectile, 155mm, Armor Piercing (AP), M112**	**Propellant:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5], Potassium Nitrate, Potassium Sulfate, Sodium Nitrate, Sulfur **Primer[8]:** Aluminum, Antimony Sulfide, Barium Nitrate, Calcium Silicide, Copper, Lead Dioxide, Lead Styphnate, Nitrocellulose, Potassium Chlorate, Pentaerythritol Tetranitrate (PETN),Potassium Nitrate, Sodium Nitrate, Sulfur, Tetrazene, Trinitrotoluene (TNT), Zinc, Zirconium **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: Projectile Filler: Explosive D (**Ammonium Picrate) – Ammonia, Picric Acid **Fuze, Projectile, Base Detonating, M60: Steel -** Carbon, Iron, Manganese, Phosphorus, Sulfur **Fuze Filler:** Potassium Nitrate, Sodium Nitrate, Sulfur, Tetryl **Fuze Primer[8]:** Antimony Sulfide, Copper, Iron, Lead, Lead Azide, Lead Thiocyanate, Potassium Chlorate, Tetryl, Trinitrotoluene (TNT)	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Shell, 10 inch, Armor Piercing (AP), MkIII	**Propelling Charge:** Antimony Sulfide, Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5], Potassium Chlorate, Rosaliline **Primer[8]:** Nitrocellulose[5], Potassium Nitrate, Sulfur **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: Projectile Filler: Explosive D (**Ammonium Picrate) – Ammonia, Picric Acid **Fuze, Projectile, Base Detonating, MkV: Steel -** Carbon, Iron, Manganese, Phosphorus, Sulfur **Fuze Filler:** Tetryl, Trinitrotoluene (TNT) **Fuze Primer[8]:** Copper, Lead, Mercury Fulminate, Potassium Nitrate, Sodium Nitrate, Sulfur, Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Shell, 10 inch, High Explosive (HE), MkIV	**Propelling Charge:** Antimony Sulfide, Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5], Potassium Chlorate, Rosaliline **Primer[8]:** Nitrocellulose[5], Potassium Nitrate, Sulfur **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: Projectile Filler: Explosive D (**Ammonium Picrate) – Ammonia, Picric Acid **Fuze, Projectile, Point Detonating, MkIV: Brass-** Copper, Iron, Sulfur, Zinc **Fuze Filler:** Tetryl **Fuze Primer[8]:** Copper, Lead, Mercury Fulminate, Potassium Nitrate, Sodium Nitrate, Sulfur, Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.

Table 4.1
Chemical Composition of MEC and Potential Munitions Constituents, Fort Pickens
Santa Rosa Island (Escambia County), Florida

MRS	Munitions Type/Model	Composition (Case and Filler)[1]	MC Analysis[2]
MRS 01 – Range Complex **Battery Van Swearingen,** **Battery Air,** **Battery Langdon,** **Battery GPF,** **Battery Pensacola,** **Battery Copper,** **Battery Cullum,** **Battery Servier,** **Battery Worth,** **Battery Fixed,** **Battery Paine,** **Battery Trueman,** **1800's Batteries,** **Battery 234,** **600 Yard Rifle Range**	**Shell, 12 inch, Armor Piercing (AP), Mk15**	**Propelling Charge:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5], Potassium Chlorate, Potassium Nitrate, Rosaliline, Sulfur **Primer[8]:** Antimony Sulfide, Potassium Nitrate, Sulfur **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: Projectile Filler: Explosive D (**Ammonium Picrate) – Ammonia, Picric Acid **Fuze, Base Detonating, MkII: Steel** - Carbon, Iron, Manganese, Phosphorus, Sulfur, **Fuze Filler:** Tetryl **Fuze Primer[8]:** Antimony Sulfide, Copper, Iron, Lead, Mercury Fulminate, Potassium Chlorate, Potassium Nitrate, Trinitrotoluene (TNT), Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Shell, 12 inch, Armor Piercing (AP), MkXVI	**Propelling Charge:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5], Potassium Chlorate, Potassium Nitrate, Rosaliline, Sulfur **Primer[8]:** Antimony Sulfide, Potassium Nitrate, Sulfur **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: Projectile Filler: Explosive D (**Ammonium Picrate) – Ammonia, Picric Acid **Fuze, Base Detonating, MkX: Steel** - Carbon, Iron, Manganese, Phosphorus, Sulfur, **Fuze Filler:** Tetryl **Fuze Primer[8]:** Antimony Sulfide, Copper, Iron, Lead, Mercury Fulminate, Potassium Chlorate, Potassium Nitrate, Trinitrotoluene (TNT), Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Shell, 12 inch, High Capacity (HC), Mk16	**Propelling Charge:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5], Potassium Chlorate, Potassium Nitrate, Rosaliline, Sulfur **Primer[8]:** Antimony Sulfide, Potassium Nitrate, Sulfur **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: Projectile Filler: Explosive D (**Ammonium Picrate) – Ammonia, Picric Acid **Fuze, Base Detonating, Mk28: Steel** - Carbon, Iron, Manganese, Phosphorus, Sulfur, **Fuze Filler:** Tetryl **Fuze Primer[8]:** Antimony Sulfide, Copper, Iron, Lead, Mercury Fulminate, Potassium Chlorate, Potassium Nitrate, Trinitrotoluene (TNT), Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Shell, 12 inch, Armor Piercing (AP), Mk18	**Propelling Charge:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5], Potassium Chlorate, Potassium Nitrate, Rosaliline, Sulfur **Primer[8]:** Antimony Sulfide, Potassium Nitrate, Sulfur **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: Projectile Filler: Explosive D (**Ammonium Picrate) – Ammonia, Picric Acid **Fuze, Base Detonating, Mk21: Steel** - Carbon, Iron, Manganese, Phosphorus, Sulfur, **Fuze Filler:** Tetryl **Fuze Primer[8]:** Antimony Sulfide, Copper, Iron, Lead, Mercury Fulminate, Potassium Chlorate, Potassium Nitrate, Trinitrotoluene (TNT), Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.

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MRS 01 – Range Complex **Battery Van Swearingen,** **Battery Air,** **Battery Langdon,** **Battery GPF,** **Battery Pensacola,** **Battery Copper,** **Battery Cullum,** **Battery Servier,** **Battery Worth,** **Battery Fixed,** **Battery Paine,** **Battery Trueman,** **1800's Batteries,** **Battery 234,** **600 Yard Rifle Range**	**Shell, 12 inch, Target, Mk19**	**Propelling Charge:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5], Potassium Chlorate, Potassium Nitrate, Rosaliline, Sulfur **Primer[8]:** Antimony Sulfide, Potassium Nitrate, Sulfur **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: Solid** **Tracer[9]:** Barium Peroxide, Magnesium Powder	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS
	Shell, 12 inch, Deck Piercing, Mk1898	**Propelling Charge:** Dibutylphthalate, Dinitrotoluene[6], Diphenylamine, Nitrocellulose[5], Potassium Chlorate, Potassium Nitrate, Rosaliline, Sulfur **Primer[8]:** Antimony Sulfide, Potassium Nitrate, Sulfur **Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Projectile Filler: Projectile Filler: Explosive D (**Ammonium Picrate) – Ammonia, Picric Acid **Fuze, Base Detonating, MkX: Steel** - Carbon, Iron, Manganese, Phosphorus, Sulfur, **Fuze Filler:** Tetryl **Fuze Primer[8]:** Antimony Sulfide, Copper, Iron, Lead, Mercury Fulminate, Potassium Chlorate, Potassium Nitrate, Trinitrotoluene (TNT), Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Smoothbore, Solid Shot, 8, 10, 13, 15, and 20-inch	**Case: Steel** – Carbon, Iron, Manganese, Phosphorus, Sulfur **Filler:** Solid Steel (Inert)	**Metals** N/A **Explosives** N/A
	Common Shell, 32 Pounder, Dahlgren	**Shell Case: Steel** – Carbon, Iron, Manganese, Phosphorus, Sulfur **Sabot:** Lead **Filler: Black Powder** – Potassium Nitrate, Sodium Nitrate, Sulfur **Fuze, Paper Time, Wooden Fuze Plug**: Black Powder – Potassium Nitrate, Sodium Nitrate, Sulfur	**Metals** Lead **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Grape Shot, 4.5-inch (12 Pounder) through 8-inch	**Filler: Steel Shot** – Carbon, Iron, Manganese, Phosphorus, Sulfur	**Metals** N/A **Explosives** N/A
	Shell, Parrot, 30 Pounder	**Shell Case: Steel** – Carbon, Iron, Manganese, Phosphorus, Sulfur **Filler: Lead or Brass Shot, Black Powder Charge** – Copper, Iron, Lead, Potassium Nitrate, Sodium Nitrate, Sulfur, Zinc	**Metals** Copper, Lead, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Shell, Absterdam (Early Type), 3-inch to 4.5-inch	**Shell Case: Steel** – Carbon, Iron, Manganese, Phosphorus, Sulfur **Filler: Black Powder** – Potassium Nitrate, Sodium Nitrate, Sulfur **Fuze: Brass** – Copper, Iron, Lead, Zinc **Primer[8]:** Copper, Iron, Lead, Mercury Fulminate, Potassium Nitrate, Sulfur, Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.

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MRS	Munitions Type/Model	Composition (Case and Filler)[1]	MC Analysis[2]
MRS 01 – Range Complex **Battery Van Swearingen,** **Battery Air,** **Battery Langdon,** **Battery GPF,** **Battery Pensacola,** **Battery Copper,** **Battery Cullum,** **Battery Servier,** **Battery Worth,** **Battery Fixed,** **Battery Paine,** **Battery Trueman,** **1800's Batteries,** **Battery 234,** **600 Yard Rifle Range**	**Brooke Shell (Ratchet Sabot), 3-inch to 7-inch**	**Projectile/Rotating Band: Steel/Copper Alloy -** Carbon, Copper, Iron, Lead, Manganese, Phosphorus, Sulfur, Zinc **Filler: Black Powder** – Potassium Nitrate, Sodium Nitrate, Sulfur **Fuze, Percussion or Time: Brass** – Copper, Iron, Lead, Zinc **Primer[8]:** Copper, Iron, Lead, Mercury Fulminate, Potassium Nitrate, Sulfur, Zinc	**Metals** Copper, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Case Shot, Smooth Bore, 6-, 12-, 18-, 24-, 32-, 42-lbs., and 8-inch	**Case: Steel** – Carbon, Iron, Manganese, Phosphorus, Sulfur **Filler: Steel or Lead Shot, Black Powder** – Carbon, Iron, Lead, Manganese, Phosphorus, Potassium Nitrate, Sodium Nitrate, Sulfur **Fuze, Paper Time or Boreman**: Black Powder – Potassium Nitrate, Sodium Nitrate, Sulfur **Primer[8]:** Copper, Iron, Lead, Mercury Fulminate, Potassium Nitrate, Sulfur, Zinc	**Metals** Copper, Lead, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS
	Common Shot, Smooth Bore, 12-, 18-, 24-, 32-, 42-lbs., and 8-inch	**Case: Steel** – Carbon, Iron, Manganese, Phosphorus, Sulfur **Filler: Black Powder** – Potassium Nitrate, Sodium Nitrate, Sulfur **Fuze, Paper Time or Paper**: Black Powder – Potassium Nitrate, Sodium Nitrate, Sulfur **Primer[8]:** Copper, Iron, Lead, Mercury Fulminate, Potassium Nitrate, Sulfur, Zinc	**Metals** N/A **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS
	Mine, Antitank, HE, M4	**Mine Case: Steel** – Carbon, Iron, Manganese, Phosphorus, Sulfur **Filler:** Trinitrotoluene (TNT) **Fuze, Mine, Anti-tank, M4: Steel -** Carbon, Iron, Manganese, Phosphorus, Sulfur **Fuze Filler:** Tetryl **Primer[8]:** Aluminum, Antimony Sulfide, Barium Nitrate, ***Lead Azide,*** Lead Styphnate, Pentaerythritol Tetranitrate (PETN), Tetrazene	**Metals** N/A **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Grenade , Hand, Fragmentation, MkII	**Munition Case: Cast Iron** - Carbon, Iron, Manganese, Phosphorus, Sulfur **Munition Filler: EC Blank Powder or Trinitrotoluene (TNT)** -Aurine Dye, Barium Nitrate, Diphenylamine, Nitrocellulose[5], Potassium Nitrate, Trinitrotoluene (TNT) **Fuze, Grenade, Delay, M204: Zinc Alloy, Aluminum Alloy** - Aluminum, Barium Chromate, Chromium, Lead Azide, Nickel, PETN (Pentaerythritol Tetranitrate), Potassium Perchlorate, Cyclotrimethylenetrinitramine (RDX), Tetryl, Titanium, Zinc, Zirconium **Fuze Primer[8]:** Antimony Sulfide, Calcium Silicide, Lead Thiocyanate, Potassium Chlorate, Tetrazene, Trinitrotoluene (TNT)	**Metals** Aluminum, Zinc **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Pot, Tear Gas (CN), M1	**Case: Steel** – Carbon, Iron, Manganese, Phosphorus, Sulfur Filler: CN Mixture - Chloracetophenone, Diphenylamine, Magnesium Oxide, Nitrocellulose **Match Head/Starter[8]:** Antimony, Barium Nitrate, Iron Oxide, Potassium Chlorate, Potassium Nitrate, Red Phosphorus, Sulfur	**Metals** N/A **Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.
	Dynamite, Commercial	**Case:** Manila Paper **Filler:** Nitroglycerin, Sodium Nitrate	**Explosives** As a conservative measure, a full explosives panel will be analyzed for from media collected at this MRS.

Table 4.1 Table Notes
Chemical Composition of MEC and Potential Munitions Constituents, Fort Pickens
Santa Rosa Island (Escambia County), Florida

(1) MC not selected for analysis are non-CERCLA substances, Semi-Volatile Organic Compounds (SVOCs) or materials that represent a very small percentage of the munitions weight.
(2) MC selected for analysis are typically CERCLA-Hazardous substances and indicative of known or suspected DOD munitions used at this MRS.
(3) As a Programmatic determination, antimony, copper and lead will be considered indicator metals for small arms ranges.
(4) A full Explosives panel will be analyzed for from media collected at known firing points of small arms ranges and ambient samples.
(5) Nitrocellulose is not considered toxic, has no risk-based screening values and there are no chemical analysis techniques that quantify nitrocellulose separately from the natural common essential nutrient nitrate. Based on this, nitrocellulose analysis will not be conducted during this SI.
(6) Dinitrotoluene products include: 2,4-and 2,6-dinitrotoluene; 2-Amino-4,6-dinitrotoluene; 2-and 3-nitrotoluene; 4-Amino-2,6-dinitrotoluene; 4-nitrotoluene.
(7) Small Arms Ranges orientation resulted in firing direction to be over the ocean; therefore, Perchlorate will not be analyzed for at this MRS.
(8) Primer materials represent a very small percentage of the munitions weight; therefore, primer constituents will not be analyzed for at this MRS (if a primer constituent is associated with a larger component of the munition it may be analyzed for).
(9) Tracer element materials represent a very small percentage of the munitions weight and is consumed while the projectile travels to the target, therefore, tracer element constituents will not be analyzed for at this MRS (if a tracer element constituent is associated with a larger component of the munition it may be analyzed for).

Source – Munitions information was supplied by the 1991, 1998 and 2003 INPR, 2007 PA, 2008 ASR Supplement, Munitions Items Disposition Action System (MIDAS) database, and USACE Range Operations Reports RO-01, RO-03, RO-13, RO-14, RO-17, RO-23.

4.1.1.5 As shown in Appendix E, the SVT noted discrete field observations throughout the course of the SI including details on topography, water features, drainage features, the presence of any barriers, and any indications of subsurface metal anomalies using the Schonstedt magnetometer. Pertinent field observations are summarized in Table 4.2. Appendix D includes related field forms.

Table 4.2
Summary of Qualitative Reconnaissance Observations
Fort Pickens, Escambia County, Florida

MRS	MEC	MD	Munitions-Related Features
MRS01 – Range Complex	None observed	3.5-inch artillery shell/casing, a 40mm signal flare cartridge and numerous .30 Caliber bullet fragments	Small arms range remnants (firing point berm and target remnants), gun mounts (Civil War, WWI, and WWII eras), artillery batteries and bunkers, Ft. Pickens remnants

4.2 Data Quality Objectives

4.2.1 Introduction

4.2.1.1 DQOs are qualitative and quantitative statements that clarify study objectives and specify the type and quality of the data necessary to support decisions. The development of DQOs for a specific site takes into account factors that determine whether the quality and quantity of data are adequate for project needs, such as data collection, uses, types, and needs. While developing these DQOs in accordance with the process presented in Chapter 3, paragraph 3.1.2 of the PWP, Parsons followed the *Guidance on Systematic Planning Using the Data Quality Objectives Process*, USEPA QA/G-4, USEPA/240/B-06/001 (USEPA, 2006).

4.2.1.2 The goal of the TPP process is to achieve stakeholder, USACE, and applicable state and federal regulatory concurrence with the DQOs for a given site. The TPP Team discussed the Fort Pickens DQOs at the TPP Meeting held on January 12, 2010. Appendix B of this SI Report presents the TPP documentation. Tables 4.3 through 4.6 present the DQO worksheets. *All the DQOs for MRS01-Range Complex have been met.*

4.2.1.3 As stated in section 1.2 of this SI Report, data must be sufficient to do the following: 1) determine whether a removal action is necessary; 2) enable HRS scoring by the USEPA; 3) characterize the release for effective and rapid initiation of a RI/FS; and 4) complete the MRSPP.

4.2.1.4 DQOs cover four project objectives that SI data must satisfy: 1) evaluate potential presence of MEC; 2) evaluate potential presence of MC; 3) collect data needed to complete MRSPP scoring sheets; and 4) collect information for HRS scoring.

4.2.2 Munitions and Explosives of Concern Data Quality Objective

The MEC DQO was achieved by evaluating potential presence of MEC at the Fort Pickens site. The SVT searched for visual evidence of MEC and MD during the QR and sampling throughout the MRS01-Range Complex. During the October 2010, SI at Fort Pickens, MD in the form of an unknown type projectile fuze was observed near Battery Van Swearingen within MRS01-Range Complex and a signal-flare cartridge case and numerous .30 Caliber projectile fragments were observed in the rifle range area. Also near the rifle range was visible evidence of the former firing line and target area downrange. Observed near the former firing line were an 8 to 10 foot high berm and remains of a brick walkway. Remnants of iron stakes in the ground at the end of the rifle range marked the former target area. A summary of these findings is included in Table 4.2.

4.2.3 Munitions Constituents Data Quality Objective

The MC DQO was achieved by evaluating potential presence of MC at the Fort Pickens FUDS. Air and ambient groundwater samples were not planned or collected. Twenty-nine biased surface soil samples, three biased surface water/sediment sample couples, and two groundwater sample were collected during the SI (plus appropriate field duplicates and QC samples). The TPP Team evaluated the composition of the munitions (and fillers) used on the MRS01 – Range Complex and developed a list of compounds/analytes for sample analysis. Explosives, aluminum, antimony, copper, lead, and zinc were selected by the TPP Team for sample analysis. While iron and tin are MCs of the munitions potentially used at this site, these MC are not included in the analytical scheme because 1) neither are CERCLA hazardous substances (Agency for Toxic Substances and Disease Registry [ATSDR], 2007) and USACE cannot respond to non-CERCLA hazardous substances under the FUDS program; and, 2) iron is considered an essential nutrient and is not expected to pose an unacceptable risk to human or ecological receptors. The complete list of munitions potentially used at the MRS01-Range Complex and their chemical composition is provided in Table 4.1. Chapter 5 presents the MC sampling results (Table 5.3).

4.2.4 Munitions Response Site Prioritization Protocol Data Quality Objective

The MRSPP DQO was achieved by obtaining sufficient information to complete the MRSPP scoring sheets for the Fort Pickens MRS. Specific input data were collected and the three modules for the MRSPP were populated as part of the SI. The MRSPP scoring sheets are included in Appendix K.

4.2.5 Hazard Ranking System Data Quality Objective

The HRS DQO was achieved by including information in the SI report necessary for the USEPA to populate the HRS score sheets. Source documents for the HRS information include the INPR, PA, and ASR Supplement documents, as well as the MC sampling results reported in Chapter 5 and information from local and state agencies regarding population, groundwater well users, and drinking water well use. The USEPA has been contacted to obtain information regarding Wellhead Protection Areas within 4 miles and surface water intakes within 15 miles of the FUDS. *This requested information was not obtained prior to submission of the Draft SI Report.*

4.3 MRS01 – RANGE COMPLEX

4.3.1 Historical Munitions and Explosives of Concern

Information provided in the INPR, PA, ASR Supplement, reported findings, visual observations, and other sources was used to develop the list of known or potential MEC items for Fort Pickens. Potential munitions used at Fort Pickens occurred over several eras of use including the Civil War, WWI, and WWII. A wide variety of light to heavy artillery ammunition, high explosives, small arms, marine mines, hand grenades, and rifle grenades were the potential munitions used and stored at the MRS01- Range Complex (Table 4.1). According to the 2007 PA, an August 1948 Preliminary and Fire Inspection Report provides indirect information indicating that the rifle range area within the MRS01-Range Complex was used by the Army and Navy for grenade practice. The 2007 PA inspection team did not find MEC or MD while conducting their site visit. During the 2010, TPP Meeting an interview with NPS personnel confirmed that a bomb was found near the rifle range area in the past and EOD personnel from Hurlburt Field responded and detonated the bomb in place. Several types of munitions have been catalogued as used at Fort Pickens and many are retained as museum exhibits.

4.3.2 Inspection Activities

4.3.2.1 The SI field effort for the MRS01 – Range Complex was conducted August 30-September 2, 2010. The SVT collected 29 biased surface soil samples, 3 biased surface water/sediment sample couples, and 2 groundwater samples. The SVT also conducted 15.23 miles of QR and searched for visual evidence of MEC and MD throughout the MRS01-Range Complex. MD in the form of a 3.5-inch artillery shell/casing, a 40mm signal flare cartridge and numerous .30 Caliber bullet fragments were observed at the site. No MEC were observed during the 2010 SI. Photographs and site observations collected in this MRS are included in Appendix E.

4.3.2.2 On August 30, 2010, the QR, observations, and soil sampling began on the western areas of the MRS. The SVT walked and observed areas around Battery Trueman, Battery Payne, and the dunes west of the main Fort Pickens area over to Pensacola Pass. Inclement weather with rain and thunderstorms were created significant delays throughout the day and limited the team's time outside. The SVT observed no evidence of MD, MEC, targets, craters, distressed vegetation from military use, or other indicators of munitions use, storage, or disposal; with the exception of the existing historic military building and fortress. The very light vegetation and white sands made observing ground debris very easy, but the sands and vegetation would mean that the

terrain and soils are shifting very often and probably significantly during major storm events.

4.3.2.3 On August 31, 2010, the SVT began QR, observations, and soil sampling near Fort Pickens proper and continued in the western areas of the MRS. The SVT walked and observed areas around the pond south of Battery Payne; around the Cullum, Sevier, and Van Swearingen Batteries; in the open field area west of the fort; in the marshy, wetland areas north and south of the fort; and within the fort, itself. Within the wetland areas, thick vegetation and standing water forced the team to deviate from the proposed QR track at times. While walking the fort, Ranger Stanley Lawhead mentioned that at no time has he or anyone he has worked with encountered any MD items anywhere at the site. Ranger Lawhead informed the SVT that the primary park curator, (Mr. Jeff Halstaed) would be an excellent resource to contact about historical munitions on the site and whether anything has been found recently. During day, the SVT did not observe evidence of MEC, targets, craters, distressed vegetation from military use, or other indicators of munitions storage or disposal. One MD item was located during the morning, between the major pond on the west side of the site and Battery Van Swearingen. The MD item was identified as a 3.5-inch artillery casing. Only about half of the brass item remained and it was heavily corroded. Soil sample FTP-MRS01-SS-02-08 was moved from its originally planned location on the south side of Battery Van Swearingen to the MD location. The SVT collected the ambient soil samples (FTP-MRS01-SS-02-30 and FTP-MRS01-SS-02-31).

4.3.2.4 During September 1, 2010, the SVT conducted QR, observations, and soil sampling around the Cullum and Sevier Batteries and the eastern area of the MRS. Additionally, the SVT collected the groundwater, surface water, and sediment samples. Ranger Andy Fernandez mentioned that the potable water wells were installed sometime before the state government took control of the land (1960's) and both were drilled down to approximately 260 feet deep. He stated that the water is treated with chlorine and regularly tested before going to the users around the fort. Water testing on the groundwater includes bacteria (4 times/year), lead and copper (1 time/year) and Florida Department of Environmental Protection stage 1 disinfectants (1 time/year). Some water well test data is included in Appendix L. Ranger Fernandez mentioned that he found small arms casings (possibly .45 and .50 cal) around the north side of the Cullum Battery, and at the former rifle range. The SVT walked the Cullum and Sevier Batteries and found no such MD during the 2010 SI. The SVT collected three soil samples at planned locations (FTP-MRS01-SS-02-09, FTP-MRS01-SS-02-10, and FTP-MRS01-SS-02-11). The surface water and sediment sample locations were mostly within marshy/wetland areas with thick vegetation and standing water that forced the SVT to move, slightly (<50 feet) the location of the planned samples and the QR path. The SVT collect three soil samples (FTP-MRS01-SS-02-27, FTP-MRS01-SS-02-28, and FTP-MRS01-SS-02-29) at Battery Langdon. During the day, the SVT observed no other evidence of MD, MEC, targets, craters, distressed vegetation from military use, or other indicators of munitions use, storage or disposal.

4.3.2.5 QR, observations, and soil sampling were completed on September 2, 2010, around the Worth, Cooper, the 234 Batteries, and the Rifle Range. The SVT

conducted QR around the Cooper and 234 Batteries as well as around two, 10-feet in diameter, old gun emplacement areas. Soil samples were collected on the south side of the batteries (FTP-MRS01-SS-02-17 and FTP-MRS01-SS-02-18). At Battery Worth, the SVT shifted the soil sample (FTP-MRS01-SS-02-25 and FTP-MRS01-SS-02-26) locations approximately 50 feet north to native soil, adjacent to the battery. Within the rifle range, the SVT found visible evidence of the firing line and target area downrange. At the firing line area, there exists an 8- to 10-feet high berm orientated perpendicular to the line of fire. At this firing line berm, the SVT located two .30 caliber rifle cartridge casings (with date stamps '43' and '53') and pieces of small arms clips. Soil sample (FTP-MRS01-SS-02-23) was collected at the firing point. Downrange, at the end of the 600 yard rifle range, visible remains of the target area were observed, including the iron target stakes still in the ground and orientated perpendicular to the line of fire, and a large concentration of small arms projectile fragments all around a 100 foot by 100 foot target area. There is numerous MD, perhaps 1000’s of small arms projectile fragments. Only .30 Caliber projectiles were properly identified. Four surface soil samples were collected in this area (FTP-MRS01-SS-02-19, FTP-MRS01-SS-02-20, FTP-MRS01-SS-02-21, and FTP-MRS01-SS-02-22). The middle of the rifle range was mostly marshy/wetland and impassable due to deep standing water. The SVT collected QR around the standing water located a .30 Caliber cartridge case towards the middle of the range, as well as a signal-flare cartridge case, also in the middle of the range. During the day, the SVT observed no evidence of MEC, craters, distressed vegetation from military use, or unusual indicators of munitions use, storage or disposal.

Table 4.3 - MEC Data Quality Objective Worksheet

SITE: **Fort Pickens, Escambia County, Florida**

PROJECT: **MMRP Site Inspection / FUDS I04FL006301**

DQO Element Number *	DQO Element Description *	Site-Specific DQO Statement	Objective Met? Yes (Y)/No (N)
Intended Data Use(s):			
1	Project Objective(s) Satisfied	Evaluate presence/lack there of MEC.	Y
Intended Need Requirements:			
2	Data User Perspective(s)	Risk, Remedy	Y
3	Contaminant or Characteristic of Interest	MEC, MD	Y
4	Media of Interest	N/A	N/A
5	Required Sampling Locations or Areas and Depths	MRS01 – Range Complex	Y
6	Number of Samples Required	N/A	N/A
7	Reference Concentration of Interest or Other Performance Criteria	Indication of target areas. Visual Confirmation of absence/presence of MEC.	Y
Appropriate Sampling and Analysis Methods:			
8	Sampling Method	Qualitative Reconnaissance (limited)	Y
9	Analytical Method	N/A	N/A

* Refer to EM 200-1-2, Paragraph 4.2.1

Table 4.4 - MC Data Quality Objective Worksheet

SITE: **Fort Pickens, Escambia County, Florida**

PROJECT: **MMRP Site Inspection / FUDS No. I04FL006301**

DQO Element Number*	DQO Element Description*	Site-Specific DQO Statement	Objective Met? Yes (Y)/No (N)
Intended Data Use(s):			
1	Project Objective(s) Satisfied	Evaluate presence/lack thereof of MC	Y
Intended Need Requirements:			
2	Data User Perspective(s)	Risk, Remedy	Y
3	Contaminant or Characteristic of Interest	Total Explosives and Selected Metals.	Y
4	Media of Interest	Surface soil, groundwater, sediment, and surface water	Y
5	Required Sampling Locations or Areas and Depths	As determined by the TPP Team and SVT, see Figure 5.1. Locations based on MRS configurations	Y
6	Number of Samples Required	Twenty-nine biased surface soil samples and two ambient surface soil samples. Three biased surface water/ sediment sample couples and one ambient surface water /sediment sample couple. Two groundwater samples. Plus associated QA/QC samples	Y

Table 4.4 - MC Data Quality Objective Worksheet (Continued)

SITE: **Fort Pickens, Escambia County, Florida**
PROJECT: **MMRP Site Inspection / FUDS No. I04FL006301**

DQO Element Number*	DQO Element Description*	Site-Specific DQO Statement	Objective Met? Yes (Y)/No (N)
7	Reference Concentration of Interest or Other Performance Criteria	The selected human health screening levels are as follows: The human health screening levels for groundwater consist of the more stringent of USEPA regional screening levels (RSLs) for Chemical Contaminants at Superfund Sites for Tap Water, May 17, 2010 and FDEP Florida Administrative Code (FAC) 62-777 Groundwater and Surface Water Cleanup Target Levels, Groundwater Criteria and FDEP FAC 62-550 Primary or Secondary Groundwater Standards. The human health screening levels for fresh surface water consist of the more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Tapwater, May 17, 2010 and FDEP FAC 62-777 Groundwater and Surface Water Cleanup Target Levels, Freshwater Surface Water Criteria and FAC 62-302 Surface Water Quality Standards (SWQS; for Class I or Class III waters). The human health screening levels for freshwater sediment consist of the more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Residential Soil, May 17, 2010 and FDEP FAC 62-777 Soil Cleanup Target Levels more stringent of the Direct Exposure Residential, leachability based on Marine Surface Water Criteria, leachability Based on Freshwater Surface Water Criteria and leachability based on Groundwater Criteria, February 2005. The human health screening	Y – Most up-to-date screening values used.

Table 4.4 - MC Data Quality Objective Worksheet (Continued)

SITE: **Fort Pickens, Escambia County, Florida**
PROJECT: **MMRP Site Inspection / FUDS No. I04FL006301**

DQO Element Number*	DQO Element Description*	Site-Specific DQO Statement	Objective Met? Yes (Y)/No (N)
		levels for brackish surface water consist of the more stringent FDEP FAC 62-777 Groundwater and Surface Water Cleanup Target Levels, Marine Surface Water Criteria and FAC 62-302 SWQS (for Class III waters; predominantly marine waters). The human health screening levels for brackish sediment were the more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Residential Soil, May 17, 2010 and FAC 62-777 Soil Cleanup Target Levels, more stringent of the Direct Exposure Residential, leachability based on Marine Surface Water Criteria, leachability based on Freshwater Surface Water Criteria and leachability based on Groundwater Criteria, February 2005. The human health screening levels for surface soil consist of the more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Residential Soil, May 17, 2010 and FDEP FAC 62-777 Soil Cleanup Target Levels more stringent of the Direct Exposure Residential, leachability based on Marine Surface Water Criteria, leachability based on Freshwater Surface Water Criteria, and leachability based on Groundwater Criteria, February 2005. The selected ecological screening levels are as follows: The ecological screening values for fresh surface water are the more stringent of FAC 62-302 SWQS (for Class III waters) and USEPA Region 4 Ecological	

Table 4.4 - MC Data Quality Objective Worksheet (Continued)

SITE: **Fort Pickens, Escambia County, Florida**
PROJECT: **MMRP Site Inspection / FUDS No. I04FL006301**

DQO Element Number*	DQO Element Description*	Site-Specific DQO Statement	Objective Met? Yes (Y)/No (N)
		Screening Values (ESVs) for Freshwater Surface Water, November 2001. The ESVs for freshwater sediment are the more stringent of FDEP Sediment Quality Assessment Guidelines (SQAG), January 2003 and USEPA Region 4 ESVs for Sediment, November 2001. The ESVs for brackish surface water are the more stringent of FAC 62-302 SWQS (for Class III waters, predominantly marine waters), February 2005 and USEPA Region 4 ESVs for Marine Surface Water, November 2001. The ESVs for brackish sediment were the more stringent of FDEP SQAG, January 2003 and USEPA Region 3 ESVs for Marine Sediment, March 2010, supplemented with ESVs obtained from sources identified in the 2005 PSAP, updated with most current values. The ESVs for surface soil were from USEPA Region 4 ESVs, November 2001.	
Appropriate Sampling and Analysis Methods:			
8	Sampling Method	Discrete samples in accordance with the FDEP and TPP Team concurrence	Y
9	Analytical Method	SW6020, SW6010B-Metals; SW8321A-Explosives; pH-SW9045C	Y

*Refer to EM 200-1-2, Paragraph 4.2.

Table 4.5 - MRSPP Data Quality Objective Worksheet

Site:	Fort Pickens				
Project:	MMRP Site Inspection / FUDS No. I04FL006301				
Module	Table #	Table Description	Known Data	Current Data Gap	Data Source
Explosive Hazard Evaluation (EHE)	1	Munitions Type	X		Historical Records/Findings
	2	Source of Hazard	X		Historical Maps
	3	Location of Munitions	X		Historical or Field Findings
	4	Ease of Access	X		Field Findings
	5	Status of Property	X		Historical Records
	6	Population Density	X		U.S. Census Bureau
	7	Population Near Hazard	X		Field Findings
	8	Types of Activities/Structures	X		Regional Zoning
	9	Ecological and/or Cultural Resources	X		State Historic Preservation Office
	10	Determining the EHE	X		Scores from Tables 1 through 9
Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE)	11	CWM Configuration	X		Historical Records/Findings
	12	Sources of CWM	X		Historical Records/Findings
	13	Location of CWM	X		Historical or Field Findings
	14	Ease of Access	X		Field Findings
	15	Status of Property	X		Historical Records
	16	Population Density	X		U.S. Census Bureau
	17	Population Near Hazard	X		Field Findings
	18	Types of Activities/Structures	X		Regional Zoning
	19	Ecological and/or Cultural Resources	X		State Historic Preservation Office
	20	Determining the CHE	X		Scores from Tables 11 through 19
Health Hazard Evaluation (HHE)	21	Groundwater Data	X		N/A
	22	Surface Water - Human Endpoint	X		Surface Water Sampling Results
	23	Sediment - Human Endpoint	X		Sediment Sampling Results
	24	Surface Water - Ecological Endpoint	X		Surface Water Sampling Results
	25	Sediment - Ecological Endpoint	X		Sediment Sampling Results
	26	Surface Soil	X		Surface Soil Sampling Results
	27	Supplemental Contaminant Hazard Factor	X		All MC Sampling Results
	28	Determining the HHE	X		Scores from Tables 21 through 27
	29	MRS Priority	X		Scores from Tables 10, 20, and 28
	A	MRS Background Information	X		DoD Databases

Table 4.6 - HRS Data Quality Objective Worksheet

Site:
Fort Pickens
Project:
MMRP Site Inspection / FUDS No. I04FL006301
DQO Statement Number: 4 of 4

Data Description	Known Data	Current Data Gap	Data Source
Source Type	X		Historical Records/Findings
Estimated Volume or Area	X		Field Findings
Hazardous Substance	X		Constituents of Suspected Munitions
Groundwater Sample Concentration	X		Sample Results
Groundwater Use	X		Well Records/Municipal Data
Surface Water Sample Concentration	X		Sample Results
Surface Water Pathways	X		Field Findings
Soil Sample Concentration	X		Sample Results
Soil Pathways	X		Municipal Data
Sensitive Environments	X		State Historic Preservation Office, US Fish and Wildlife Service, various government agencies
Attractiveness/Accessibility	X		Field Findings/Land Use Records

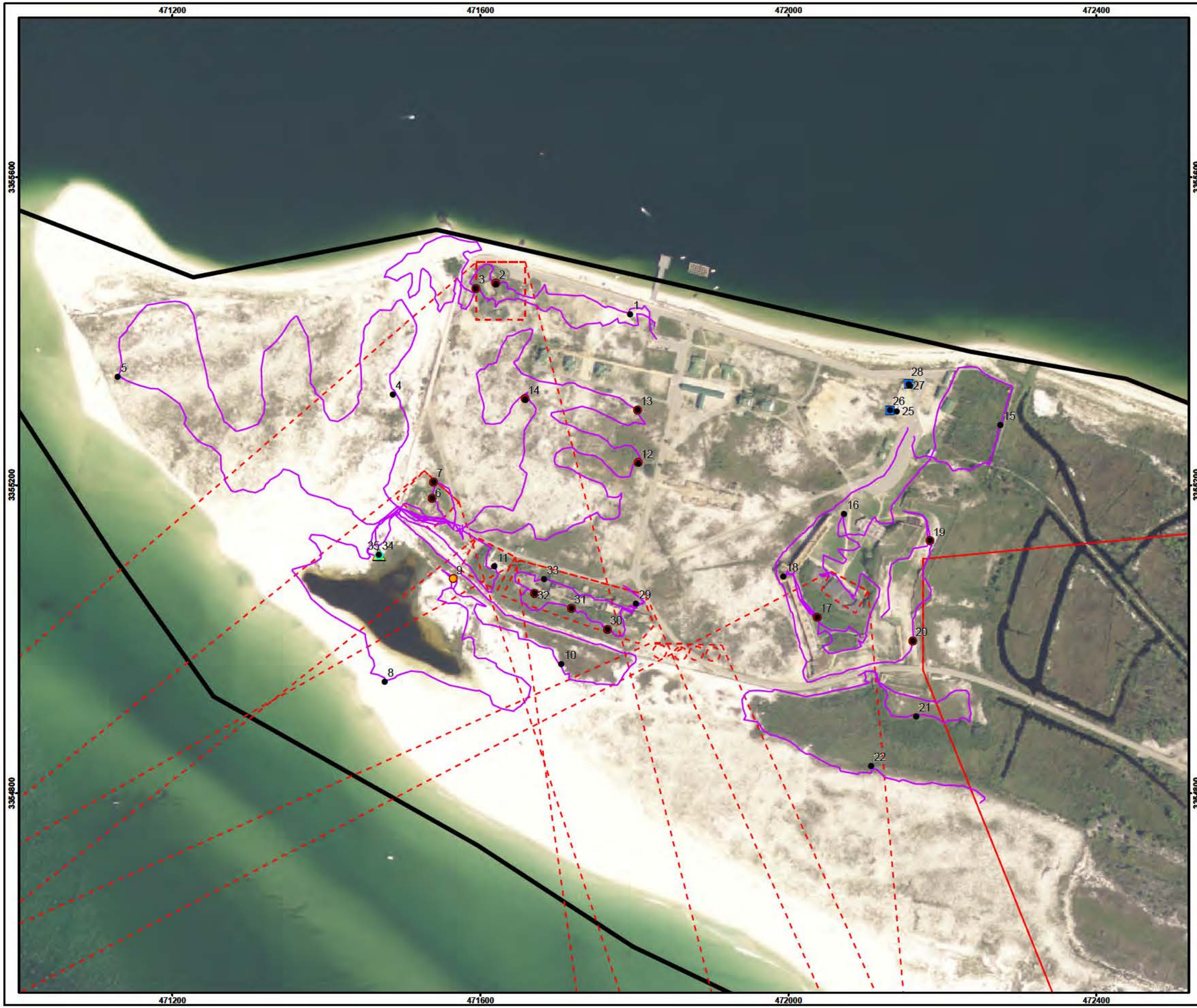


Figure 4.1a

Qualitative Reconnaissance and Field Observation Locations Fort Pickens FUDS Project No. I04FL006301

Escambia County, Florida

Legend

- 35 Munitions Constituent Location
- 44 Munitions Debris Location
- 40 Field Observation Location
- Biased Surface Soil Sample Location
- Ambient Surface Soil Sample Location
- Groundwater Sample Location
- Fresh Surface Water/Sediment Sample Location
- Ambient Surface Water/Sediment Sample Location
- Brackish Surface Water/Sediment Sample Location
- Qualitative Reconnaissance Track
- Range Complex
- FUDS Project Boundary

Note:
Observation #35 - Munitions constituent RDX location (MC was present in field duplicate sample FTP-MRS01-SD-05, which is field duplicate of FTP-MRS01-SD-01)

N

Image Source: 2007 Orthophto
Projection: UTM Zone 16 NAD83, Map Units in Meters

Meters
100 50 0 100

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY BT	Qualitative Reconnaissance and Field Observation Locations		
DRAWN BY BT			
CHECKED BY JH	SCALE As Shown	PROJECT NUMBER 747140.86137	
SUBMITTED BY TD	DATE October 2010	PAGE NUMBER	
	FILE X:\GIS\Site_inspections_se\Maps\pickens_FL\Fig4_1a.mxd		

Figure 4.1b

Qualitative Reconnaissance and Field Observation Locations Fort Pickens FUDS Project No. I04FL006301

Escambia County, Florida

Legend

- 44 Munitions Debris Location
- 40 Field Observation Location
- Biased Surface Soil Sample Location
- Ambient Surface Soil Sample Location
- Fresh Surface Water/Sediment Sample Location
- Ambient Surface Water/Sediment Sample Location
- Qualitative Reconnaissance Track
- Range Complex
- FUDS Project Boundary

N

Image Source: 2007 Orthophto
Projection: UTM Zone 16 NAD83, Map Units in Meters

Meters
300 150 0 300

PARSONS

U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY	BT
DRAWN BY	BT
CHECKED BY	JH
SUBMITTED BY	TD

Qualitative Reconnaissance and Field Observation Locations

SCALE	As Shown	PROJECT NUMBER	747140.86137
DATE	October 2010	PAGE NUMBER	
FILE	X:\GIS\Site_inspections_se\Maps\pickens_FL\Fig4_1b.mxd		

CHAPTER 5
EXPOSURE PATHWAYS AND RECEPTORS

5.1 INTRODUCTION

5.1.1 This chapter of the SI report evaluates the potential presence or absence of exposure pathways and receptors, based on site-specific conditions, providing the information used in Chapter 6 to evaluate risks posed to potential receptors under current and future land use scenarios. This chapter evaluates exposure pathways for groundwater, surface water and sediment, soil, and air. The CSEM for the Fort Pickens FUDS (Appendix J) summarizes which potential receptor exposure pathways are (or may be) complete and which are (and are likely to remain) incomplete. For an exposure pathway to be considered complete, all four of the following factors (in *italics*) must be present (USEPA, 1989). An example regarding a hypothetical groundwater pathway accompanies each pathway element.

- *A source of contamination*. For example, a site has known MEC from which MC have leached and contaminated surface soil.
- *An environmental transport and/or exposure medium*. In the example, the MC in soil is mobile and can contaminate groundwater.
- *A point of exposure at which the contaminant can interact with a receptor*. A drinking water well drawing from the contaminated aquifer is at the site.
- *A receptor and a likely route of exposure at the exposure point*. An on-site resident uses groundwater as a source of drinking water.

5.1.2 In the hypothetical example of the resident, all four factors are present and, therefore, the groundwater exposure pathway is complete. If any single factor was not present (for example, MC were not present in soil, or the resident used drinking water from another source), the pathway would be incomplete.

5.2 GENERAL INFORMATION

General information regarding the geology, hydrogeology, and hydrology of the Fort Pickens FUDS presented below was obtained from the PA (USACE, 2007), except where noted. Regional information is followed by a discussion of MRS-specific characteristics and sampling results for the MRSs investigated as part of the SI.

5.2.1 Regional Geologic Setting

5.2.1.1 Geologically, the area surrounding Escambia County, Florida is within the Floridian Section of the Coastal Plain Physiographic Province and is comprised of a thick sequence of sand, gravel, clay overlying a sequence of carbonate rocks that form the

Floridan aquifer. Age of the sediments overlying the carbonate rocks range from recent day to Miocene.

5.2.1.2 The soils of Santa Rosa Island are 99 percent quartz sand and 1 percent sediment of heavy minerals such as illmenite and rutile. The Island has undergone extensive morphological changes since 1979 due to hurricanes. Exposed soil areas are susceptible to wind and water erosion and the backshore is subjected to wind action that blows the dry sand landward, creating dunes. Wetlands provide excellent stabilization and protection from erosion for the landward shoreline (USACE 2007).

5.2.2 Regional Hydrogeologic Setting

5.2.2.1 Two predominant aquifers are found near the Fort Pickens FUDS; the Sand and Gravel aquifer and the Floridan aquifer. The Sand and Gravel aquifer is made up of the upper layers of sand and gravel along the Florida Panhandle and southern portion of the surrounding states of Mississippi and Alabama. The Floridan aquifer is comprised of the limestone formations found below the Sand and Gravel aquifer.

5.2.2.2 The Sand and Gravel aquifer exists under unconfined conditions and is recharged locally by infiltrating rainfall. Due to highly permeable soils and the lack of effective confinement, the entire occurrence for the Aquifer is a recharge area. In coastal areas, the aquifer discharges into the bays or the Gulf of Mexico. Due to its proximity to the land surface and lithologic characteristics, the Sand and Gravel Aquifer is highly vulnerable to contamination. In Escambia County, the Sand and Gravel Aquifer has been informally subdivided into three zones. The uppermost zone is composed of primarily fine sands and is referred to as the surficial zone and discharges to the bays and bayous. Underlying the surficial zone is the low permeability zone that restricts the vertical flow of ground water between the overlying surficial zone and the underlying main-producing zone. The main-producing zone is the lowermost zone and is characterized by highly permeable coarse sand and gravel beds interspersed in places with fine sand and clayey sand beds. The majority of water withdrawn from the Sand and Gravel Aquifer in Escambia County is derived from the main producing zone. The groundwater within this zone exists under semi-confined conditions. The thickness of the main-producing zone ranges between 90 ft and 290 ft in southern Escambia County (USACE, 2007).

5.2.2.3 Carbonate rock units, mainly limestones underlying the Sand and Gravel aquifer, make up the Floridan aquifer. The upper Floridan aquifer consists of the remnants of the Tampa Limestone found in the area as well as the Chickasawhay Limestone. In most places, it yields sufficient water for most purposes so that drilling deeper into the lower portions of the aquifer is not warranted.

5.2.2.4 According to interviews and the well data provided to Parsons by GINS, there are two groundwater water wells within the Fort Pickens FUDS boundary and both have well depths of approximately 300 feet below ground surface.

5.2.3 Regional Groundwater Use

Table 5.1 lists the registered groundwater wells within 4 miles of the Range Complex MRS at the Fort Pickens FUDS. There are 234 reported groundwater wells within a 4-mile radius of the Fort Pickens site. Two groundwater wells are located on-site at the MRS01 - Range Complex (Figure 5.1). The majority of these reported wells (164) near the site are registered as "landscape irrigation (LA)" wells. The reported wells have drilled depths ranging from approximately 0 to 300 feet. Information regarding the type, location, ownership, and use for each water well is located in the well report in Appendix L of this SI report.

Table 5.1
Registered Groundwater Wells within a
4-Mile Radius of the Range Complex MRS
Fort Pickens FUDS

On-Site	0 to ¼ mile	¼ to ½ mile	½ to 1 mile	1 to 2 miles	2 to 3 miles	3 to 4 miles	Total
2	1	2	8	76	73	72	234

5.2.4 Regional Hydrologic Setting

The two major water bodies to which surface water ultimately drains are Pensacola Bay to the north and the Gulf of Mexico to the south. Ponds and marshes are scattered throughout Santa Rosa Island, predominantly on the north (Bay) side of the island. Much of the island is subject to inundation from storm tides (USACE 2007).

5.2.5 Regional Sensitive Ecological Resources

5.2.5.1 The state of Florida supports 114 federally listed Threatened and Endangered (T&E) species consisting of 59 animals and 55 plants. According to the FNAI, the USFWS Northwest Florida Ecological Services Panama City Field Office, and ECOS databases, there are 12 federally listed T&E species for Escambia County. Of these 12 T&E species, 11 federally listed T&E species may be within the FUDS or MRS01-Range Complex. The one other federally listed T&E species, the American alligator (*Alligator mississippiensis*), is not known or likely to be found on-site. The 11 federally listed T&E species potentially within the FUDS or MRS boundaries are shown in Table 5.2. In addition to the 11 federally listed T&E species, the federally delisted peregrine falcon was observed during SI field activities. The peregrine falcon is protected under the Migratory Bird Treaty Act, and is included on the Table 5.2. No T&E species were impacted by the SI sampling event.

5.2.5.2 The USFWS Wetlands Online Mapper, through the NWI, was used to identify wetlands within the Fort Pickens FUDS (Figure 5.3). The predominant wetland areas within the FUDS and MRS01- Range Complex consist mainly of three wetland systems with various classes, subclasses, and modifiers. According to the NWI, the predominate wetland types located within the FUDS and MRS01-Range Complex are:

- E1UBL- Estuarine, sub-tidal, unconsolidated bottom, sub-tidal;
- M1UBL- Marine, sub-tidal, unconsolidated bottom, sub-tidal;
- M2USN- Marine, intertidal, unconsolidated shore, regularly exposed;
- PEM1A- Palustrine, emergent, persistent, temporarily flooded;
- PEM1Cd- Palustrine, emergent, persistent, seasonally flooded, partially drained/ditched;
- PUBH- Palustrine, unconsolidated bottom, permanently flooded;
- PFO4Cd- Palustrine, forested, needle-leaved evergreen, seasonally flooded, partially drained/ditched; and
- PEM1/SS1Cd- Palustrine, emergent, persistent/scrub-shrub, broad-leaved deciduous, seasonally flooded, partially drained/ditched.

5.2.5.3 Other wetlands not identified in the Wetland Online Mapper may be present on the site. Sensitive environments were not impacted by the SI effort.

5.2.5.4 Using the criteria in the Army Checklist for Important Ecological Places (USACE, 2006), the Fort Pickens FUDS and MRS01-Range Complex are classified as important ecological places since they support wetland areas (Figure 5.3), critical habitat, are within a NPS unit of the Gulf Islands National Seashore and State Aquatic Preserve, and known T&E species on-site. Fort Pickens is within a state park and is listed in the NRIS and the NRHP databases. The determinations regarding important ecological places pertain to whether or not ecological receptors will be evaluated at the site (Subchapter 4.7.2). Therefore, ecological receptors are potential receptors for exposure pathways at this site.

Table 5.2
Federally and State-Listed Threatened and Endangered Species Potentially Within Fort Pickens, Escambia County, Florida

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat (NatureServe, 2010)	Habitat Present On-Site?
Manatee	*Trichechus manatus*	Endangered	Endangered	In Florida, manatees occur in freshwater, brackish, and marine environments; typical coastal and inland habitats include coastal tidal rivers and streams, mangrove swamps, salt marshes, freshwater springs, and vegetated bottoms; where feeding often occurs in shallow grass beds, with ready access to deep channels.	Yes

Table 5.2
Federally and State-Listed Threatened and Endangered Species Potentially Within Fort Pickens, Escambia County, Florida

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat (NatureServe, 2010)	Habitat Present On-Site?
Wood Stork	*Mycteria americana*	Endangered	Endangered	Chiefly freshwater situations: marshes, swamps, lagoons, ponds, flooded fields; depressions in marshes are important during drought; also occurs in brackish wetlands. Nests mostly in upper parts of cypress trees, mangroves, or dead hardwoods over water or on islands along streams or adjacent to shallow lakes. Feeds in freshwater marshes, swamps, lagoons, ponds, flooded pastures and flooded ditches, depressions in marshes (especially during drought).	Yes

Table 5.2
Federally and State-Listed Threatened and Endangered Species Potentially Within Fort Pickens, Escambia County, Florida

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat (NatureServe, 2010)	Habitat Present On-Site?
Loggerhead Sea Turtle	*Caretta caretta*	Threatened	Threatened	Open sea to more than 500 miles from shore, mostly over continental shelf, and in bays, estuaries, lagoons, creeks, and mouths of rivers; mainly warm temperate and subtropical regions not far from shorelines. Adults occupy various habitats, from turbid bays to clear waters of reefs. Sub-adults occur mainly in near shore and estuarine waters. Hatchlings move directly to sea after hatching, often float in masses of sea plants (*Sargassum*); may remain associated with *Sargassum* rafts perhaps for 3-5 years.	Yes, known nesting on-site.

Table 5.2
Federally and State-Listed Threatened and Endangered Species Potentially Within Fort Pickens, Escambia County, Florida

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat (NatureServe, 2010)	Habitat Present On-Site?
Eastern Indigo Snake	*Drymarchon couperi*	Threatened	Threatened	Habitat includes sandhill regions dominated by mature longleaf pines, turkey oaks, and wiregrass; flatwoods; most types of hammocks; coastal scrub; dry glades; palmetto flats; prairie; brushy riparian and canal corridors; and wet fields. Occupied sites are often near wetlands and frequently are in association with gopher tortoise burrows. Pineland habitat is maintained by periodic fires. Viable populations of this species require relatively large tracts of suitable habitat. Refuges include tortoise burrows, stump holes, land crab burrows, armadillo burrows, or similar sites. Eggs may be laid in gopher burrows.	Yes

Table 5.2
Federally and State-Listed Threatened and Endangered Species Potentially Within Fort Pickens, Escambia County, Florida

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat (NatureServe, 2010)	Habitat Present On-Site?
Green Sea Turtle	*Chelonia mydas*	Endangered	Endangered	Most commonly feeds in shallow, low-energy waters with abundant submerged vegetation. Migrates across open seas. Adults are tropical in distribution, whereas juveniles range into temperate waters. Hatchlings often float in masses of sea plants (e.g., Sargassum) in convergence zones. Coral reefs and rocky outcrops near feeding pastures often are used as resting areas.	Yes, known nesting on-site.

Table 5.2
Federally and State-Listed Threatened and Endangered Species Potentially Within Fort Pickens, Escambia County, Florida

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat (NatureServe, 2010)	Habitat Present On-Site?
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	Endangered	Endangered	Shallow coastal and estuarine waters, usually over sand or mud bottoms where crabs are numerous. Often associated with subtropical shorelines of red mangrove. Transmitter-tagged individuals in the southeastern U.S. frequented waters 1-140 m deep in areas up to 77 km offshore; they spent 89% of their time submerged. Apparently largely benthic. Post-hatchlings apparently spend many months as surface pelagic drifters in weed lines of offshore currents.	Yes, known nesting on-site.

Table 5.2
Federally and State-Listed Threatened and Endangered Species Potentially Within Fort Pickens, Escambia County, Florida

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat (NatureServe, 2010)	Habitat Present On-Site?
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered	Endangered	Marine; open ocean, often near edge of continental shelf; also seas, gulfs, bays, and estuaries. Mainly pelagic, seldom approaching land except for nesting. Dives almost continuously to depths of up to at least several thousand meters; may linger at the surface at midday but spends most of time submerged.	Yes, known nesting on-site.

Table 5.2
Federally and State-Listed Threatened and Endangered Species Potentially Within Fort Pickens, Escambia County, Florida

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat (NatureServe, 2010)	Habitat Present On-Site?
Piping Plover	*Charadrius melodus*	Threatened	Threatened	Sandy upper beaches, especially where scattered grass tufts are present, and sparsely vegetated shores and islands of shallow lakes, ponds, rivers, and impoundments. Nests may also be built on sandy open flats among shells or cobble behind fore-dunes.	Yes

Table 5.2
Federally and State-Listed Threatened and Endangered Species Potentially Within Fort Pickens, Escambia County, Florida

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat (NatureServe, 2010)	Habitat Present On-Site?
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	Threatened	Species of Concern	Primarily marine/estuarine in winter; migrates to upper rivers in spring for spawning; returns to sea/estuary in fall; some may remain near spawning areas. First two years are spent in riverine habitats. Spawns in fresh water (sometimes tidal) usually over bottom of hard clay, rubble, gravel, or shell. May spawn in brackish water. Most spawn in natal river.	Yes, with critical habitat surrounding the FUDS.

Table 5.2
Federally and State-Listed Threatened and Endangered Species Potentially Within Fort Pickens, Escambia County, Florida

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat (NatureServe, 2010)	Habitat Present On-Site?
Reticulated Flatwoods Salamander	*Ambystoma bishopi*	Endangered	Species of Concern	Post-larval individuals inhabit mesic longleaf pine (*Pinus palustris*)-wiregrass (*Aristida stricta*) flatwoods and savannas. The terrestrial habitat is best described as topographically flat or slightly rolling wiregrass-dominated grassland having little to no midstory and an open overstory of widely scattered longleaf pine. Low-growing shrubs, such as saw palmetto (*Serenoa repens*), gallberry (*Ilex glabra*) and blueberries (*Vaccinium* spp.), co-exist with grasses and forbs in the groundcover. Groundcover plant diversity is usually very high. The underlying soil is typically poorly drained sand that becomes seasonally inundated.	Undetermined

Table 5.2
Federally and State-Listed Threatened and Endangered Species Potentially Within Fort Pickens, Escambia County, Florida

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat (NatureServe, 2010)	Habitat Present On-Site?
Perdido Key Beach Mouse Tracks observed during site visit	*Peromyscus polionotus trissyllepsis*	Endangered	Endangered	Dry, sandy, sparsely vegetated frontal coastal dunes of medium height, with no or very few secondary dunes lying inland; vegetation of inhabited dunes includes mainly sea oats and bluestem at moderate density; scrub dunes are lacking in presently occupied habitat. Young are born in underground burrows.	Yes, tracks observed on-site with critical habitat near the FUDS.

Table 5.2
Federally and State-Listed Threatened and Endangered Species Potentially Within Fort Pickens, Escambia County, Florida

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat (NatureServe, 2010)	Habitat Present On-Site?
Peregrine Falcon	*Falco peregrinus*	Delisted	Not Listed	Various open situations from tundra, moorlands, steppe, and seacoasts, especially where there are suitable nesting cliffs, to mountains, open forested regions, and human population centers (AOU 1983). When not breeding, occurs in areas where prey concentrate, including farmlands, marshes, lakeshores, river mouths, tidal flats, dunes and beaches, broad river valleys, cities, and airports. Tundra breeders migrate farthest, bypassing those farther south; a few winter in Florida, some in Caribbean, perhaps some in Central America, most in southern South America.	Yes, observed in flight on-site during the site visit.

5.2.6 Sample Locations and Methods

5.2.6.1 The SVT mobilized to the site on August 29, 2010. The field work was conducted from August 30, 2010 through September 2, 2010, and included QR and MC sampling. No intrusive MEC investigations, explosives handling, or MEC detonations were conducted.

5.2.6.2 Groundwater, surface water/sediment couples, and surface soil sampling was conducted during the Fort Pickens site inspection. Two biased groundwater samples (FTP-MRS01-GW-01 and FTP-MRS01-GW-02) and one field duplicate sample (FTP-MRS01-GW-03) were collected within the MRS. Three surface water/sediment sample couples (FTP-MRS01-SW/SD-01, FTP-MRS01-SW/SD-02, and FTP-MRS01-SW/SD-03) and one field duplicate sample couple (FTP-MRS01-SW/SD-05) were collected from locations within the MRS. Twenty-nine biased surface soil samples (FTP-MRS01-SS-02-01 - FTP-MRS01-SS-02-29) and four field duplicate samples (FTP-MRS01-SS-02-32, FTP-MRS01-SS-02-33, FTP-MRS01-SS-02-34, and FTP-MRS01-SS-02-35) were collected from locations within the MRS. All samples were collected in areas with the highest likelihood for the presence of MEC or MC contamination, per the SS-WP Addendum (Parsons, 2009b), and do not necessarily reflect the conditions throughout the site.

5.2.6.3 One ambient surface water/sediment sample couple (FTP-AMB-SW/SD-04) and two ambient surface soil samples (FTP-AMB-SS-02-30 and FTP-AMB-SS-02-31) were collected from an area outside the MRS, but within the FUDS boundary. These ambient samples were collected to provide information only and to assist in the MRSPP scoring. The ambient sample data will not be used for comparison (Subchapter 5.2.7).

5.2.6.4 Preliminary sample locations were identified before the SI team arrived on site and were approved by the Unexploded Ordnance (UXO) technician prior to final location selection and sample collection. For safety reasons, the UXO technician used a Schonstedt magnetometer for anomaly avoidance during the collection of the samples. The sample locations were recorded using the GPS unit.

5.2.6.5 The collected samples were packaged and shipped to TestAmerica Denver for analysis. TestAmerica-Denver is accredited under the state of Florida acceding authority for the National Environmental Laboratory Accreditation Program (NELAP). The laboratory submitted the chemical data under Sample Delivery Group (SDG) numbers 280-6891, 280-6953, 280-6982, and 280-7048 to Parsons. The data are presented in Appendix F. Parsons validated and assessed the data in accordance with the guidelines outlined in the PSAP (consisting of the Field Sampling Plan and the Quality Assurance Project Plan) for the MMRP SI Program, prepared by the USACE Military Munitions Center of Expertise and PSAP Addendum, prepared by Parsons. The data validation indicates that the laboratory correctly performed the analyses and that no data were rejected. The data validation summary reports are presented in Appendix G. The samples were analyzed for explosives (Method SW8321A) and select metals (Methods SW6020 and SW6010B) aluminum, antimony, copper, lead, and zinc. Additionally, the soil samples were analyzed for pH (Method SW9045D). Sample results are presented in

Table 5.3 (groundwater and surface water), Table 5.4 (sediment), and Table 5.5 (surface soil).

5.2.6.6 All sample collection procedures presented in the Final PSAP (USACE, 2005) and the Parsons Final PSAP Addendum (Parsons, 2006) were followed.

Table 5.3
SUMMARY OF VALIDATED ANALYTICAL RESULTS FOR FORT PICKENS MMRP WATER SAMPLES COLLECTED IN SEPTEMBER 2010
FORT PICKENS, ESCAMBIA COUNTY, FLORIDA

SAMPLE ID:		FTP-AMB-SW-04*		FTP-MRS01-SW-01		FTP-MRS01-SW-02		FTP-MRS01-SW-05**		FTP-MRS01-SW-03		FTP-MRS01-GW-01		FTP-MRS01-GW-03**		FTP-MRS01-GW-02	
DATE SAMPLED:		09/01/10		09/01/10		09/01/10		09/01/10		09/01/10		09/01/10		09/01/10		09/01/10	
LAB SAMPLE ID:		280-6982-20		280-6982-11		280-6982-9		280-6982-10		280-6982-12		280-6982-14		280-6982-15		280-6982-13	
	Units																
Explosives - SW8321A																	
1,3,5-Trinitrobenzene	µg/L	2.4	U	2.3	U	2.8	U	4.2	U	3.3	U	0.12	U	0.12	U	0.11	UJ
1,3-Dinitrobenzene	µg/L	0.12	UJ	0.11	UJ	0.14	UJ	0.21	UJ	0.17	UJ	0.12	U	0.12	U	0.11	UJ
2,4,6-Trinitrotoluene (TNT)	µg/L	0.12	UJ	0.11	UJ	0.14	UJ	0.21	UJ	0.17	UJ	0.12	U	0.12	U	0.11	UJ
2,4-Dinitrotoluene	µg/L	0.12	UJ	0.11	UJ	0.14	UJ	0.21	UJ	0.17	UJ	0.12	U	0.12	U	0.11	UJ
2,6-Dinitrotoluene	µg/L	0.12	UJ	0.11	UJ	0.14	UJ	0.21	UJ	0.17	UJ	0.12	U	0.12	U	0.11	UJ
2-Amino-4,6-dinitrotoluene	µg/L	2.4	U	2.3	U	2.8	U	4.2	U	3.3	U	0.12	U	0.12	U	0.11	UJ
2-Nitrotoluene	µg/L	0.20	UJ	0.19	UJ	0.23	UJ	0.35	UJ	0.28	UJ	0.19	U	0.19	U	0.19	UJ
3-Nitrotoluene	µg/L	0.20	UJ	0.19	UJ	0.23	UJ	0.35	UJ	0.28	UJ	0.19	U	0.19	U	0.19	UJ
4-Amino-2,6-dinitrotoluene	µg/L	2.4	U	2.3	U	2.8	U	4.2	U	3.3	U	0.12	U	0.12	U	0.11	UJ
4-Nitrotoluene	µg/L	0.20	UJ	0.19	UJ	0.23	UJ	0.35	UJ	0.28	UJ	0.19	U	0.19	U	0.19	UJ
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	µg/L	2.4	U	2.3	U	2.8	U	4.2	U	3.3	U	0.46	U	0.12	U	0.11	UJ
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	µg/L	2.4	U	2.3	U	2.8	U	4.2	U	3.3	U	0.12	U	0.12	U	0.11	UJ
Nitrobenzene	µg/L	0.12	UJ	0.11	UJ	0.14	UJ	0.21	UJ	0.17	UJ	0.12	U	0.12	U	0.11	UJ
Nitroglycerin	µg/L	0.15	UJ	0.14	UJ	0.17	UJ	0.26	UJ	0.21	UJ	0.14	U	0.15	U	0.14	UJ
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	µg/L	2.4	U	2.3	U	2.8	U	4.2	U	6.7	U	0.46	U	0.47	U	0.46	UJ
Pentaerythritol Tetranitrate (PETN)	µg/L	2.4	U	2.3	U	2.8	U	4.2	U	3.3	U	0.12	U	0.12	U	0.11	UJ
Total Metals - SW6010B/6020																	
Aluminum	µg/L	**79**	J	**19**	J	**220**	J	**220**	J	**79**	J	300	U	300	U	300	U
Antimony	µg/L	6.0	U	**0.20**	J	**0.16**	J	**0.091**	J	**0.21**	J	6.0	U	6.0	U	6.0	U
Copper	µg/L	**2.4**		**1.0**	J	**1.5**	J	**3.3**		**1.0**	J	2.0	U	2.0	U	**2.2**	
Lead	µg/L	**1.5**	J	**0.69**	J	**1.7**	J	**1.8**	J	**1.6**	J	3.0	U	3.0	U	3.0	U
Zinc	µg/L	**8.4**	J	**6.9**	J	**6.7**	J	**7.8**	J	**7.8**	J	20	U	20	UJ	20	U

QA NOTES AND DATA QUALIFIERS:

(NO CODE) - Confirmed identification.
U - Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa).
UJ - Analyte not detected, reported PQL_sa may be inaccurate or imprecise.
J - Analyte detected, estimated concentration.
* - Ambient sample.
** - Field duplicate of sample on left.
Detections are bolded.

Table 5.4
SUMMARY OF VALIDATED ANALYTICAL RESULTS FOR FORT PICKENS MMRP SEDIMENT SAMPLES COLLECTED IN SEPTEMBER 2010
FORT PICKENS, ESCAMBIA COUNTY, FLORIDA

SAMPLE ID:		FTP-AMB-SD-04*		FTP-MRS01-SD-01		FTP-MRS01-SD-05**		FTP-MRS01-SD-02		FTP-MRS01-SD-03	
DATE SAMPLED:		09/01/10		09/01/10		09/01/10		09/01/10		09/01/10	
LAB SAMPLE ID:		280-6982-19		280-6982-4		280-6982-7		280-6982-5		280-6982-6	
	Units										
Explosives - SW8321A											
1,3,5-Trinitrobenzene	mg/kg	0.097	U	0.093	U	0.099	U	0.099	U	0.098	U
1,3-Dinitrobenzene	mg/kg	0.097	U	0.093	U	0.099	U	0.099	U	0.098	U
2,4,6-Trinitrotoluene (TNT)	mg/kg	0.097	U	0.093	U	0.099	U	0.099	U	0.098	U
2,4-Dinitrotoluene	mg/kg	0.097	U	0.093	U	0.099	U	0.099	U	0.098	U
2,6-Dinitrotoluene	mg/kg	0.097	U	0.093	U	0.099	U	0.099	U	0.098	U
2-Amino-4,6-dinitrotoluene	mg/kg	0.097	U	0.093	U	0.099	U	0.099	U	0.098	U
2-Nitrotoluene	mg/kg	0.097	U	0.093	U	0.099	U	0.099	U	0.098	U
3-Nitrotoluene	mg/kg	0.097	U	0.093	U	0.099	U	0.099	U	0.098	U
4-Amino-2,6-dinitrotoluene	mg/kg	0.097	U	0.093	U	0.099	U	0.099	U	0.098	U
4-Nitrotoluene	mg/kg	0.097	U	0.093	U	0.099	U	0.099	U	0.098	U
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	mg/kg	0.097	U	0.093	U	**0.010**	J	0.099	U	0.098	U
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	mg/kg	0.097	U	0.093	U	0.099	U	0.099	U	0.098	U
Nitrobenzene	mg/kg	0.097	U	0.093	U	0.099	U	0.099	U	0.098	U
Nitroglycerin	mg/kg	0.097	U	0.093	U	0.099	U	0.099	U	0.098	U
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	mg/kg	0.097	U	0.093	U	0.099	U	0.099	U	0.098	U
Pentaerythritol Tetranitrate (PETN)	mg/kg	0.097	U	0.093	U	0.099	U	0.099	U	0.098	U
Metals - SW6010B/6020											
Aluminum	mg/kg	**200**		**15**	J	**14**	J	**4200**		**82**	J
Antimony	mg/kg	0.27	U	0.27	U	0.27	U	**0.044**	J	**0.076**	J
Copper	mg/kg	**0.53**		0.34	U	**0.15**	J	**1.4**		**0.40**	J
Lead	mg/kg	**5.3**		**0.21**	J	**0.21**	J	**3.6**		**5.5**	
Zinc	mg/kg	**3.4**		2.7	U	2.7	U	**1.7**	J	3.6	U
Percent Moisture											
Moisture, percent	%	**18**		**20**		**20**		**22**		**35**	

QA NOTES AND DATA QUALIFIERS:

(NO CODE) - Confirmed identification.
U - Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa).
J - Analyte detected, estimated concentration.
* - Ambient sample.
** - Field duplicate of sample on left.
Detections are bolded.

Table 5.5
SUMMARY OF VALIDATED ANALYTICAL RESULTS FOR FORT PICKENS MMRP SOIL SAMPLES COLLECTED IN SEPTEMBER 2010
FORT PICKENS, ESCAMBIA COUNTY, FLORIDA

SAMPLE ID:		FTP-AMB-SS-02-30*		FTP-AMB-SS-02-31*		FTP-MRS01-SS-02-01		FTP-MRS01-SS-02-32**		FTP-MRS01-SS-02-02		FTP-MRS01-SS-02-03		FTP-MRS01-SS-02-04		FTP-MRS01-SS-02-05		FTP-MRS01-SS-02-06		FTP-MRS01-SS-02-07		FTP-MRS01-SS-02-08		FTP-MRS01-SS-02-09	
DATE SAMPLED:		08/31/10		08/31/10		08/30/10		08/30/10		08/30/10		08/30/10		08/30/10		08/31/10		08/31/10		08/31/10		08/31/10		09/01/10	
LAB SAMPLE ID:		280-6953-8		280-6953-9		280-6891-1		280-6891-5		280-6891-2		280-6891-3		280-6891-4		280-6953-1		280-6953-2		280-6953-3		280-6953-4		280-6982-1	
	Units																								
Explosives - SW8321A																									
1,3,5-Trinitrobenzene	mg/kg	0.099	U	0.099	U	0.097	U	0.097	U	0.098	U	0.097	U	0.098	U	0.098	U	0.099	U	0.098	U	0.099	U	0.098	U
1,3-Dinitrobenzene	mg/kg	0.099	U	0.099	U	0.097	U	0.097	U	0.098	U	0.097	U	0.098	U	0.098	U	0.099	U	0.098	U	0.099	U	0.098	U
2,4,6-Trinitrotoluene (TNT)	mg/kg	0.099	U	0.099	U	0.097	U	0.097	U	0.098	U	0.097	U	0.098	U	0.098	U	0.099	U	**0.0049**	J	0.099	U	0.098	U
2,4-Dinitrotoluene	mg/kg	0.099	U	0.099	U	0.097	U	0.097	U	0.098	U	0.097	U	0.098	U	0.098	U	0.099	U	0.098	U	0.099	U	0.098	U
2,6-Dinitrotoluene	mg/kg	0.099	U	0.099	U	0.097	U	0.097	U	0.098	U	0.097	U	0.098	U	0.098	U	0.099	U	0.098	U	0.099	U	0.098	U
2-Amino-4,6-dinitrotoluene	mg/kg	0.099	U	0.099	U	0.097	U	0.097	U	0.098	U	0.097	U	0.098	U	0.098	U	0.099	U	0.098	U	0.099	U	0.098	U
2-Nitrotoluene	mg/kg	0.099	U	0.099	U	0.097	U	0.097	U	0.098	U	0.097	U	0.098	U	0.098	U	0.099	U	0.098	U	0.099	U	0.098	U
3-Nitrotoluene	mg/kg	0.099	U	0.099	U	0.097	U	0.097	U	0.098	U	0.097	U	0.098	U	0.098	U	0.099	U	0.098	U	0.099	U	0.098	U
4-Amino-2,6-dinitrotoluene	mg/kg	0.099	U	0.099	U	0.097	U	0.097	U	0.098	U	0.097	U	0.098	U	0.098	U	0.099	U	0.098	U	0.099	U	0.098	U
4-Nitrotoluene	mg/kg	0.099	U	0.099	U	0.097	U	0.097	U	0.098	U	0.097	U	0.098	U	0.098	U	0.099	U	0.098	U	0.099	U	0.098	U
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	mg/kg	0.099	U	0.099	U	0.097	U	0.097	U	0.098	U	0.097	U	0.098	U	0.098	U	0.099	U	0.098	U	0.099	U	0.098	U
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	mg/kg	0.099	U	0.099	U	0.097	U	0.097	U	0.098	U	0.097	U	0.098	U	0.098	U	0.099	U	0.098	U	0.099	U	0.098	U
Nitrobenzene	mg/kg	0.099	U	0.099	U	0.097	U	0.097	U	0.098	U	0.097	U	0.098	U	0.098	U	0.099	U	0.098	U	0.099	U	0.098	U
Nitroglycerin	mg/kg	0.099	U	0.099	U	0.097	U	0.097	U	0.098	U	0.097	U	0.098	U	0.098	U	0.099	U	0.098	U	0.099	U	0.098	U
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	mg/kg	0.099	U	0.099	U	0.097	U	0.097	U	0.098	U	0.097	U	0.098	U	0.098	U	0.099	U	0.098	U	0.099	U	0.098	U
Pentaerythritol Tetranitrate (PETN)	mg/kg	0.099	U	0.099	U	0.097	U	0.097	U	0.098	U	0.097	U	0.098	U	0.098	U	0.099	U	0.098	U	0.099	U	0.098	U
Metals - SW6010B/6020																									
Aluminum	mg/kg	**210**		**170**		**530**	J	**640**		**280**		**95**		**230**		**720**		**200**		**220**		**29**	J	**360**	
Antimony	mg/kg	0.27	U	0.21	U	0.24	UJ	0.25	U	0.25	U	0.24	U	0.22	U	0.27	U	0.27	U	0.24	U	0.28	U	**0.085**	J
Copper	mg/kg	0.34	U	0.35	U	**2.0**		**2.3**		**0.92**		**0.17**	J	**1.3**		**0.83**		**0.73**		**2.4**		0.36	U	**7.3**	
Lead	mg/kg	**0.81**		**2.1**		**7.9**		**9.1**		**2.6**		**1.5**		**12**		**10**		**7.9**		**210**		**1.6**		**28**	
Zinc	mg/kg	**0.94**	J	**2.3**		**7.0**		**12**		**2.5**		**1.7**	J	**4.6**		**4.2**		**2.3**	J	**11**		**0.55**	J	**6.5**	
pH - SW9045D																									
pH	pH units	**6.3**		**7.6**		**5.5**		**5.8**		**7.2**		**7.6**		**6.0**		**6.3**		**5.7**		**6.2**		**6.3**		**5.5**	
Percent Moisture																									
Moisture, percent	%	**12**		**1.3**		**1.3**		**1.9**		**2.5**		**5.4**		**5.0**		**8.7**		**8.4**		**3.5**		**21**		**4.0**	

(NO CODE) - Confirmed identification.
U - Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa).
UJ - Analyte not detected, reported PQL_sa may be inaccurate or imprecise.
J - Analyte detected, estimated concentration.
* - Ambient sample.
** - Field duplicate of sample on left.
Detections are bolded.

Table 5.5 (Continued)
SUMMARY OF VALIDATED ANALYTICAL RESULTS FOR FORT PICKENS MMRP SOIL SAMPLES COLLECTED IN SEPTEMBER 2010
FORT PICKENS, ESCAMBIA COUNTY, FLORIDA

SAMPLE ID:		FTP-MRS01-SS-02-10		FTP-MRS01-SS-02-11		FTP-MRS01-SS-02-33**		FTP-MRS01-SS-02-12		FTP-MRS01-SS-02-13		FTP-MRS01-SS-02-14		FTP-MRS01-SS-02-15		FTP-MRS01-SS-02-16		FTP-MRS01-SS-02-17		FTP-MRS01-SS-02-18		FTP-MRS01-SS-02-19		FTP-MRS01-SS-02-20	
DATE SAMPLED:		09/01/10		09/01/10		09/01/10		08/31/10		08/31/10		08/31/10		09/02/10		09/02/10		09/02/10		09/02/10		09/02/10		09/02/10	
LAB SAMPLE ID:		280-6982-2		280-6982-3		280-6982-8		280-6953-5		280-6953-6		280-6953-7		280-7048-1		280-7048-2		280-7048-3		280-7048-4		280-7048-5		280-7048-6	
	Units																								
Explosives - SW8321A																									
1,3,5-Trinitrobenzene	mg/kg	0.096	U	0.098	U	0.097	U	0.098	U	0.098	U	0.097	U	0.098	U	0.095	U	0.096	U	0.098	U	0.097	U	0.098	U
1,3-Dinitrobenzene	mg/kg	0.096	U	0.098	U	0.097	U	0.098	U	0.098	U	0.097	U	0.098	U	0.095	U	0.096	U	0.098	U	0.097	U	0.098	U
2,4,6-Trinitrotoluene (TNT)	mg/kg	0.096	U	0.098	U	0.097	U	0.098	U	0.098	U	0.097	U	0.098	U	0.095	U	0.096	U	0.098	U	0.097	U	0.098	U
2,4-Dinitrotoluene	mg/kg	0.096	U	0.098	U	0.097	U	0.098	U	0.098	U	0.097	U	0.098	U	0.095	U	0.096	U	0.098	U	0.097	U	0.098	U
2,6-Dinitrotoluene	mg/kg	0.096	U	0.098	U	0.097	U	0.098	U	0.098	U	0.097	U	0.098	U	0.095	U	0.096	U	0.098	U	0.097	U	0.098	U
2-Amino-4,6-dinitrotoluene	mg/kg	0.096	U	0.098	U	0.097	U	0.098	U	0.098	U	0.097	U	0.098	U	0.095	U	0.096	U	0.098	U	0.097	U	0.098	U
2-Nitrotoluene	mg/kg	0.096	U	0.098	U	0.097	U	0.098	U	0.098	U	0.097	U	0.098	U	0.095	U	0.096	U	0.098	U	0.097	U	0.098	U
3-Nitrotoluene	mg/kg	0.096	U	0.098	U	0.097	U	0.098	U	0.098	U	0.097	U	0.098	U	0.095	U	0.096	U	0.098	U	0.097	U	0.098	U
4-Amino-2,6-dinitrotoluene	mg/kg	0.096	U	0.098	U	0.097	U	0.098	U	0.098	U	0.097	U	0.098	U	0.095	U	0.096	U	0.098	U	0.097	U	0.098	U
4-Nitrotoluene	mg/kg	0.096	U	0.098	U	0.097	U	0.098	U	0.098	U	0.097	U	0.098	U	0.095	U	0.096	U	0.098	U	0.097	U	0.098	U
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	mg/kg	0.096	U	0.098	U	0.097	U	0.098	U	0.098	U	0.097	U	0.098	U	0.095	U	0.096	U	0.098	U	0.097	U	0.098	U
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	mg/kg	0.096	U	0.098	U	0.097	U	0.098	U	0.098	U	0.097	U	0.098	U	0.095	U	0.096	U	0.098	U	0.097	U	0.098	U
Nitrobenzene	mg/kg	0.096	U	0.098	U	0.097	U	0.098	U	0.098	U	0.097	U	0.098	U	0.095	U	0.096	U	0.098	U	0.097	U	0.098	U
Nitroglycerin	mg/kg	0.096	U	0.098	U	0.097	U	0.098	U	0.098	U	0.097	U	0.098	U	0.095	U	0.096	U	0.098	U	0.097	U	0.098	U
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	mg/kg	0.096	U	0.098	U	0.097	U	0.098	U	0.098	U	0.097	U	0.098	U	0.095	U	0.096	U	0.098	U	0.097	U	0.098	U
Pentaerythritol Tetranitrate (PETN)	mg/kg	0.096	U	0.098	U	0.097	U	0.098	U	0.098	U	0.097	U	0.098	U	0.095	U	0.096	U	0.098	U	0.097	U	0.098	U
Metals - SW6010B/6020																									
Aluminum	mg/kg	**1800**		**380**		**330**		**71**		**140**		**420**		**310**		**840**		**20**	J	**590**		**9.3**	J	**93**	
Antimony	mg/kg	**0.015**	J	**0.013**	J	0.21	U	0.26	U	0.28	U	0.25	U	0.23	U	0.23	U	0.23	U	0.25	U	0.24	U	0.29	U
Copper	mg/kg	**11**		**1.3**		**1.6**		**0.99**		0.50	U	**2.3**		**4.7**		**1.4**		**0.13**	J	**2.5**		0.31	U	**0.35**	J
Lead	mg/kg	**46**		**3.4**		**3.5**		**7.7**		**5.0**		**21**		**8.0**		**5.5**		**0.26**	J	**15**		**0.14**	J	**7.4**	J
Zinc	mg/kg	**15**		**2.5**		**5.2**		**4.4**		**3.3**		**10**		**5.3**		**4.3**		**0.76**	J	**8.3**		**0.38**	J	**0.65**	J
pH - SW9045D																									
pH	pH units	**6.0**		**5.2**		**5.2**		**6.5**		**7.2**		**7.5**		**6.3**		**6.3**		**6.0**		**5.7**		**6.3**		**5.8**	
Percent Moisture																									
Moisture, percent	%	**4.7**		**2.8**		**2.7**		**18**		**20**		**7.4**		**2.1**		**3.8**		**0.50**		**3.6**		**1.1**		**18**	

(NO CODE) - Confirmed identification.
U - Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa).
UJ - Analyte not detected, reported PQL_sa may be inaccurate or imprecise.
J - Analyte detected, estimated concentration.
* - Ambient sample.
** - Field duplicate of sample on left.
Detections are bolded.

Table 5.5 (Continued)
SUMMARY OF VALIDATED ANALYTICAL RESULTS FOR FORT PICKENS MMRP SOIL SAMPLES COLLECTED IN SEPTEMBER 2010
FORT PICKENS, ESCAMBIA COUNTY, FLORIDA

SAMPLE ID:		FTP-MRS01-SS-02-34**		FTP-MRS01-SS-02-21		FTP-MRS01-SS-02-22		FTP-MRS01-SS-02-23		FTP-MRS01-SS-02-24		FTP-MRS01-SS-02-25		FTP-MRS01-SS-02-26		FTP-MRS01-SS-02-35**		FTP-MRS01-SS-02-27		FTP-MRS01-SS-02-28		FTP-MRS01-SS-02-29	
DATE SAMPLED:		09/02/10		09/02/10		09/02/10		09/02/10		09/02/10		09/02/10		09/02/10		09/02/10		09/01/10		09/01/10		09/01/10	
LAB SAMPLE ID:		280-7048-13		280-7048-7		280-7048-8		280-7048-9		280-7048-10		280-7048-11		280-7048-12		280-7048-14		280-6982-16		280-6982-17		280-6982-18	
	Units																						
Explosives - SW8321A																							
1,3,5-Trinitrobenzene	mg/kg	0.097	U	0.099	U	0.095	U	0.093	U	0.099	U	0.096	U	0.096	U	0.091	U	0.098	U	0.097	U	0.099	U
1,3-Dinitrobenzene	mg/kg	0.097	U	0.099	U	0.095	U	0.093	U	0.099	U	0.096	U	0.096	U	0.091	U	0.098	U	0.097	U	0.099	U
2,4,6-Trinitrotoluene (TNT)	mg/kg	0.097	U	0.099	U	0.095	U	0.093	U	0.099	U	0.096	U	0.096	U	0.091	U	0.098	U	0.097	U	0.099	U
2,4-Dinitrotoluene	mg/kg	0.097	U	0.099	U	0.095	U	0.093	U	0.099	U	0.096	U	0.096	U	0.091	U	0.098	U	0.097	U	0.099	U
2,6-Dinitrotoluene	mg/kg	0.097	U	0.099	U	0.095	U	0.093	U	0.099	U	0.096	U	0.096	U	0.091	U	0.098	U	0.097	U	0.099	U
2-Amino-4,6-dinitrotoluene	mg/kg	0.097	U	0.099	U	0.095	U	0.093	U	0.099	U	0.096	U	0.096	U	0.091	U	0.098	U	0.097	U	0.099	U
2-Nitrotoluene	mg/kg	0.097	U	0.099	U	0.095	U	0.093	U	0.099	U	0.096	U	0.096	U	0.091	U	0.098	U	0.097	U	0.099	U
3-Nitrotoluene	mg/kg	0.097	U	0.099	U	0.095	U	0.093	U	0.099	U	0.096	U	0.096	U	0.091	U	0.098	U	0.097	U	0.099	U
4-Amino-2,6-dinitrotoluene	mg/kg	0.097	U	0.099	U	0.095	U	0.093	U	0.099	U	0.096	U	0.096	U	0.091	U	0.098	U	0.097	U	0.099	U
4-Nitrotoluene	mg/kg	0.097	U	0.099	U	0.095	U	0.093	U	0.099	U	0.096	U	0.096	U	0.091	U	0.098	U	0.097	U	0.099	U
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	mg/kg	0.097	U	0.099	U	0.095	U	0.093	U	0.099	U	0.096	U	0.096	U	0.091	U	0.098	U	0.097	U	0.099	U
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	mg/kg	0.097	U	0.099	U	0.095	U	0.093	U	0.099	U	0.096	U	0.096	U	0.091	U	0.098	U	0.097	U	0.099	U
Nitrobenzene	mg/kg	0.097	U	0.099	U	0.095	U	0.093	U	0.099	U	0.096	U	0.096	U	0.091	U	0.098	U	0.097	U	0.099	U
Nitroglycerin	mg/kg	0.097	U	0.099	U	0.095	U	0.093	U	0.099	U	0.096	U	0.096	U	0.091	U	0.098	U	0.097	U	0.099	U
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	mg/kg	0.097	U	0.099	U	0.095	U	0.093	U	0.099	U	0.096	U	0.096	U	0.091	U	0.098	U	0.097	U	0.099	U
Pentaerythritol Tetranitrate (PETN)	mg/kg	0.097	U	0.099	U	0.095	U	0.093	U	0.099	U	0.096	U	0.096	U	0.091	U	0.098	U	0.097	U	0.099	U
Metals - SW6010B/6020																							
Aluminum	mg/kg	**70**		**37**	J	**45**	J	**310**		**300**		**360**		**310**		**400**		**210**		**6000**		**52**	J
Antimony	mg/kg	0.29	U	**0.14**	J	0.30	U	0.24	U	0.25	U	0.24	U	0.23	U	0.23	U	0.23	U	0.22	U	0.24	U
Copper	mg/kg	**0.23**	J	**0.61**		**0.22**	J	**0.37**		**1.3**		**1.5**		**4.2**		**3.5**		**1.6**		**2.3**		**0.42**	
Lead	mg/kg	**3.2**	J	**6.7**		**1.4**		**1.0**		**6.2**		**17**		**48**		**49**		**3.0**		**5.8**		**0.56**	
Zinc	mg/kg	**0.51**	J	**0.44**	J	**0.61**	J	**0.74**	J	**6.3**		**43**		**26**		**27**		**6.0**		**4.9**		**1.2**	J
pH - SW9045D																							
pH	pH units	**6.0**		**5.9**		**6.2**		**5.7**		**6.0**		**7.4**		**7.2**		**7.3**		**5.1**		**5.6**		**6.5**	
Percent Moisture																							
Moisture, percent	%	**19**		**19**		**21**		**1.5**		**1.4**		**1.8**		**1.2**		**2.4**		**3.3**		**6.4**		**0.92**	

(NO CODE) - Confirmed identification.
U - Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa).
UJ - Analyte not detected, reported PQL_sa may be inaccurate or imprecise.
J - Analyte detected, estimated concentration.
* - Ambient sample.
** - Field duplicate of sample on left.
Detections are bolded.

5.2.7 Ambient Metals Concentrations

5.2.7.1 Parsons did not collect "background" samples, but rather "ambient" samples to provide separation from the statistical-based and baseline risk assessment connotation. For the Fort Pickens site, one ambient surface water/sediment couple sample (FTP-AMB-SW/SD-04), as shown on Figure 5.1, was collected during the SI. No MEC or MD was observed near the ambient sample location, which suggests that this sample is likely representative of the naturally occurring soil in the area. No explosives were detected in the ambient surface water/sediment sample couple. Based on conductivity (113 µS/cm), this surface water/sediment sample was collected in fresh water.

5.2.7.2 Two ambient surface soil samples (FTP-AMB-SS-02-30 and FTP-AMB-SS-02-31), as shown on Figure 5.1, were collected during the SI. No MEC or MD was observed near the ambient sample locations, which suggests that these samples are likely representative of the naturally occurring soil in the area. No explosives were detected in the ambient surface soil samples.

5.2.7.3 The TPP Team agreed, at the request of FDEP, that any of the selected MC detected in the biased samples will be compared directly to the relevant FDEP-approved risk-screening value without comparison against the ambient sample data for the SLRA. Simply stated, the analytes that are potential MC and are detected in the biased samples will be retained for consideration in the SLRA (Chapter 6). However, the ambient sample data will be used in the MRSPP scoring. Any detection of explosives will be considered due to munitions-related activities and will be retained for analyses in the SLRA (Chapter 6).

5.2.8 Munitions Constituents Source Evaluation

As explained earlier in this chapter, an exposure pathway is not considered complete unless MC have been released at the site. To make this determination, analytical results for MC are evaluated using several criteria to determine whether MC have been released to environmental media. MC that are detected in the sample medium may have been released due to munitions-related activities. Any detection of MC in the groundwater, surface water, sediment, or surface soil at the MRS is considered a potential release and is evaluated further in the SLRA (Chapter 6).

5.3 MRS01 – RANGE COMPLEX

This section of the SI Report evaluates exposure pathways for the MRS01 – Range Complex. The analysis of each pathway is described in detail. The related CSEM for this MRS is provided in Appendix J.

5.3.1 Historical MC Information

Prior to the 2010 SI, sampling has been conducted at the Fort Pickens FUDS on three occasions. On July 20, 2004, the two groundwater wells on-site were sampled and analyzed for volatile organic chemicals, inorganic chemicals, disinfection byproducts, and synthetic organic material. On March 24, 2008, the surface soil was sampled for

lead, and on March 19, 2009, the drinking water was sampled for lead. All of the sampling results were compiled into the 2009 Summary Report for GINS and it stated that initially, lead in the surface soil was found to be a concern, but later data indicated lead was below the human health risk levels. The results for the previous sampling efforts at Fort Pickens are located in Appendix L of this SI report.

5.3.2 Groundwater Exposure Pathway

Groundwater can serve as a contaminant transport mechanism that may affect surface water bodies, sediment, drinking water supplies, vegetation, and sensitive environmental areas such as wetlands. The likelihood of exposure is influenced by such factors as the mass and concentration of MC in soil at the ground surface that can be transported to the groundwater, site-specific geology, climate, and the expected future land use.

5.3.2.1 Geologic and Hydrogeologic Setting

There are no known differences between the geologic and hydrogeologic setting at the MRS01 – Range Complex and the setting described for the overall range in subchapter 5.2. There are two known water wells inside the MRS boundary (Figure 5.2).

5.3.2.2 Releases and Potential Releases to Groundwater

There are no known releases of MC to groundwater at the Range Complex MRS. If MC were released to surface soil, the MC may have leached to groundwater in the MRS.

5.3.2.3 Groundwater Exposure Pathways and Receptors

MRS01 – Range Complex is used for historical preservation and recreation as Fort Pickens State Park and is part of the Gulf Islands National Seashore. There are two groundwater wells within the MRS. Based on the current and future land use of the MRS01 – Range Complex, potential receptors in this MRS include commercial/industrial workers (for example, park employees), and site visitors or recreational users. Groundwater is not directly accessible to most ecological receptors so this pathway is incomplete at this MRS. Human receptors could be exposed to groundwater via ingestion as drinking water, incidental ingestion, or dermal contact.

5.3.2.4 Groundwater Sample Locations and Methods

There are two groundwater water wells within the Range Complex MRS and both have depths greater than 250feet below ground surface. Two groundwater water samples (FTP-MRS01-GW-01 and FTP-MRS01-GW-02) and a field duplicate sample (FTP-MRS01-GW-03) were collected from these wells during the SI. The samples were analyzed for explosives (8321A) and select metals (SW6010B/6020), aluminum, antimony, copper, lead, and zinc.

5.3.2.5 Groundwater Analytical Results

The analytical results for the groundwater samples collected at the MRS01 – Range Complex during the SI are presented in Table 5.3. These results were evaluated using the criteria described in Subchapter 5.2.8. No explosives were detected in the groundwater

samples, so this evaluation was performed for metals only. As shown in Table 5.6, copper was detected in groundwater samples collected at this MRS. However, aluminum, antimony, lead, and zinc were not detected in groundwater samples. Copper will be retained for further evaluation in the SLRA (Chapter 6).

5.3.2.6 Groundwater Exposure Pathway Conclusions

Groundwater wells are present in the MRS01 – Range Complex, and human receptors could be exposed to MC in groundwater. Copper was detected in groundwater samples, and therefore, based on the analytical results presented in this report, there is potential release of MC to groundwater and the exposure pathways are complete for human receptors. Human receptors may be exposed to MC in groundwater through incidental ingestion, ingestion as drinking water, and dermal contact. Ecological receptors generally do not have direct contact with groundwater, and therefore, the groundwater exposure pathway is incomplete for ecological receptors. Copper is evaluated in the SLRA.

TABLE 5.6
MRS01 – RANGE COMPLEX
GROUNDWATER SOURCE EVALUATION
FORT PICKENS, ESCAMBIA COUNTY, FLORIDA

Analyte	Units	Maximum Detected Site Concentration		Potential MC? (1)	SLRA Required?	Primary reason for exclusion from SLRA
Metals						
Aluminum	µg/L	300	U	**Yes**	No	Not detected at MRS
Antimony	µg/L	6	U	**Yes**	No	Not detected at MRS
Copper	µg/L	2.2		**Yes**	**Yes**	--
Lead	µg/L	3	U	**Yes**	No	Not detected at MRS
Zinc	µg/L	20	U	**Yes**	No	Not detected at MRS

(1) - Potential MC as listed in Table 4.1

Notes:

(NO CODE) - Confirmed identification.

U - Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa).

µg/L - micrograms per liter

5.3.3 Surface Water and Sediment Exposure Pathways

Surface water can serve as a contaminant transport mechanism that may affect surface water bodies, sediment, drinking water supplies, vegetation, and sensitive environmental areas such as wetlands. The likelihood of exposure is influenced by such factors as the mass and concentration of MC in soil at the ground surface that can be transported to the surface water and sediment through runoff and erosion.

5.3.3.1 Hydrologic Setting

The hydrologic setting the MRS01-Range Complex is described in subchapter 5.2.4. As shown on Figure 5.1, there are small ponds, marshes, and streams scattered throughout the MRS and the FUDS boundary. The wetlands located throughout the site (Figure 5.3) consist mainly of marine and palustrine wetlands. Some of the wetlands are considered freshwater and others are considered brackish water. Conductivity values collected in the field were used to determine if the wetlands were fresh or brackish. The wetlands on-site at the MRS01-Range Complex are listed in subchapter 5.2.5.2.

5.3.3.2 Releases and Potential Releases to Surface Water and Sediment

5.3.3.2.1 Based on the location of the battery sub-ranges at the MRS, there could be direct releases of MC to wetlands and to fresh surface water or freshwater sediment at the MRS01–Range Complex. There are wetlands and creeks throughout the MRS, and it is possible that MC in surface soil could migrate to fresh surface water and freshwater sediment via runoff and erosion.

5.3.3.2.2 Based on the location of the battery sub-ranges at the MRS, there could be direct releases of MC to wetlands and to brackish surface water or brackish sediment at the MRS01 – Range Complex. Some wetlands are inundated by seawater, but are not saline enough to be considered marine. It is possible that MC in surface soil could migrate to brackish surface water and brackish sediment via runoff and erosion.

5.3.3.2.3 Munitions-related activities could have lead to direct releases of MC to marine surface water and marine sediment at this MRS. It is also possible that MC in surface soil could migrate to marine surface water and marine sediment via runoff and erosion.

5.3.3.3 Surface Water and Sediment Exposure Pathways and Receptors

5.3.3.3.1 The surface water and sediment exposure pathways account for the potential threat to human and ecological receptors on or near the MRS01- Range Complex who may be exposed to MC in surface water or sediment. Based on the current and future land use of the MRS01–Range Complex, potential receptors include commercial/industrial workers (for example, park employees), site visitors or recreational users, and ecological receptors.

5.3.3.3.2 Surface waters within the MRS are fresh, brackish, or marine. Brackish water is present in areas that are occasionally inundated by seawater, but are not saline enough to be considered marine waters. Marine waters are also present within the MRS.

Therefore, fresh, brackish, and marine surface water and sediment are considered as separate exposure pathways.

5.3.3.3.3 Fresh water within the MRS includes freshwater wetlands and creeks, and receptors could be exposed to fresh surface water and freshwater sediment. Based on the current and future land use of the MRS01 – Range Complex, potential receptors include commercial/industrial workers (for example, park employees), site visitors or recreational users, and ecological receptors. The fresh surface water at the MRS is not used as drinking water, but human receptors could be exposed to MC in fresh surface water or freshwater sediment through incidental ingestion and dermal contact. In addition, fishing is a popular recreational activity at the Fort Pickens site, so recreational users and site visitors may be indirectly exposed to MC through ingestion of biota that have been exposed to MC. Ecological receptors could be exposed to MC in fresh surface water or freshwater sediment through ingestion as drinking water, incidental ingestion, dermal contact, and ingestion of biota that have been exposed to MC.

5.3.3.3.4 Brackish water within the MRS includes wetlands that are slightly saline, and receptors could be exposed to brackish surface water and brackish sediment. Based on the current and future land use of the MRS01 – Range Complex, potential receptors include commercial/industrial workers (for example, park employees), site visitors or recreational users, and ecological receptors. The brackish surface water at the MRS is not used for human consumption, but human receptors could be exposed to MC in brackish surface water or brackish sediment through incidental ingestion and dermal contact. In addition, fishing is a popular recreational activity at the Fort Pickens site, so recreational users and site visitors may be indirectly exposed to MC through ingestion of biota that have been exposed to MC. Ecological receptors could be exposed to MC in brackish surface water or brackish sediment through ingestion as drinking water, incidental ingestion, dermal contact, and ingestion of biota that have been exposed to MC.

5.3.3.3.5 A large portion of the MRS01 – Range Complex extends into the Gulf of Mexico, and receptors could be exposed to marine surface water and marine sediment. Based on the current and future land use of the MRS01 – Range Complex, potential receptors include commercial/industrial workers (for example, park employees), site visitors or recreational users, and ecological receptors. Human receptors do not use marine waters as drinking water, but may be exposed to MC in marine surface water or marine sediment through incidental ingestion or dermal exposure. In addition, fishing is a popular recreational activity at the Fort Pickens site, so recreational users and site visitors may be indirectly exposed to MC through ingestion of biota that have been exposed to MC. Ecological receptors may be exposed to MC in marine surface water or marine sediment through ingestion as drinking water, incidental ingestion, dermal contact, and ingestion of biota that have been exposed to MC.

5.3.3.4 Surface Water and Sediment Sample Locations and Methods

5.3.3.4.1 There is fresh surface water and freshwater sediment within the MRS01 – Range Complex. Two biased surface water/sediment samples (FTP-MRS01-SW/SD-02, and FTP-MRS01-SW/SD-03) and one field duplicate sample (FTP-MRS01-SW/SD-05)

were collected within the MRS01 - Range Complex. Conductivity of the water was measured at each sample location to determine if the water was fresh. Based on conductivity readings, this surface water location is considered fresh surface water and freshwater sediment (FTP-MRS01-SW-02, conductivity is 81 µS/cm; FTP-MRS01-SW-03, conductivity is 191 µS/cm; and FTP-MRS01-SW-05, conductivity is 81 µS/cm).

5.3.3.4.2 There is brackish surface water and brackish sediment within the MRS01 – Range Complex. One biased brackish surface water/sediment sample (FTP-MRS01-SW/SD-01) was collected within the MRS (Table 5.3). Conductivity of the water was measured at each sample location to determine if the water was brackish. Based on conductivity readings, this is considered brackish surface water and brackish sediment (FTP-MRS01-SW-01, conductivity is 4,770 µS/cm).

5.3.3.4.3 There is marine surface water and marine sediment within the MRS01-Range Complex. No marine surface water or marine sediment samples were collected during the SI.

5.3.3.4.4 The samples were analyzed for explosives (8321A) and select metals (SW6010B/6020) aluminum, antimony, copper, lead and zinc. The sample results are shown in Table 5.3 (surface water) and Table 5.4 (sediment).

5.3.3.5 Surface Water and Sediment Analytical Results

5.3.3.5.1 The analytical results are presented for surface water (Table 5.3) and sediment (Table 5.4). Because both fresh and brackish waters are present within the MRS, the samples collected from each water type are evaluated separately.

5.3.3.5.2 The MC metals aluminum, antimony, copper, lead, and zinc were detected in fresh surface water (Table 5.7), and will be retained for further evaluation in the SLRA (Chapter 6).

5.3.3.5.3 The MC metals aluminum, antimony, copper, lead, and zinc were detected in freshwater sediment samples (Table 5.9), and will be retained for further evaluation in the SLRA (Chapter 6). In addition to MC metals, one explosive, hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) was detected in freshwater sediment samples and will be retained for further evaluation in the SLRA (Chapter 6).

5.3.3.5.4 The MC metals aluminum, antimony, copper, lead, and zinc were detected in brackish surface water (Table 5.8), and will be retained for further evaluation in the SLRA (Chapter 6).

5.3.3.5.5 The MC metals aluminum and lead were detected in brackish sediment samples (Table 5.10), and will be retained for further evaluation in the SLRA (Chapter 6).

TABLE 5.7
MRS01 – RANGE COMPLEX
FRESH SURFACE WATER SOURCE EVALUATION
FORT PICKENS, ESCAMBIA COUNTY, FLORIDA

Analyte	Units	Maximum Detected Site Concentration		Potential MC? (1)	SLRA Required?	Primary reason for exclusion from SLRA
Metals						
Aluminum	µg/L	220	J	**Yes**	**Yes**	--
Antimony	µg/L	0.21	J	**Yes**	**Yes**	--
Copper	µg/L	3.3		**Yes**	**Yes**	--
Lead	µg/L	1.8	J	**Yes**	**Yes**	--
Zinc	µg/L	7.8	J	**Yes**	**Yes**	--

(1) - Potential MC as listed in Table 4.1

Notes:

(NO CODE) - Confirmed identification.

J - Analyte detected, estimated concentration.

µg/L - micrograms per liter

TABLE 5.8
MRS01 – RANGE COMPLEX
SEDIMENT SOURCE EVALUATION (FRESH WATER)
FORT PICKENS, ESCAMBIA COUNTY, FLORIDA

Analyte	Units	Maximum Detected Site Concentration		Potential MC? (1)	SLRA Required?	Primary reason for exclusion from SLRA
Metals						
Aluminum	mg/kg	4,200		**Yes**	**Yes**	--
Antimony	mg/kg	0.076	J	**Yes**	**Yes**	--
Copper	mg/kg	1.4		**Yes**	**Yes**	--
Lead	mg/kg	5.5		**Yes**	**Yes**	--
Zinc	mg/kg	1.7	J	**Yes**	**Yes**	--
Explosives						
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	mg/kg	0.01		**Yes**	**Yes**	--

(1) - Potential MC as listed in Table 4.1

Notes:

(NO CODE) - Confirmed identification.

U - Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa).

J - Analyte detected, estimated concentration.

mg/kg - milligrams per kilogram

TABLE 5.9
MRS01 – RANGE COMPLEX
BRACKISH SURFACE WATER SOURCE EVALUATION
FORT PICKENS, ESCAMBIA COUNTY, FLORIDA

Analyte	Units	Maximum Detected Site Concentration		Potential MC? (1)	SLRA Required?	Primary reason for exclusion from SLRA
Metals						
Aluminum	µg/L	19	J	**Yes**	**Yes**	--
Antimony	µg/L	0.2	J	**Yes**	**Yes**	--
Copper	µg/L	1	J	**Yes**	**Yes**	--
Lead	µg/L	0.69	J	**Yes**	**Yes**	--
Zinc	µg/L	6.9	J	**Yes**	**Yes**	--

(1) - Potential MC as listed in Table 4.1

Notes:

J - Analyte detected, estimated concentration.

µg/L - micrograms per liter

TABLE 5.10
MRS01 – RANGE COMPLEX
SEDIMENT SOURCE EVALUATION (BRACKISH WATER)
FORT PICKENS, ESCAMBIA COUNTY, FLORIDA

Analyte	Units	Maximum Detected Site Concentration		Potential MC? (1)	SLRA Required?	Primary reason for exclusion from SLRA
Metals						
Aluminum	mg/kg	15	J	**Yes**	**Yes**	--
Antimony	mg/kg	0.27	U	**Yes**	No	Not detected at MRS
Copper	mg/kg	0.34	U	**Yes**	No	Not detected at MRS
Lead	mg/kg	0.21	J	**Yes**	**Yes**	--
Zinc	mg/kg	2.7	U	**Yes**	No	Not detected at MRS

(1) - Potential MC as listed in Table 4.1

Notes:

(NO CODE) - Confirmed identification.

U - Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa).

J - Analyte detected, estimated concentration.

mg/kg - milligrams per kilogram

5.3.3.6 Surface Water and Sediment Exposure Pathway Conclusions

5.3.3.6.1 Fresh surface water and sediment are present within the MRS01 – Range Complex, and human and ecological receptors could be exposed to MC in fresh surface water or sediment. Aluminum, antimony, copper, lead, and zinc were detected in fresh surface water and sediment, and the explosive RDX was detected in freshwater sediment. Therefore, based on the analytical results presented in this report, there is a potential release of MC present in fresh surface water and freshwater sediment. Human receptors may be exposed to MC in fresh surface water and freshwater sediment through incidental ingestion and dermal contact, and site visitors or recreational users may be exposed to MC in fresh surface water through ingestion of biota that have been exposed to MC. Ecological receptors may be exposed to MC in fresh surface water through incidental ingestion, dermal contact, ingestion as drinking water, and ingestion of biota that have been exposed to MC. The MC metals (aluminum, antimony, copper, lead, and zinc) and the explosive (RDX; sediment only) will be evaluated in the SLRA.

5.3.3.6.2 Brackish surface water and sediment are present within the MRS01 – Range Complex, and human and ecological receptors could be exposed to MC in brackish surface water or brackish sediment. Aluminum, antimony, copper, lead, and zinc were detected in brackish surface water. Aluminum and copper were detected in brackish sediment. Therefore, based on the analytical results presented in this report, there is a potential release of MC present in brackish surface water and brackish sediment. Human receptors may be exposed to MC in brackish surface water and brackish sediment through incidental ingestion and dermal contact, and site visitors or recreational users may be exposed to MC in fresh surface water through ingestion of biota that have been exposed to MC. Ecological receptors may be exposed to MC in brackish surface water through incidental ingestion, dermal contact, ingestion as drinking water, and ingestion of biota that have been exposed to MC. The MC metals (aluminum, antimony, copper, lead, and zinc) for brackish surface water will be evaluated in the SLRA. The MC metals (aluminum and lead) for brackish sediment will be evaluated in the SLRA.

5.3.3.6.3 Marine surface water and sediment are present within the MRS01 – Range Complex, and human and ecological receptors could be exposed to MC in marine surface water or marine sediment. Potential human receptors could be exposed to MC in the marine surface water and marine sediment through incidental ingestion and dermal contact, and site visitors or recreational users may be exposed to MC in fresh surface water through ingestion of biota that have been exposed to MC. Ecological receptors could be exposed to MC in the marine surface water and marine sediment through incidental ingestion, dermal contact, ingestion as drinking water, and ingestion of biota that have been exposed to MC. Because no marine surface water or marine sediment samples were collected during the SI, the marine water and marine sediment pathways are considered potentially complete, but not quantitatively assessed for potential receptors. The marine exposure pathway is not shown on the CSEM. While MC could have been released directly to marine surface water and marine sediment as a result of munitions activities, the large volume of marine water compared to the mass of MC that could have been released, as well as the amount of time that has passed since munitions

activities were conducted at this site, make it unlikely that MC in marine surface water and marine sediment would pose a threat to human and ecological receptors at this site.

5.3.4 Soil Exposure Pathway

Potential soil exposure pathways include incidental ingestion, dermal contact, and inhalation of resuspended particulates by both human and ecological receptors, as well as leaching to groundwater and runoff and erosion to fresh, brackish, and marine surface water and sediment. The likelihood of exposure to contaminants in soil is influenced by such factors as the mass and concentration of MC in soil exposed at the ground surface, site-specific geology, climate, and expected future land use.

5.3.4.1 Physical Source Access Conditions

The MRS01–Range Complex property is currently part of the historical preservation and recreation of Fort Pickens State Park (Florida). The Fort Pickens FUDS is located within the GINS along the western tip of Santa Rosa Island. There are no access restrictions to the site; roads are present and can be used to access areas throughout the MRS. NPS police patrols are the main source of security for the FUDs property. The land use is not expected to change.

5.3.4.2 Actual or Potential Contamination Areas

5.3.4.2.1 Fort Pickens functioned as a coastal defense site from the Civil War through World War II. There is one MRS at the site, the Range Complex MRS. Located within the Range Complex MRS are nine concrete artillery batteries, two anti-aircraft batteries, an anti-motor torpedo boat battery, the rifle range, and fire control and searchlight structures. Munitions used at the FUDS over the years include a wide variety of light to heavy artillery ammunition (1830s era through World War II era), small arms, marine mines, hand grenades, and rifle grenades (Table 4.1).

5.3.4.2.2 Munitions activities could have directly affected the surface soil at this site. The most likely location for contamination is considered the areas around the battery locations, the firing lines and target areas within the rifle range. During the 2010 SI, MD in the form of a 3.5-inch artillery casing was observed near Battery Van Swearingen and soil sample FTP-MRS01-SS02-08 was collected from this location. In addition, a 40mm signal-flare cartridge and numerous .30 caliber bullet fragments were observed in the rifle range area. Soil samples FTP-MRS01-SS02-19 through FTP-MRS01-SS02-23 were collected from within the rifle range area where MD was observed.

5.3.4.3 Soil Exposure Pathways and Receptors

The soil exposure pathway accounts for the potential threat to human and ecological receptors on or near the MRS01 – Range Complex who may be exposed to MC in surface soil via dermal contact, incidental ingestion, or inhalation of resuspended soil particulates. Inhalation of resuspended soil particulates is addressed in Subchapter 5.3.5. Based on the current and future land use of the MRS, potential human receptors in this MRS include commercial/industrial workers (for example, park employees), site visitors or recreational users, and ecological receptors.

5.3.4.4 Soil Sample Locations and Methods

Twenty-nine biased surface soil samples (FTP-MRS01-SS-02-01 through FTP-MRS01-SS-02-29) and four field duplicate samples (FTP-MRS01-SS-02-32 through FTP-MRS01-SS-02-35) were collected from locations within the MRS01 - Range Complex. The samples were analyzed for explosives (8321A) and select metals (SW6010B/6020) aluminum, antimony, copper, lead and zinc. The pH (SW9045D) was also analyzed in the soil samples. The analytical data are presented in Table 5.5. Figure 5.1 shows the actual QR paths and sample locations.

5.3.4.5 Soil Analytical Results

The analytical results for surface soil samples collected from the MRS01 – Range Complex during the SI are presented in Table 5.5. These results were evaluated using the criteria described in Subchapter 5.2.8. As shown in Table 5.11, aluminum, antimony, copper, lead, and zinc were detected in soil samples collected from this MRS. The explosive 2,4,6-trinitrotoluene (TNT) was also detected in one of the surface soil samples. These analytes will be retained for further evaluation in the SLRA.

5.3.4.6 Soil Exposure Pathway Conclusions

One explosive, 2,4,6- TNT was detected in one of the surface soil samples from the MRS01 – Range Complex, and the MC metals aluminum, antimony, copper, lead, and zinc were detected in the surface soil (Table 5.11). Therefore, based on the analytical results presented in this report, there is a potential release of MC present, which is a necessary element for a complete exposure pathway. The surface soil pathways are considered complete for all potential receptors at this MRS. This explosive and the five MC metals are further evaluated in the SLRA (Chapter 6).

Table 5.11
MRS01 - Range Complex
Soil Source Evaluation
Fort Pickens, Escambia County, Florida

Analyte	Units	Maximum Detected Site Concentration		Potential MC? (1)	SLRA Required?	Primary reason for exclusion from SLRA
Metals						
Aluminum	mg/kg	6,000		Yes	Yes	--
Antimony	mg/kg	0.14	J	Yes	Yes	--
Copper	mg/kg	11		Yes	Yes	--
Lead	mg/kg	210		Yes	Yes	--
Zinc	mg/kg	43		Yes	Yes	--
Explosives						
'2,4,6-Trinitrotoluene (TNT)	mg/kg	0.0049	J	Yes	Yes	--

(1) - Potential MC as listed in Table 4.1

Notes:
(NO CODE) - Confirmed identification.
J - Analyte detected, estimated concentration.
mg/kg - milligrams per kilogram

5.3.5 Air Exposure Pathway

The air exposure pathway accounts for hazardous substance exposure in gaseous or particulate form through the air. Inhalation of a contaminant can be a potential exposure pathway for human and ecological receptors. No air sampling has been performed at this site, and the TPP Team agreed that air sampling would not be performed as part of this SI.

5.3.5.1 Climate

The climate at the site is described in subchapter 2.2.3.

5.3.5.2 Releases and Potential Releases to Air

There are no known direct releases of MC to air at the MRS01 – Range Complex.

5.3.5.3 Air Exposure Pathway and Receptors

Because there are no known volatile MC associated with the munitions used at the site, the only remaining air exposure pathway evaluated during the SI would be via the inhalation of resuspended soil particulates. Based on the current and future land use of the MRS01 – Range Complex, potential human receptors in this MRS include commercial/industrial workers (for example, park employees), site visitors or recreational users, and ecological receptors. These receptors could be exposed to MC in air through inhalation of resuspended soil particulates.

5.3.5.4 Air Sample/Monitoring Locations and Methods

No air sampling is known to have been previously performed at the MRS01 – Range Complex and the TPP Team agreed that air sampling would not be conducted as part of this SI.

5.3.5.5 Air Analytical Results

Not applicable.

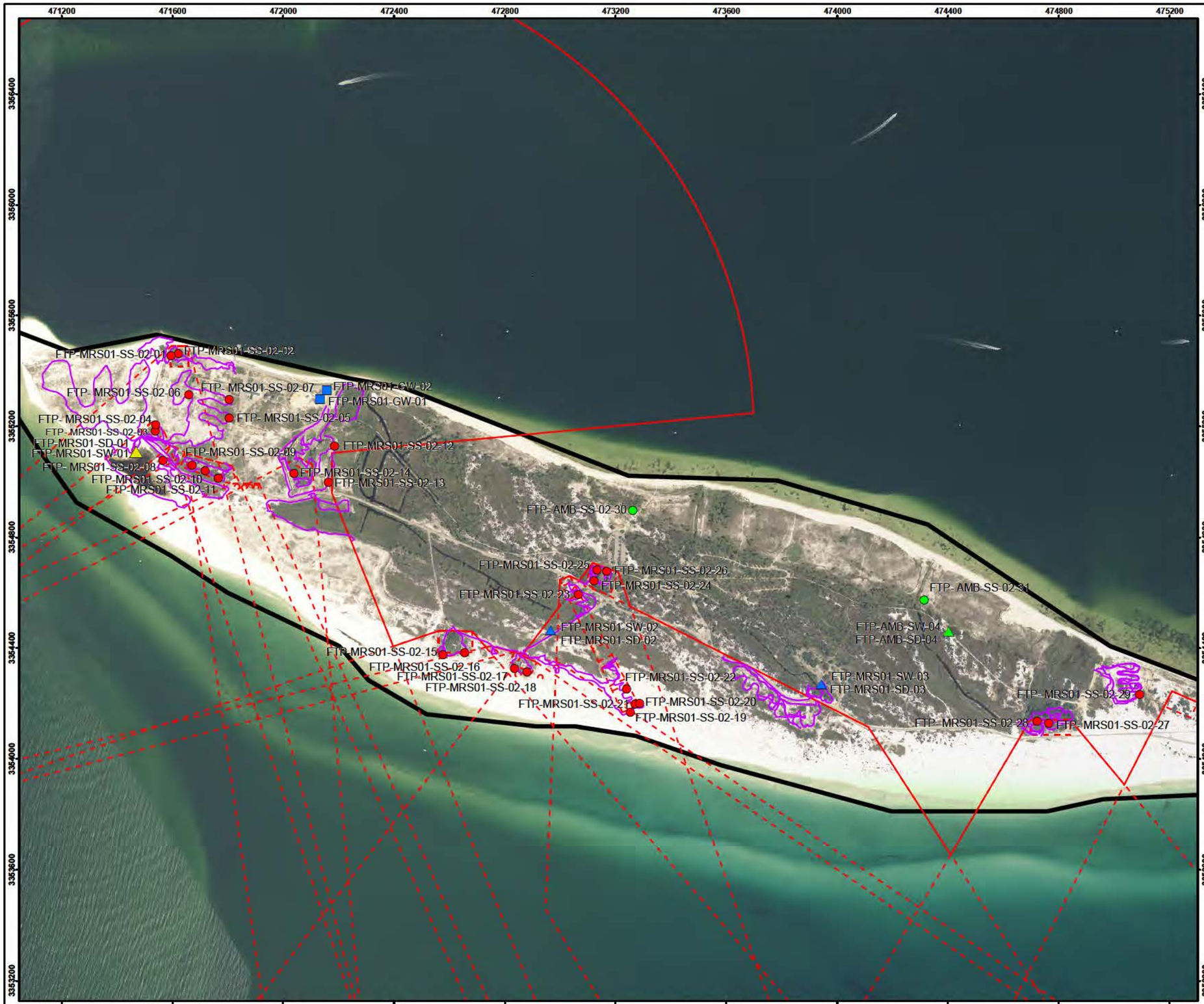
5.3.5.6 Air Exposure Pathway Conclusions

As discussed in Subchapter 5.3.4.5, five MC metals (aluminum, antimony, copper, lead, and zinc) and one explosive (2,4,6-TNT) were detected in surface soil. Based on these results, the air exposure pathway is complete for all receptors present at the MRS01 – Range Complex. The air exposure pathway for human receptors is assessed through the soil exposure pathway, as the screening values for human receptors include inhalation. While the inhalation exposure pathway is indirectly evaluated through the human health screening values for soil, the ecological screening values for soil do not evaluate this pathway, and the air exposure pathway is considered potentially complete, but not quantitatively assessed for ecological receptors at this MRS.

Figure 5.1

Qualitative Reconnaissance and Sample Locations Fort Pickens FUDS Project No. I04FL006301

Escambia County, Florida



Legend

- Biased Surface Soil Sample Location
- Ambient Surface Soil Sample Location
- Groundwater Sample Location
- Fresh Surface Water/Sediment Sample Location
- Ambient Surface Water/Sediment Sample Location
- Brackish Surface Water/Sediment Sample Location
- Qualitative Reconnaissance Track
- Range Complex
- FUDS Project Boundary

Site Location in Florida

N

Image Source: 2007 Orthophto
Projection: UTM Zone 16 NAD83, Map Units in Meters

400 200 0 400 Meters

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY BT	Qualitative Reconnaissance and Sample Locations		
DRAWN BY BT			
CHECKED BY JH	SCALE As Shown	PROJECT NUMBER 747140.86137	
SUBMITTED BY TD	DATE October 2010	PAGE NUMBER	
	FILE X:\GIS\Site_inspections_se\Maps\pickens_FL\Fig5_1.mxd		

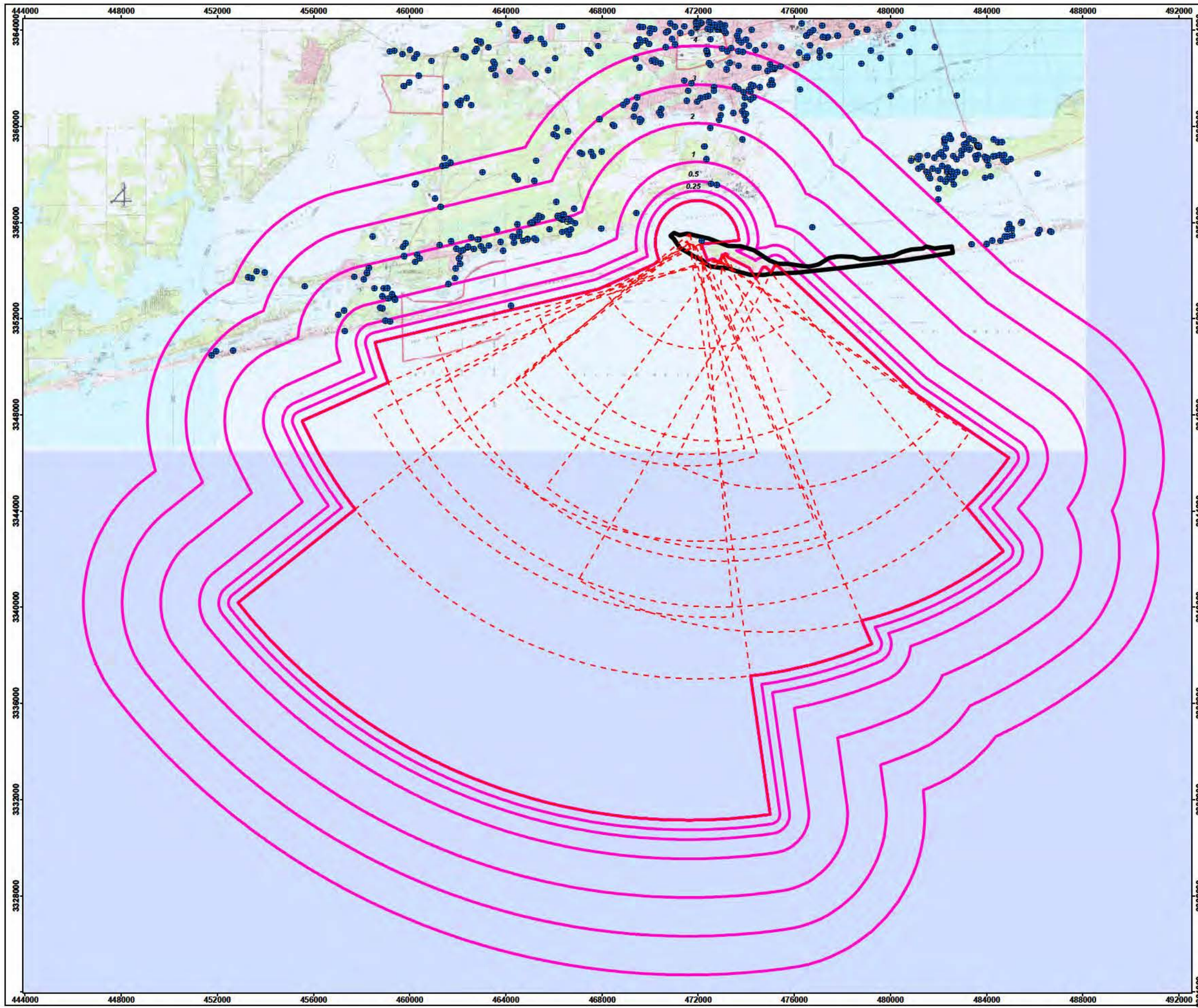


Figure 5.2

Water Wells within 4-Mile Buffer
Fort Pickens
FUDS Project No. I04FL006301

Escambia County, Florida

Legend

- Active Water Well Location
- Range Complex
- FUDS Project Boundary
- Buffer (Mile)

N

Image Source: USGS Topo Map, Date Unknown
Projection: UTM Zone 16 NAD83, Map Units in Meters

4 2 0 4 Kilometers

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY BT	Water Wells within 4-Mile Buffer		
DRAWN BY BT			
CHECKED BY JH	SCALE As Shown	PROJECT NUMBER 747140.86137	
SUBMITTED BY TD	DATE October 2010	PAGE NUMBER	
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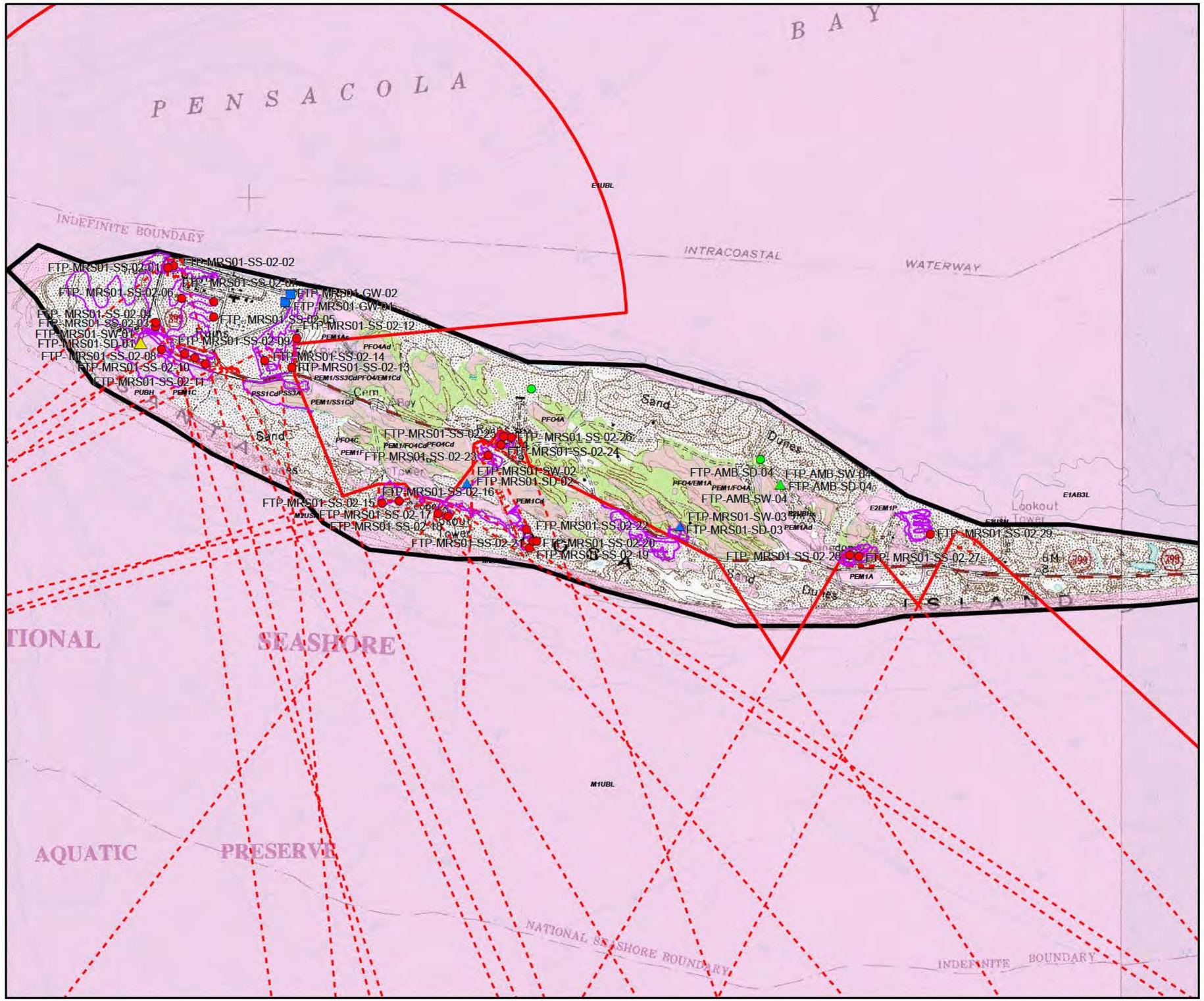

Figure 5.3

Wetlands
Fort Pickens
FUDS Project No. I04FL006301

Escambia County, Florida

Legend

- Biased Surface Soil Sample Location
- Ambient Surface Soil Sample Location
- Groundwater Sample Location
- Fresh Surface Water/Sediment Sample Location
- Ambient Surface Water/Sediment Sample Location
- Brackish Surface Water/Sediment Sample Location
- Qualitative Reconnaissance Track
- Range Complex
- FUDS Project Boundary
- Wetland (Obtained from U.S. Fish & Wildlife Service)

Predominant Wetland Types:

E1UBL- Estuarine, sub-tidal, unconsolidated bottom, sub-tidal
M1UBL- Marine, sub-tidal, unconsolidated bottom, sub-tidal
M2USN- Marine, intertidal, unconsolidated shore, regularly exposed
PEM1A- Palustrine, emergent, persistent, temporarily flooded
PEM1Cd- Palustrine, emergent, persistent, seasonally flooded, partially drained/ditched
PUBH- Palustrine, unconsolidated bottom, permanently flooded
PFO4Cd- Palustrine, forested, needle-leaved evergreen, seasonally flooded, partially drained/ditched
PEM1/SS1Cd- Palustrine, emergent, persistent/scrub-shrub, broad-leaved deciduous, seasonally flooded, partially drained/ditched

N

Image Source: USGS Topo Map, Date Unknown
Projection: UTM Zone 16 NAD83, Map Units in Meters

500 250 0 500 Meters

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY BT	Wetlands		
DRAWN BY BT			
CHECKED BY JH	SCALE As Shown		PROJECT NUMBER 747140.86137
SUBMITTED BY TD	DATE October 2010		PAGE NUMBER
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CHAPTER 6
SCREENING-LEVEL RISK ASSESSMENT

6.1 MUNITIONS AND EXPLOSIVES OF CONCERN SCREENING-LEVEL RISK ASSESSMENT

6.1.1 Conceptual Site Model

The Conceptual Site Model (CSM) for Fort Pickens, included in Appendix J, summarizes conditions at the site that could result in human exposure to MEC. It describes the types of MEC potentially present in each MRS, past MEC and MD findings, and current and projected future land use and receptors.

6.1.2 Introduction

6.1.2.1 A qualitative risk evaluation was conducted to assess the potential explosive safety risk to the public at the Fort Pickens FUDS. The purpose of this risk evaluation is to qualitatively communicate whether a potential risk is present at the site and the primary causes of that potential risk. The risk evaluation presented here is based on historical information presented in prior studies (for example, INPR, ASR, and ASR Supplement) and observations made during the SI QR.

6.1.2.2 An explosive safety risk exists if a person can come near or into contact with a MEC item and interact with it in a manner that results in a detonation. The potential for an explosive safety risk depends upon the presence of three critical elements:

- a source (*such as,* presence of MEC), AND
- a human receptor (*such as,* a person), AND
- the potential for interaction between the source and receptor (such as, the possibility that the item might be picked up or disturbed by the receptor).

6.1.2.3 All three of these elements must be present for there to be an explosive safety risk. There is no risk if any one element is missing. Each of these three elements provides a basis for implementing effective risk-management response actions.

6.1.3 Qualitative Risk Evaluation

6.1.3.1 The potential risk posed by MEC was characterized qualitatively by evaluating three primary risk factors for each MRS at a site. These factors are related to the three critical elements listed above and are:

1) MEC Presence: whether there is the potential for MEC to be present at the MRS;
2) MEC Type: the type(s) of MEC that might be present at the MRS and the related potential explosive hazards; and
3) Site Accessibility: the potential receptors at the MRS and how they might interact with the MEC.

6.1.3.2 The known or suspected presence of an explosive hazard and any potential human receptors at an MRS will typically be considered sufficient justification for RI/FS. The following paragraphs describe each of the primary risk factors.

6.1.3.3 **MEC Presence**: this factor describes whether MEC either has been confirmed or is suspected to be present at the MRS, either at the surface or in the subsurface, and is based on historical information presented in prior studies (for example, INPR, ASR, and ASR Supplement) and observations made during the SI QR. Note that if there is historical evidence of potential MEC presence at a site, lack of confirmation of MEC presence during the SI QR will not be considered as evidence of MEC absence for this qualitative risk evaluation. Table 6.1 lists the three possible categories used to describe MEC Presence for this evaluation.

Table 6.1
Categories of MEC Presence

MEC Presence	Description
Confirmed or suspected	There is physical or confirmed historical evidence of MEC presence at the MRS, or there is physical or historical evidence indicating that MEC may be present at the MRS.
Small arms only(1)	The presence of small arms ammunition is confirmed or suspected, and there is evidence that no other types of munitions were used or are present at the MRS.
Evidence of no munitions	Following investigation of the MRS, there is physical or historical evidence that there are no UXO or discarded military munitions (DMM) present.

(1) Small arms ammunition is defined as "ammunition, without projectiles that contain explosives (other than tracers), that is .50 Caliber or smaller or for shotguns" (Department of the Army, 2005).

6.1.3.4 **MEC Type**: this factor describes whether the MEC potentially present at the MRS might be detonated, resulting in injury to one or more human receptors. If multiple MEC items are potentially present at an MRS, the item that poses the greatest risk to public health is selected for purposes of this qualitative risk evaluation. This determination is based on historical information presented in prior studies (for example, INPR, ASR, and ASR Supplement) and observations made during the SI QR. Table 6.2 lists the three possible categories used to describe MEC Presence for this evaluation.

Table 6.2
Categories of MEC Type

MEC Type	Description
Potentially Hazardous	Fuzed or unfuzed MEC that may result in physical injury to an individual if detonated by an individual's activities.
Small arms only(1)	Small arms ammunition is confirmed or suspected, and there is evidence that no other types of munitions were used or are present at the MRS.
Inert	Munitions debris or other items that will cause no injury (for example, training ordnance containing no explosives, fuzes, spotting charges, etc.).

(1) Small arms ammunition is defined as "ammunition, without projectiles that contain explosives (other than tracers), that is .50 Caliber or smaller or for shotguns" (Department of the Army, 2005).

6.1.3.5 **Site Accessibility**: this factor describes whether human receptors have any access to the MRS and, therefore, may interact with any MEC that is present at the surface or in the subsurface. For purposes of this qualitative risk evaluation, if MEC is confirmed or suspected to be present at the MRS, it is assumed that human receptors might come into contact with that MEC unless there is "Complete Restriction to Access." A description of the potential receptors will also be given with this assessment. Table 6.3 lists the two possible categories used to describe Site Accessibility for this evaluation.

Table 6.3
Categories of Site Accessibility

Site Accessibility	Description
Accessible	Access control is not complete: residents, site workers, or visitors can gain access to all or part of the MRS.
Complete restriction to access	Human receptors are completely prevented from gaining access to the MRS.

6.1.3.6 With regard to this qualitative risk evaluation, further evaluation (such as, RI/FS) for the MRS will typically be justified if the following conditions are true:

- MEC is confirmed or suspected to be present, AND
- The MEC confirmed or suspected to be present is potentially hazardous, AND
- The MRS is accessible.

6.1.3.7 The primary risk factors identified above were evaluated for the MRS01 - Range Complex at Fort Pickens using the data collected during the SI field investigation and the historical data available from other studies. The following sections discuss the qualitative risk evaluation by each primary risk factor to determine whether further evaluation is justified at the MRS.

6.1.4 Munitions and Explosives of Concern Risk Assessment – MRS01 – Range Complex

6.1.4.1 During the October 2010 SI at Fort Pickens, MD in the form of a 3.5-inch artillery casing was observed near Battery Van Swearingen within MRS01-Range Complex. In addition, a 40mm signal flare cartridge and numerous .30 Caliber bullet fragments were observed in the rifle range area. Based on this information and the historic documentation of live munitions used and stored at the site, the presence of MEC at the MRS01 – Range Complex is assessed to be ***"Confirmed or suspected."***

6.1.4.2 Based on the ASR Supplement (USACE, 2008) and the PA (USACE, 2007), it is suspected that high explosives were used and stored at Fort Pickens. A wide variety of light to heavy artillery ammunition (1830s era through World War II era), small arms, marine mines, hand grenades, and rifle grenades are the potential munitions used at the MRS01- Range Complex and present a residual hazard if they remain at the site intact. Based on this information, the MEC Type at the MRS01 – Range Complex is assessed to be ***"Potentially Hazardous."***

6.1.4.3 The MRS01 – Range Complex is currently used for historical preservation and recreation as Fort Pickens State Park (Florida) and as part of the GINS NPS. The Fort Pickens FUDS is located within the GINS along the western tip of Santa Rosa Island. Guard stations are the only access restriction at the site and the site is considered a major tourist attraction. Based on these land uses and the lack of complete access restrictions, it is possible that site visitors, park workers, construction workers, and recreational users might access the MRS. Based on this information, the Site Accessibility at the MRS01 - Range Complex is considered ***"Accessible."***

6.1.5 Risk Summary

6.1.5.1 The qualitative MEC risk evaluation for the Fort Pickens FUDS is summarized in Table 6.4.

6.1.5.2 Based on this qualitative MEC risk evaluation, there is the possibility that human receptors might come into contact with explosively hazardous MEC at the MRS01 - Range Complex associated with the Fort Pickens FUDS; therefore, there is the potential for an explosive safety risk at this MRS.

Table 6.4
MEC Risk Evaluation
Fort Pickens, Escambia County, FL

MRS	MEC Presence	MEC Type (1)		Site Accessibility	Further Evaluation?
Range Complex	Confirmed or suspected	Grenade, Hand, Fragmentation, MkII (2)	Potentially Hazardous	Accessible	Yes

(1)-Where multiple MEC items were used at an MRS, the item which poses the greatest risk to public health is listed for purposes of this risk assessment.

(2)-Grenade, Hand, Fragmentation, MkII poses the greatest risk to public health due to the sensitivity of the fuze. Although no grenades or grenade fragments were found during the 2010 SI, the 1948 report cited in Subchapters 3.4.4 and 4.3.1 stated that the Army and Navy might have used grenades on the rifle range area.

6.2 MUNITIONS CONSTITUENTS HUMAN HEALTH SCREENING LEVEL RISK ASSESSMENT

6.2.1 Conceptual Site Exposure Model

6.2.1.1 Based on the current and future land use of the MRS01 – Range Complex, potential human receptors include commercial/industrial workers (for example, park employees), and site visitors or recreational users. The site is currently used for historical preservation and recreation as part of the GINS NPS. The Fort Pickens FUDS is located within the GINS along the western tip of Santa Rosa Island and consists of inland waters, wetland areas, and marshes. The future land use is projected to remain the same. The MC CSEM (Appendix J) identifies affected media, transport mechanism, exposure routes, and potential receptors.

6.2.1.2 Human receptors at the MRS01 – Range Complex may be exposed to MC in groundwater (ingestion as drinking water, incidental ingestion, or dermal contact), fresh or brackish surface water or sediment (incidental ingestion or dermal contact), or surface soil (incidental ingestion or dermal contact). Air is indirectly evaluated using soil RSLs that include the inhalation pathway. In addition, fishing is a popular recreational activity at the Fort Pickens site, so recreational users and site visitors may be indirectly exposed to MC through ingestion of biota that have been exposed to MC. Marine surface water would not be used as drinking water by humans, but human exposure to MC in marine water could occur through incidental ingestion or dermal contact. Marine surface water and marine sediments were not sampled at the MRS01- Range Complex. For this reason, the marine surface water and sediment exposure pathways were considered potentially complete, but not quantitatively assessed for potential human receptors and the potential risks are not evaluated for these media.

6.2.2 Affected Media

Direct release of MC from munitions activities within the MRS could be to fresh, brackish, and marine surface water and sediment and to surface soil. Direct releases to the wetlands may have occurred from the use of munitions at the different battery locations and the rifle range area. In addition to potential direct release of MC to surface soil because of the munitions-related activities, MC in the soil could migrate to groundwater through leaching or could migrate to fresh, brackish, or marine surface water and sediment through runoff and erosion. MC in the surface soil can also become airborne in resuspended soil particulates. Marine surface water, marine sediment, and air samples were not collected at the MRS01 - Range Complex.

6.2.3 Human Health Screening Values

6.2.3.1 Groundwater. The human health screening levels for groundwater consist of the more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Tap Water, May 17, 2010, and FDEP FAC 62-777 Groundwater and Surface Water Cleanup Target Levels, Groundwater Criteria and FDEP FAC 62-550 Primary or Secondary Groundwater Standards.

6.2.3.2 Fresh surface water. The human health screening levels for fresh surface water consist of the more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Tapwater, May 17, 2010, and FDEP FAC 62-777 Groundwater and Surface Water Cleanup Target Levels, Freshwater Surface Water Criteria and FAC 62-302 Surface Water Quality Standards (for Class I or Class III waters).

6.2.3.3 Fresh water sediment. The human health screening levels for freshwater sediment consist of the more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Residential Soil, May 17, 2010, and FDEP FAC 62-777 Soil Cleanup Target Levels more stringent of the Direct Exposure Residential, leachability based on Marine Surface Water Criteria, leachability Based on Freshwater Surface Water Criteria and leachability based on Groundwater Criteria, February 2005.

6.2.3.4 Brackish surface water. There are brackish surface water areas present within the MRS. Although these samples are considered brackish, they will be analyzed using the screening levels for marine waters. The human health screening levels for brackish surface water consist of the more stringent FDEP FAC 62-777 Groundwater and Surface Water Cleanup Target Levels, Marine Surface Water Criteria and FAC 62-302 Surface Water Quality Standards (for Class III waters; predominantly marine waters).

6.2.3.5 Brackish sediment. There are brackish sediment areas present within the MRS. Although these samples are considered brackish, they will be analyzed using the screening levels for marine sediment. The human health screening levels for brackish sediment were the more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Residential Soil, May 17, 2010, and FAC 62-777 Soil Cleanup Target Levels, more stringent of the Direct Exposure Residential, leachability based on Marine Surface Water Criteria, leachability based on Freshwater Surface Water Criteria and leachability based on Groundwater Criteria, February 2005.

6.2.3.6 Surface soil. The human health screening levels for surface soil consist of the more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Residential Soil, May 17, 2010, and FDEP FAC 62-777 Soil Cleanup Target Levels more stringent of the Direct Exposure Residential, leachability based on Marine Surface Water Criteria, leachability based on Freshwater Surface Water Criteria, and leachability based on Groundwater Criteria, February 2005.

6.2.4 Risk Characterization

As discussed in Subchapter 5.2.8, the MC source evaluation is used to determine which analytes are retained for consideration in a SLRA. To complete the human health risk characterization for groundwater, fresh and brackish surface water and sediment, and surface soil at the MRS01 – Range Complex, the maximum detected concentration of each analyte retained for consideration in Chapter 5 was compared to selected human health screening values as described above. For an analyte to be considered as a possible risk to human health, it would be necessary for the analyte to be present above the risk screening level.

6.2.5 MRS01 – Range Complex

6.2.5.1 Groundwater. Two groundwater samples (and one field duplicate sample) were collected at the MRS01 – Range Complex. As shown in Table 5.6, copper was detected. As shown in Table 6.5, copper was detected at a concentration less than the human health screening value for groundwater.

6.2.5.2 Fresh surface water. Two fresh surface water samples (and one field duplicate sample) were collected at MRS01 – Range Complex. As shown in Table 5.7, the MC aluminum, antimony, copper, lead, and zinc were detected. As shown in Table 6.6, antimony, copper, lead, and zinc were detected at concentrations less than their selected human health screening values for fresh surface water, and therefore, are not expected to pose a human health risk. However, aluminum was detected at a concentration greater than the human health screening value.

6.2.5.3 Fresh water sediment. Two freshwater sediment samples (and one field duplicate sample) were collected at MRS01 – Range Complex. As shown in Table 5.8, the MC aluminum, antimony, copper, lead, and zinc were detected. In addition, the explosive RDX was detected in freshwater sediment samples. As shown in Table 6.7, aluminum, antimony, copper, lead, and zinc were detected as concentrations less than their selected human health screening values for freshwater sediment, and therefore, are not expected to pose a human health risk. However, RDX was detected in freshwater sediment samples at a concentration greater than the human health screening value.

6.2.5.4 Brackish surface water. One brackish surface water sample was collected at MRS01 – Range Complex. As shown in Table 5.9, the MC aluminum, antimony, copper, lead, and zinc were detected. As shown in Table 6.8, aluminum, antimony, copper, lead, and zinc were detected at concentrations less than their selected human health screening values for brackish surface water, and therefore, are not expected to pose a human health risk.

6.2.5.5 Brackish sediment. One brackish sediment sample was collected at MRS01 – Range Complex. As shown in Table 5.10, the MC aluminum and lead were detected. As shown in Table 6.9, aluminum and lead were detected at concentrations less than their selected human health screening values for brackish sediment, and therefore, are not expected to pose a human health risk.

6.2.5.6 Surface soil. Twenty-nine surface soil samples (and four field duplicates) were collected at MRS01 – Range Complex. As shown in Table 5.11, 2,4,6-TNT and MC metals aluminum, antimony, copper, lead, and zinc were detected at the MRS. As shown in Table 6.10, 2,4,6-TNT and the MC metals aluminum, antimony, copper, lead, and zinc were detected at concentrations less than their selected human health screening values for surface soil, and therefore, are not expected to pose a human health risk.

Table 6.5
MRS01 - Range Complex
Groundwater Human Health Screening Level Risk Assessment
Fort Pickens, Escambia County, Florida

Analyte	Units	Maximum Detected Site Concentration	Screening Levels (1)	Exceeds Screening Level?
Metals				
Copper	µg/L	2.2	1,000 (2)	No

(1) - More stringent of USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites for Tap Water, November, 2010 **and** FDEP FAC 62-777 Groundwater and Surface Water Cleanup Target Levels, Groundwater Criteria **and** FDEP FAC 62-550 Primary or Secondary Groundwater Standards.
(2) FDEP FAC 62-550 Primary or Secondary Groundwater Standards September 18, 2007 (http://www.dep.state fl.us/legal/Rules/drinkingwater/62-550.pdf).
Notes:
(NO CODE) - Confirmed identification.
µg/L - micrograms per liter

Table 6.6
MRS01 – Range Complex
Fresh Surface Water Human Health Screening Level Risk Assessment
Fort Pickens, Escambia County, Florida

Analyte	Units	Maximum Detected Site Concentration		Screening Levels (1)		Exceeds Screening Level?
Metals						
Aluminum	µg/L	220	J	13	(2)	**Yes**
Antimony	µg/L	0.21	J	14	(3)	No
Copper	µg/L	3.3		1,500	(4)	No
Lead	µg/L	1.8	J	15	(5)	No
Zinc	µg/L	7.8	J	11,000	(4)	No

(1) More stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Tapwater, November, 2010 **and** FDEP FAC 62-777 Groundwater and Surface Water Cleanup Target Levels, Freshwater Surface Water Criteria **and** FAC 62-302 Surface Water Quality Standards (for Class I or Class III waters).
(2) FAC 62-777, Groundwater and Surface Water Cleanup Target Levels, Freshwater Surface Water, February 2005 (http://www.dep.state fl.us/waste/quick_topics/publications/wc/FinalGuidanceDocumentsFlowCharts_April2005/TechnicalReport2FinalFeb2005(Final3-28-05).pdf)
(3) Florida Administrative Code (FAC) 62-302, Criteria for Surface Water Quality Classifications, Class I: Potable Water Supply (http://www.dep.state fl.us/legal/Rules/shared/62-302/302-Table.pdf)
(4) USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites, Tapwater, November, 2010 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_NOVEMBER2010.pdf).
(5) - USEPA MCLs, National Primary Drinking Water Standards, 2006 (http://www.epa.gov/safewater/contaminants/index.html).

Notes:
(NO CODE) - Confirmed identification.
J - Analyte detected, estimated concentration.
µg/L - micrograms per liter

Table 6.7
MRS01 - Range Complex
Freshwater Sediment Human Health
Screening Level Risk Assessment
Fort Pickens, Escambia County, Florida

Analyte	Units	Maximum Detected Site Concentration		Screening Levels (1)		Exceeds Screening Level?
Metals						
Aluminum	mg/kg	4,200		77,000	(2)	No
Antimony	mg/kg	0.076	J	5.4	(3)	No
Copper	mg/kg	1.4		150	(4)	No
Lead	mg/kg	5.5		400	(2)	No
Zinc	mg/kg	1.7	J	23,000	(2)	No
Explosives						
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	mg/kg	0.01	J	0.002	(3)	**Yes**

(1) Used more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Residential Soil, November, 2010 **and** FDEP FAC 62-777 Soil Cleanup Target Levels, more stringent of the Direct Exposure Residential **and** leachability Based on Freshwater Surface Water Criteria **and** leachability based on Marine Surface Water Criteria, **and** leachability based on Groundwater Criteria, February 2005.
(2) USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites for Soil, November, 2010 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_NOVEMBER2010.pdf).
(3) FAC 62-777. Leachability based on Groundwater Criteria, February 2005
(http://www.dep.state fl.us/waste/quick_topics/publications/wc/FinalGuidanceDocumentsFlowCharts_April2005/TechnicalReport2FinalFeb2005(Final3-28-05).pdf).
(4) FAC 62-777, Soil Cleanup Levels, Direct Exposure Residential, February 2005.
(http://www.dep.state fl.us/waste/quick_topics/publications/wc/FinalGuidanceDocumentsFlowCharts_April2005/TechnicalReport2FinalFeb2005(Final3-28-05).pdf).

Notes:
(NO CODE) - Confirmed identification.
J - Analyte detected, estimated concentration.
mg/kg - milligrams per kilogram

Table 6.8
MRS01 - Range Complex
Brackish Surface Water Human Health
Screening Level Risk Assessment
Fort Pickens, Escambia County, Florida

Analyte	Units	Maximum Detected Site Concentration		Screening Levels (1)		Exceeds Screening Level?
Metals						
Aluminum	µg/L	19	J	1,500	(2)	No
Antimony	µg/L	0.2	J	4,300	(2)	No
Copper	µg/L	1	J	2.9	(2)	No
Lead	µg/L	0.69	J	8.5	(2)	No
Zinc	µg/L	6.9	J	86	(2)	No

(1) More stringent FDEP FAC 62-777 Groundwater and Surface Water Cleanup Target Levels, Marine Surface Water Criteria **and** FAC 62-302 Surface Water Quality Standards (for Class III waters; predominantly marine waters).
(2) FAC 62-777, Groundwater and Surface Water Cleanup Target Levels, Marine Surface Water, February 2005 (http://www.dep.state fl.us/waste/quick_topics/publications/wc/FinalGuidanceDocumentsFlowCharts_April2005/TechnicalReport2FinalFeb2005(Final3-28-05).pdf).

Notes:
J - Analyte detected, estimated concentration.
µg/L - micrograms per liter

Table 6.9
MRS01 - Range Complex
Brackish Sediment Human Health Screening Level Risk Assessment
Fort Pickens, Escambia County, Florida

Analyte	Units	Maximum Detected Site Concentration		Screening Levels (1)		Exceeds Screening Level?
Metals						
Aluminum	mg/kg	15	J	77,000	(2)	No
Lead	mg/kg	0.21	J	400	(2)	No

(1) Used more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Residential Soil, November, 2010 **and** FDEP FAC 62-777 Soil Cleanup Target Levels, more stringent of the Direct Exposure Residential **and** leachability Based on Freshwater Surface Water Criteria **and** leachability based on Marine Surface Water Criteria, **and** leachability based on Groundwater Criteria, February 2005.
(2) USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites for Soil, November, 2010 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_NOVEMBER2010.pdf).

Notes:
(NO CODE) - Confirmed identification.
J - Analyte detected, estimated concentration.
mg/kg - milligrams per kilogram

Table 6.10
MRS01 - Range Complex
Soil Human Health Screening Level Risk Assessment
Fort Pickens, Escambia County, Florida

Analyte	Units	Maximum Detected Site Concentration		Screening Levels (1)		Exceeds Screening Level?
Metals						
Aluminum	mg/kg	6,000		77,000	(2)	No
Antimony	mg/kg	0.14	J	5.4	(3)	No
Copper	mg/kg	11		150	(4)	No
Lead	mg/kg	210		400	(2)	No
Zinc	mg/kg	43		23,000	(2)	No
Explosives						
'2,4,6-Trinitrotoluene (TNT)	mg/kg	0.0049	J	0.006	(3)	No

(1) Used more stringent of USEPA RSLs for Chemical Contaminants at Superfund Sites for Residential Soil, November, 2010 **and** FDEP FAC 62-777 Soil Cleanup Target Levels, more stringent of the Direct Exposure Residential, leachability based on Marine Surface Water Criteria, leachability based on Freshwater Surface Water Criteria, **and** leachability based on Groundwater Criteria, February 2005.
(2) USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites for Soil, November, 2010 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_NOVEMBER2010.pdf).
(3) Florida Administrative Code 62-777 Soil Cleanup Target Levels leachability based on Groundwater Criteria, February 2005 (http://www.dep.state fl.us/waste/quick_topics/publications/wc/FinalGuidanceDocumentsFlowCharts_April2005/TechnicalReport2FinalFeb2005(Final3-28-05).pdf).
(4) FAC 62-777 Soil Cleanup Target Levels Direct Exposure Residential, February 2005. (http://www.dep.state fl.us/waste/quick_topics/publications/wc/FinalGuidanceDocumentsFlowCharts_April2005/TechnicalReport2FinalFeb2005(Final3-28-05).pdf).

Notes:
(NO CODE) - Confirmed identification.
J - Analyte detected, estimated concentration.
mg/kg - milligrams per kilogram

6.2.6 Discussion

6.2.6.1 The human health screening value for aluminum in fresh surface water (Table 6.6) was exceeded for the MRS01 – Range Complex. The human health screening value for RDX in freshwater sediment (Table 6.7) was exceeded for the MRS01 – Range Complex. This screening value was based on the potential for RDX to leach to groundwater that is used as a drinking water source. Therefore, based on the analytical results presented in this report, an unacceptable human health risk due to munitions-related activities may be present from exposure to aluminum in fresh surface water and exposure to RDX in freshwater sediment that has leached to groundwater.

6.2.6.2 Marine surface water and marine sediments were not sampled at the MRS01 - Range Complex. For this reason, the marine surface water and sediment exposure pathways were considered potentially complete, but not quantitatively assessed for potential human receptors and the potential risks cannot be evaluated for these media. Potential human receptors could be exposed to MC in marine surface water and marine sediment through incidental ingestion and dermal contact, and may be exposed to MC through ingestion of biota that have been exposed to MC. Marine surface water would not be used as drinking water by humans. While MC could have been released directly to marine surface water and sediment as a result of firing activities at the MRS01 – Range Complex and indirectly via erosion and runoff at the MRS, the large volume of marine water compared to the mass of MC that could have been released, as well as the amount of time that has passed since munitions activities were conducted at this site, make it unlikely that MC in marine surface water and sediment would pose a risk to human receptors at this site.

6.3 MUNITIONS CONSTITUENTS SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

Using the criteria in the Army Checklist for Important Ecological Places (USACE, 2006), the MRS01 – Range Complex is classified as an important ecological place based on the presence of wetlands and being a state and county recognized sensitive aquatic environment. Therefore, ecological receptors are potential receptors for exposure pathways at this site.

6.3.1 Conceptual Site Exposure Model

Because the site is considered an important ecological place, exposure of wildlife to MC through direct exposure to contaminated fresh and brackish surface water and sediment through direct dermal contact, incidental ingestion, ingestion as drinking water, and ingestion of other biota that have been exposed to MC should be evaluated. Exposure of wildlife to MC could also occur through direct exposure to contaminated surface soil through direct dermal contact, incidental ingestion, and inhalation of resuspended particulates. Further, wildlife may be exposed to MC through direct exposure to contaminated marine surface water and marine sediment at the MRS01 – Range Complex. Marine surface water and marine sediments were not sampled at the site. For this reason, the marine surface water and sediment exposure pathways were considered potentially complete, but not quantitatively assessed for potential ecological

receptors and the potential ecological risks cannot be evaluated for these media. Because groundwater is not typically accessible to ecological receptors, the groundwater exposure pathways are incomplete for ecological receptors. The MC CSEM identifies affected media, transport mechanisms, exposure routes, and potential receptors. A CSEM has been developed for the MRS01 - Range Complex that is included in Appendix J.

6.3.2 Affected Media

Direct release of MC from munitions activities within the MRS could be to fresh, brackish, and marine surface water and sediment and to surface soil. Direct releases to the wetlands may have occurred from residual contamination from the use of munitions at the different battery locations and the rifle range area. In addition to potential direct release of MC to surface soil because of munitions-related activities, MC could migrate to groundwater through leaching or could migrate to fresh, brackish, or marine surface water and sediment through runoff and erosion. MC in the surface soil can also become airborne as resuspended soil particulates. Marine surface water, marine sediment, and air samples were not collected at the MRS01 – Range Complex.

6.3.3 Ecological Screening Values

6.3.3.1 Fresh Surface Water. The ESVs for fresh surface water are the more stringent of FAC 62-302 Surface Water Quality Standards (SWQS; for Class III waters) and USEPA Region 4 ESVs for Freshwater Surface Water, November 2001.

6.3.3.2 Fresh water Sediment. The ESVs for freshwater sediment are the more stringent of FDEP SQAG, January 2003 and USEPA Region 4 ESVs for Sediment, November 2001.

6.3.3.3 Brackish Surface Water. The ESVs for brackish surface water are the more stringent of FAC 62-302 Surface Water Quality Standards (SWQS; for Class III waters, predominantly marine waters), February 2005 and USEPA Region 4 ESVs for Marine Surface Water, November 2001.

6.3.3.4 Brackish Sediment. The ESVs for brackish sediment were the more stringent of FDEP Sediment Quality Assessment Guidelines (SQAG), January 2003 and USEPA Region 3 ESVs for Marine Sediment, March 2010, supplemented with ESVs obtained from sources identified in the 2006 PSAP Addendum, updated with most current values.

6.3.3.5 Surface Soil. The ESVs for surface soil were from USEPA Region 4 ESVs, November 2001.

6.3.3.6 The ESVs are based on a number of conservative assumptions, including assumptions about the types of receptors present at a site (for example, insectivores, terrestrial mammals, etc.) and assumptions about exposure parameters such as soil ingestion rate and receptor range. Site-specific information was not used to develop these screening values. The use of site-specific information typically results in less conservative, and higher, screening values.

6.3.4 Ecological Risk Characterization

Subchapter 5.2.8, the MC source evaluation is used to determine which analytes are retained for consideration in a SLRA. To complete the ecological risk characterization for this site, the maximum detected concentration of each selected analyte was evaluated using the agreed upon screening values (Subchapter 6.3.3). This comparison resulted in the calculation of a Hazard Quotient (HQ) for each analyte. The HQ was calculated by determining the ratio of the maximum detected site concentration to the screening value. If the HQ is equal to or less than 1, the potential for ecological risk for that receptor group is considered negligible. If the HQ is greater than 1, unacceptable ecological risks cannot be ruled out based on the screening comparison alone. HQs that are greater than 1 should be further evaluated to determine their significance.

6.3.5 MRS01 – Range Complex

6.3.5.1 Fresh surface water. Two fresh surface water samples (and one field duplicate sample) were collected at MRS01 – Range Complex. As shown in Table 5.7, aluminum, antimony, copper, lead, and zinc were detected. As shown in Table 6.11, aluminum and lead were detected at maximum concentrations that exceeded their selected ESVs, resulting in HQ values greater than one. The HQ for aluminum was 2.5 and for lead was 1.4. Therefore, based on the analytical results presented in this report, an unacceptable risk to ecological receptors due to munitions-related activities may be present from exposure to aluminum and lead in fresh surface water.

6.3.5.2 Fresh water sediment. Two freshwater sediment samples (and one field duplicate sample) were collected at MRS01 – Range Complex. As shown in Table 5.8, aluminum, antimony, copper, lead, and zinc were detected. In addition, the explosive RDX was detected in freshwater sediment samples. As shown in Table 6.12, aluminum was detected at a maximum concentration that exceeded the selected ecological screening value, resulting in an HQ value of 15. Therefore, based on the analytical results presented in this report, an unacceptable risk to ecological receptors due to munitions-related activities may be present from exposure to aluminum in freshwater sediment.

6.3.5.3 Brackish surface water. One brackish surface water sample was collected at MRS01 – Range Complex. As shown in Table 5.9, aluminum, antimony, copper, lead, and zinc were detected. As shown in Table 6.13, the maximum detected concentrations of aluminum, antimony, copper, lead, and zinc were less than their selected screening values, resulting in HQ values of less than 1. Therefore, based on the analytical results presenting in this report, an unacceptable ecological risk due to munitions-related activities is not expected due to exposure to brackish surface water.

6.3.5.4 Brackish sediment. One brackish sediment sample was collected at MRS01 – Range Complex. As shown in Table 5.10, aluminum and lead were detected. As shown in Table 6.14, the maximum detected concentrations of aluminum and lead were less than their selected screening values, resulting in HQ values of less than 1. Therefore, based on the analytical results presented in this report, an unacceptable ecological risk due to munitions-related activities is not expected due to exposure to brackish sediment.

6.3.5.5 Surface soil. Twenty-nine surface soil samples (and four field duplicates) were collected at MRS01 – Range Complex. As shown in Table 5.11, 2,4,6-TNT, aluminum, antimony, copper, lead, and zinc were detected at the MRS. As shown in Table 6.15, the maximum detected concentration of aluminum was greater than the selected ESV, resulting in a HQ value of 120. The maximum detected concentration of lead was greater than the selected ESV, resulting in a HQ value of 4.2. Therefore, based on the analytical results presented in this report, an unacceptable risk to ecological receptors due to munitions-related activities may be present from exposure to aluminum or lead in surface soil.

Table 6.11
MRS01 - Range Complex
Fresh Surface Water Screening Level Ecological Risk Assessment
Fort Pickens, Escambia County, Florida

Analyte	Units	Maximum Detected Site Concentration		Ecological Screening Values (ESVs) (1)		HQ
Metals						
Aluminum	µg/L	220	J	87	(2)	2.5
Antimony	µg/L	0.21	J	160	(2)	≤1
Copper	µg/L	3.3		6.5	(2)	≤1
Lead	µg/L	1.8	J	1.3	(2)	1.4
Zinc	µg/L	7.8	J	59	(2)	≤1

(1) More stringent of FAC 62-302 Surface Water Quality Standards (SWQS; for Class III waters) **and** USEPA Region 4 Ecological Screening Values for Freshwater Surface Water.
(2) USEPA Region 4, Ecological Screening Values, Freshwater Surface Water, November 20, 2001 (http://www.epa.gov/region04/waste/ots/ecolbul htm)

Notes:

(NO CODE) - Confirmed identification.
J - Analyte detected, estimated concentration.
µg/L - micrograms per liter

Table 6.12
MRS01 - Range Complex
Fresh Sediment Screening Level Ecological Risk Assessment
Fort Pickens, Escambia County, Florida

Analyte	Units	Maximum Detected Site Concentration		Ecological Screening Values (ESVs) (1)		HQ
Metals						
Aluminum	mg/kg	4,200		280	(2)	15
Antimony	mg/kg	0.076	J	12	(3)	≤1
Copper	mg/kg	1.4		19	(3)	≤1
Lead	mg/kg	5.5		30	(3)	≤1
Zinc	mg/kg	1.7	J	120	(4)	≤1
Explosives						
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	mg/kg	0.01	J	45	(2)	≤1

(1) -Used more stringent of FDEP Sediment Quality Assessment Guidelines (SQAG), January 2003 and USEPA Region 4 Ecological Screening Values for Sediment supplemented with ESVs obtained from sources identified in the 2005 Programmatic Sampling and Analysis Plan (PSAP), updated with most current values, in absence of available ESV from FDEP SQAG and Region 4 ESVs (http://www.dep.state fl.us/water/monitoring/docs/seds/SQAGs_for_Florida_Inland_Waters_01_03.PDF).
(2) - Screening value not available from primary source. Used Los Alamos National Laboratory (LANL), Ecorisk Database (Release 2.5) 2010 (http://www.lanl.gov/environment/cleanup/ecorisk.shtml).
(3) - USEPA Region 4 Ecological Screening Values, November 30, 2001 (http://www.epa.gov/region04/waste/ots/ecolbul html#tbl3).
(4) - FDEP Sediment Quality Assessment Guidelines, January 2003. TEC for sediment-dwelling organisms (Table 5.1) (http://www.dep.state fl.us/water/monitoring/docs/seds/SQAGs_for_Florida_Inland_Waters_01_03.PDF).

Notes:
(NO CODE) - Confirmed identification.
J - Analyte detected, estimated concentration.
mg/kg - milligrams per kilogram

Table 6.13
MRS01 - Range Complex
Brackish Surface Water Screening Level Ecological Risk Assessment
Fort Pickens, Escambia County, Florida

Analyte	Units	Maximum Detected Site Concentration		Ecological Screening Values (ESVs) (1)		HQ
Metals						
Aluminum	µg/L	19	J	1,500	(2)	≤1
Antimony	µg/L	0.2	J	4300	(2)	≤1
Copper	µg/L	1	J	3.7	(2)	≤1
Lead	µg/L	0.69	J	8.5	(2)	≤1
Zinc	µg/L	6.9	J	86	(2)	≤1

(1) More stringent of FAC 62-302 Surface Water Quality Standards (SWQS; for Class III waters, predominantly marine waters) **and** USEPA Region 4 Ecological Screening Values for Marine Surface Water.
(2) FAC 62-302 Surface Water Quality Standards for Class III waters, predominantly marine waters, February 2005 , (http://www.dep.state fl.us/legal/Rules/shared/62-302/302-Table.pdf)

Notes:
(NO CODE) - Confirmed identification.
J - Analyte detected, estimated concentration.
µg/L - micrograms per liter

Table 6.14
MRS01 - Range Complex
Brackish Sediment Screening Level Ecological Risk Assessment
Fort Pickens, Escambia County, Florida

Analyte	Units	Maximum Detected Site Concentration		Ecological Screening Values (ESVs) (1)	HQ
Metals					
Aluminum	mg/kg	15	J	280 (2)	≤1
Lead	mg/kg	0.21	J	30 (3)	≤1

(1) -Used more stringent of FDEP Sediment Quality Assessment Guidelines (SQAG), January 2003 and USEPA Region 3 Ecological Screening Values for Marine Sediment supplemented with ESVs obtained from sources identified in the 2005 Programmatic Sampling and Analysis Plan (PSAP), updated with most current values, in absence of available ESV from FDEP SQAG and Region 4 ESVs (http://www.dep.state fl.us/water/monitoring/docs/seds/SQAGs_for_Florida_Inland_Waters_01_03.PDF).
(2) - Screening value not available from primary source. Used Los Alamos National Laboratory (LANL), Ecorisk Database (Release 2.5) 2010 (http://www.lanl.gov/environment/cleanup/ecorisk.shtml).
(3) USEPA Region 3 Ecological Screening Benchmarks for Marine Sediment, March 19, 2010 (http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/marsed/screenbench htm.)

Notes:
(NO CODE) - Confirmed identification.
U - Analyte was analyzed for but not detected above the sample specific practical quantitation limit (PQL_sa).
J - Analyte detected, estimated concentration.
mg/kg - milligrams per kilogram

Table 6.15
MRS01 - Range Complex
Soil Screening Level Ecological Risk Assessment
Fort Pickens, Escambia County, Florida

Analyte	Units	Maximum Detected Site Concentration		Ecological Screening Values (ESVs) (1)	HQ
Metals					
Aluminum	mg/kg	6,000		50	120
Antimony	mg/kg	0.14	J	3.5	≤1
Copper	mg/kg	11		40	≤1
Lead	mg/kg	210		50	4.2
Zinc	mg/kg	43		50	≤1
Explosives					
'2,4,6-Trinitrotoluene (TNT)	mg/kg	0.0049	J	6.4 (2)	≤1

(1) - USEPA Region 4 Ecological Screening Values, updated November 30, 2001 (http://www.epa.gov/region04/waste/ots/epatab4.pdf).

(2) - Los Alamos National Laboratory (LANL), Ecorisk Database (Release 2.5) 2010 (http://www.lanl.gov/environment/cleanup/ecorisk.shtml).

Notes:
(NO CODE) - Confirmed identification.
J - Analyte detected, estimated concentration.
mg/kg - milligrams per kilogram

6.3.6 Discussion

6.3.6.1 For the MRS01 – Range Complex, the maximum detected concentrations of aluminum and lead in fresh surface water were greater than their selected screening values, resulting in a HQ of 2.5 for aluminum and a HQ of 1.4 for lead. The maximum detected concentration of aluminum in freshwater sediment was greater than the selected screening value, resulting in a HQ value of 15. The maximum detected concentrations of aluminum and lead in surface soil were greater than the selected screening values, resulting in a HQ value of 120 for aluminum and 4.2 for lead. Therefore, based on the analytical results presented in this report, an unacceptable ecological risk due to munitions-related activities may be present from exposure to aluminum and lead in fresh surface water, from exposure to aluminum in freshwater sediment, and from exposure to aluminum and lead in surface soil at the MRS.

6.3.6.2 Marine surface water, marine sediment, and air samples were not collected during this SI at the MRS01 – Range Complex. Therefore, these pathways are considered potentially complete but not quantitatively assessed and were not directly evaluated in the Screening Level Ecological Risk Assessment (SLERA). Marine surface water could be used as drinking water by marine species. Potential ecological receptors could also be exposed to MC in the marine surface water and marine sediment through incidental ingestion and dermal contact. While MC could have been released directly to marine surface water and sediment as a result of munitions activities at the MRS01 – Range Complex and indirectly via runoff or erosion at the MRS, the large volume of marine water compared to the mass of MC that could have been released, as well as the amount of time that has passed since munitions activities were conducted at this site, make it unlikely that MC in marine surface water and sediment would pose a risk to ecological receptors at this site.

CHAPTER 7
SUMMARY AND CONCLUSIONS

7.1 SUMMARY

7.1.1 The MRS01 - Range Complex was identified at the Fort Pickens FUDS in Escambia County, Florida, and evaluated to determine if it potentially was impacted by prior DoD munitions use and, subsequently, presented a potential to cause significant contamination to the environment or to adversely affect human and ecological receptors. The evaluation included the collection of surface soil, groundwater, surface water, and sediment samples, as well as the implementation of QR within the MRS during the October 2010 SI.

7.1.2 Fort Pickens was used as a coastal defense site from the Civil War through World War II. The FUDS property land acreage totals 1,168 acres and the offshore water acreage totals 137,297 acres. Presently, the FUDS property is used for historical preservation and recreation as part of the GINS.

7.2 MUNITIONS AND EXPLOSIVES OF CONCERN EXPOSURE PATHWAYS

A MEC SLRA was conducted based on the QR completed in the field during the 2010 SI and historical data regarding previous site visits (Chapter 6). During the October 2010 SI at Fort Pickens, no MEC was observed, but MD in the form of an unknown type projectile fuze was found near Battery Van Swearingen. In addition, a signal-flare cartridge case, and numerous .30 Caliber projectile fragments were observed at the site within the rifle range area. Munitions used at this MRS contain compounds and/or components that may pose a safety hazard if any remain on-site intact. The large variety of munitions used or stored over the life of Fort Pickens presents a possible continuing hazard from MEC at this FUDS. There is potential for significant storm surges to inundate the island resulting in movement and exposure of any buried munitions. Additionally, these same storm surges could move offshore munitions, such as any fired during training or wartime, back onto the island. The MEC exposure pathway at the MRS01 - Range Complex is potentially complete.

7.3 CONCLUSIONS REGARDING POTENTIAL MUNITIONS CONSTITUENTS EXPOSURE PATHWAYS

7.3.1 An exposure pathway is not complete unless all four of the following elements are present (USEPA, 1989):

- A source and mechanism for chemical release;
- An environmental transport/exposure medium;
- A receptor exposure point; and

- A receptor and a likely route of exposure at the exposure point.

7.3.2 MRS01 – Range Complex: The air exposure pathway for human receptors is complete with potential exposure through inhalation of airborne particulates. While the inhalation exposure pathway is indirectly evaluated through the human health screening values for soil, the ecological screening values for soil do not evaluate this pathway, and the air exposure pathway is considered potentially complete, but not quantitatively assessed for ecological receptors at this MRS. The surface soil, groundwater, surface water, and sediment pathways are complete, as selected MC metals were detected in the samples collected from these media at the site and the samples were retained for SLRA. Aluminum, antimony, copper, lead, and zinc were detected in the fresh surface water, freshwater sediment, brackish surface water and the surface soil. TNT was detected in the surface soil samples. Aluminum and lead were detected the brackish sediment and copper was detected in the groundwater. Along with MC metals, RDX was detected in the freshwater sediment.

7.3.3 The SLRA results revealed the following results for the samples collected at MRS01-Range Complex: Copper was detected at a concentration less than the human health screening value for groundwater. Aluminum was detected in the fresh surface water samples at a concentration greater than the human health screening value. RDX was detected in the freshwater sediment samples at a concentration greater than the human health screening value. Aluminum, antimony, copper, lead, and zinc were detected in the brackish surface water sample at concentrations less than their selected human health screening values. Aluminum and lead were detected in the brackish sediment sample at concentrations less than their selected human health screening values and aluminum, antimony, copper, lead, zinc, and TNT were detected in the surface soil samples at concentrations less than their selected human health screening values.

7.3.4 The human health screening values for copper in groundwater, aluminum in fresh surface water and RDX in freshwater sediment were exceeded for the MRS01 – Range Complex. ***Therefore, based on the analytical results presented in this report, an unacceptable human health risk due to munitions-related activities may be present from exposure to aluminum in fresh surface water and from exposure to RDX in freshwater sediment at the MRS01-Range Complex.***

7.3.5 The SLERA results revealed the following results for the samples collected at MRS01-Range Complex: Aluminum and lead were detected in the fresh surface water samples at maximum concentrations that exceeded their selected ESVs, resulting in HQ values of greater than one. The HQ for aluminum was 2.5 and for lead was 1.4. Aluminum was detected in the fresh water sediment at a maximum concentration that exceeded the selected ESV, resulting in an HQ value of 15. Aluminum, antimony, copper, lead, and zinc were less than their selected screening values for brackish surface water resulting in HQ values of less than 1. Aluminum and lead were detected in brackish sediment at a maximum concentration less than their selected ESVs, resulting in HQ values of less than 1. Aluminum was detected in the surface soil samples at a maximum concentration greater than the selected ESV, resulting in a HQ value of 120. Lead was detected in the surface soil at a maximum concentration greater than the selected ESV, resulting in a HQ value of 4.2.

7.3.6 The ESVs for aluminum and lead in fresh surface water, aluminum in fresh water sediment, and aluminum and lead in surface soil were exceeded at the MRS01-Range Complex. ***Therefore, based on the analytical results presented in this report, an unacceptable ecological risk due to munitions-related activities may be present from exposure to aluminum and lead in fresh surface water, from exposure to aluminum in fresh water sediment, and from exposure to aluminum and lead in surface soil at the MRS01-Range Complex.***

7.3.7 Marine surface water and sediment are present within the MRS01 – Range Complex, and human and ecological receptors could be exposed to MC in marine surface water or marine sediment. Because no marine surface water or marine sediment samples were collected during the SI, the marine water and marine sediment pathways are considered potentially complete, but not quantitatively assessed for potential receptors.

7.4 OVERALL CONCLUSIONS

7.4.1 MRS01 – Range Complex

During the October 2010 SI at Fort Pickens, no MEC was observed but MD in the form of a 3.5-inch artillery casing was observed near Battery Van Swearingen within MRS01-Range Complex. In addition, a signal-flare cartridge case and numerous .30 Caliber projectile fragments were observed in the rifle range area. Munitions used at this MRS contain compounds and/or components that may pose a safety hazard if any remain on-site intact. The MEC exposure pathway at the MRS01 - Range Complex is potentially complete. Due to historical documentation of live munitions used and stored at this site, MD findings during the 2010 SI, and unrestricted access to the site by receptors, there is potential for an explosive safety risk at the MRS01-Range Complex. ***Based on these findings, the known use of the MRS and the potential for MEC to remain within the MRS, the MEC exposure pathway for the MRS01 – Range Complex is complete. The groundwater, surface water (fresh water and brackish), sediment (fresh water and brackish), and surface soil pathways are complete and an unacceptable human health risk and ecological risk to receptors via exposure to MC is possible at the MRS01-Range Complex.***

CHAPTER 8
RECOMMENDATIONS

Based on the October 2010 SI field effort, the analysis results, and the historical record review, the MRS01 – Range Complex at the Fort Pickens FUDS is recommended for RI/FS (Table 8.1). ***Munitions removal actions are not warranted at this time.*** The RI/FS recommendation is based on the following:

- During the October 2010 SI at Fort Pickens, no MEC was observed but MD in the form of an unknown type projectile fuze was observed near Battery Van Swearingen within MRS01 – Range Complex. A signal-flare cartridge case and numerous .30 Caliber projectile fragments were observed in the rifle range area and there is a potential for more to be present at the site. There is a potential that grenades were used on the site by Army and Navy personnel during training (Subchapters 3.4.4 and 4.3.1). Based on the qualitative MEC risk evaluation (Subchapter 6.1), there is a possibility that human receptors might come into contact with explosively hazardous MEC at the MRS01 – Range Complex associated with the Fort Pickens FUDS; therefore, there is the potential for an explosive safety risk at this MRS.
- MC metals were detected in the samples collected from the site and the sample data were retained for a SLRA. Aluminum, antimony, copper, lead, and zinc were detected in the fresh surface water, fresh water sediment, brackish surface water, and the surface soil. Aluminum and lead were detected the brackish sediment and surface soil and copper was detected in the groundwater. Along with MC metals, RDX was detected in the fresh water sediment and TNT was detected in the surface soil.
- The human health screening values for aluminum in fresh surface water and RDX in fresh water sediment were exceeded for the MRS01 – Range Complex. The ESVs for aluminum and lead in fresh surface water, aluminum in fresh water sediment, and aluminum and lead in surface soil were exceeded at the MRS01-Range Complex. ***Further surface soil, surface water, and sediment sampling may be warranted to confirm and define any potential impact from munitions at the MRS01- Range Complex.***

Table 8.1
Recommendations
Fort Pickens, Escambia County, Florida

MRS	Acreage	Munitions and Explosive of Concern and/or Munitions Debris Assessment (1)	Munitions Constituents Assessment (2)	Recommendation
MRS01 – Range Complex	138,465	***YES*** USACE documents issued since site closing confirm the use and storage of live munitions and high explosives at the site. Munitions used at the FUDS over the years include a wide variety of light to heavy artillery ammunition (1830s era through World War II era), small arms, marine mines, hand grenades, and rifle grenades. The munitions suspected to have been used at this MRS contain explosives that might present a residual hazard if they remain at the site intact. MD was found on-site during the field event for the 2010 SI.	***YES*** An unacceptable human health risk due to munitions-related activities may be present from exposure to aluminum in fresh surface water, and from exposure to RDX in freshwater sediment at the MRS01-Range Complex. An unacceptable ecological risk due to munitions-related activities may be present from exposure to aluminum and lead in fresh surface water, from exposure to aluminum in freshwater sediment, and from exposure to aluminum and lead in surface soil at the MRS01-Range Complex.	**RI/FS** Additional investigation for MEC may be warranted. Further, surface soil, surface water, and sediment sampling may be warranted to confirm and define any potential impact from munitions at the MRS01- Range Complex.

Notes:

(1) "Yes" in this column indicates confirmed MEC or MD presence indicative of potential MEC presence, resulting in a RI/FS recommendation for the MRS. "No" in this column indicates no confirmed MEC or MD indicative of potential MEC presence.

(2) "Yes" in this column indicates the presence of MC at levels indicating a potential elevated risk to human health or ecological receptors, resulting in a recommendation for further MC sampling during a RI/FS. "No" in this column of the table indicates the absence of MC at levels indicating a potential risk to human health or ecological receptors, resulting in a recommendation for no further MC sampling for the MRS.

CHAPTER 9
REFERENCES

Florida Geological Survey, 1965. Water Resources of Escambia and Santa Rosa Counties, Florida. Report of Investigations No. 40.

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