FINAL

Site Inspection Report
Mill Cove Bombing Site
Clay County, Florida

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

FUDS Project No. I04FL037701
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
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4820 University Square
Huntsville, Alabama 35816-1822

Prepared By:
PARSONS
5390 Triangle Parkway, Suite 100
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September 2008

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Parsons has completed the Final Site Inspection report for the Mill Cove Bombing Site, Clay 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.

September 29, 2008

Study/Design Team Leader and Team Members

September 29, 2008

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.

September 29, 2008

Parsons Program Manager(s)

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September 29, 2008

U.S. Army Engineer Center Huntsville
CEHNC-OE-DC (Mr. Doug Garretson)
4820 University Square
Huntsville, AL 35816-1822
(256)895-1066

Subject: Contract W912DY-04-D-0005, Delivery Order 0008
MMRP SI for SE and Pacific IMA Region - Final SI Report,
Mill Cove Bombing Site, Clay County, Florida

Dear Mr. Garretson:

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). The MRSPP notification announcement was prepared with coordination with USACE, Jacksonville District (CESAJ) Public Affairs Office (PAO) and Project Manager (PM) and appeared in the agreed newspaper prior to the second (closeout) TPP Meeting held in the CESAJ offices in Jacksonville, FL on September 16, 2008. The comments received during the second TPP Meeting have been incorporated into the Final as discussed at the meeting.

We have forwarded 5 copies of the document to Mr. Charles Fales of the Jacksonville District for his records and distribution to the stakeholders. We have also submitted single copies of this Final document to the EM CX. Electronic copies have also been provided.

If you have any questions or comments, please contact me at (678) 969-2384 or (404) 606-0346 (cell) or the Project Manager (Ms. Laura Kelley) at (678) 969-2437.

Sincerely,

PARSONS

Don Silkebakken, P.E.
MMRP SI Program Manager

cc: Charles Fales – 5 copies/5 CDs
Jeff Waugh – 1 CD
Brad McCowan/Deborah Walker (EM CX) – 1 copy/1 CD
Heidi Novotny (EM CX) - 1 CD
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U.S. Army Corps of Engineers
Southeast and Pacific IMA Region

FINAL
Site Inspection Report
Mill Cove Bombing Site
Clay County, Florida

FUDS Project No. I04FL037701
September 2008

In Support of

FUDS MMRP Site Inspections Project

Prepared by:
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Contract: W912DY-04-D-0005
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ACRONYMS AND ABBREVIATIONS

APP	Accident Prevention Plan
ASR	Archive Search Report
CEHNC	U.S. Army Corps of Engineers, Huntsville District
CEMVS	U.S. Army Corps of Engineers, St. Louis District
CEMVR	U.S. Army Corps of Engineers, Rock Island District
CESAC	U.S. Army Corps of Engineers, Charleston District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CRREL	Cold Regions Research and Engineering Laboratory
CSEM	Conceptual Site Exposure Model
CSM	Conceptual Site Model
CZMP	Coastal Zone Management Program
DERP	Defense Environmental Response Program
DMM	Discarded Military Munitions
DoD	Department of Defense
DQO	Data Quality Objective
EPP	Environmental Protection Plan
ER	Engineer Regulation
FDE	Findings and Determination of Eligibility
FDEP	Florida Department of Environmental Protection
FTL	Field Team Leader
FUDS	Formerly Used Defense Site
GIS	Geographic Information System
gpm	gallons per minute
GPS	Global Positioning System
HRS	Hazard Ranking Score
HTW	Hazardous Toxic Waste
IGD	Interim Guidance Document
IMA	Installation Management Agency
MC	Munitions Constituents
MD	Munitions Debris
MDL	Method Detection Limit
MEC	Munitions and Explosives of Concern
mg/kg	Milligrams Per Kilograms
MMRP	Military Munitions Response Program
MRDS	Mineral Resources Data System
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSSL	Medium Specific Screening Level
NAD	North American Datum
NCP	National Contingency Plan
NDAI	No Department of Defense Action Indicated
NHA	National Heritage Areas

ACRONYMS AND ABBREVIATIONS (CONTINUED)

NHL	National Historic Landmarks
NHP	Natural Heritage Program
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRHP	National Register of Historic Places
NRIS	National Register Information System
NTCRA	Non-time Critical Removal Action
NWI	National Wetlands Inventory
NWRS	National Wildlife Refuge System
PA	Preliminary Assessment
Parsons	Parsons Corporation
ppm	Parts Per Million
PQL	Practical Quantitation Limit
PRG	Preliminary Remediation Goal
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
RI/FS	Remedial Investigation and Feasibility Study
ROE	Right-of-Entry
SAP	Sampling & Analysis Plan
SI	Site Inspection
SLERA	Screening Level Ecological Risk Assessment
SLRA	Screening Level Risk Assessment
SOP	Standard Operating Procedure
SS-WP	Site-Specific Work Plan
SSL	Soil Screening Level
SVT	Site Visit Team
TCRA	Time Critical Removal Action
TESS	Threatened and Endangered Species System
TPP	Technical Project Planning
US	United States
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
WWII	World War II

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 Mill Cove Bombing Site in Clay County, Florida warrants further evaluation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) beyond the site inspection (SI) stage. The Mill Cove Bombing Site has been declared a Formerly Used Defense Site (FUDS) and assigned FUDS project # I04FL037701. 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, Parsons conducted qualitative reconnaissance (QR) and collected surface water and sediment samples to analyze for MC. 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 The Mill Cove Bombing Site is connected to Doctors Lake in Clay County, Florida. There is one MRS, Bombing Range, at Mill Cove Bombing Site covering a total acreage of 649 (mostly water or wetlands) which includes a large range safety fan around the target area that extends beyond the original FUDS project boundary (160 acres). During 1941, the US Navy acquired the property for use as a training site for Jacksonville Naval Air Station (NAS). The site is a water target enclosed by wetlands and land on three sides, with the fourth side opening to Doctors Lake which connects to the St. Johns River. During use, the site had a target constructed in a pyramid shape using palmetto logs that were painted yellow. Remnants of this target are visible under the water near the center of Mill Cove. The target was used by the Navy until late 1945 or early 1946, when it was declared surplus. The exact date of termination of operations is not known. Munitions used on site included AN-Mk 5, AN-Mk 23, and AN-Mk 43 Miniature Practice Bombs with AN-Mk 4 spotting charges; Mk 15 series practice bombs (100 lbs); Mk 6, Mk 7, Mk 4, and Mk 5 practice bomb signals; and .50-caliber ammunition during strafing practice. The property is currently owned by multiple private and government entities. Land use includes residential and recreational (boating, swimming, and fishing).

ES.3 To accomplish the primary SI project objective (anticipated RI/FS); the TPP Team has agreed that the SI data collection efforts would focus on the placement of munitions constituents (MC) sample locations in and around areas that represent the highest likelihood for the presence of MC contamination. Five biased sediment samples (MC-MRS01-SD-01 through MC-MRS01-SD-05) and five biased surface water samples (MC-MRS01-SW-01 through MC-MRS01-SW-05) were collected from site locations with maximum bias for the presence of MC contamination. Two sediment samples (MC-OB-SD-06 and MC-OB-SD-07) and two surface water samples (MC-OB-SW-06 and

MC-OB-SW-07) were collected from areas outside the MRS to serve as ambient metals data for comparison. All environmental samples collected during this SI were analyzed for explosives and a list of metals as defined in the SI report. The TPP Team agreed that the SI data collection efforts would focus on screening for MC contamination in surface water and sediment samples from within Mill Cove.

ES.4 The SI field effort for Mill Cove Bombing Site was conducted from April 6 through 8, 2008. Five biased surface water and sediment sample couples were collected from this MRS. Figure ES.1 illustrates the completed QR track (near observations 13 and 14), observation locations, and sample locations. Mill Cove Bombing Site is a former water target; consequently, site QR predominately consisted of limited visual reconnaissance, via boat, traversing Mill Cove to sample, and a limited walking QR, totaling approximately 1,100 feet, of accessible shoreline to identify indicators of suspect areas, including earthen berms, distressed vegetation, stained soil, ground scars or craters, target remnants, and visible metallic debris. Most of the shoreline was inaccessible because of the presence of wetlands.

ES.5 The site visit team (SVT) did not observe MEC or MD during the field visit to the Bombing Range MRS. What appears to be a remnant of the wooden target was observed near the target center in the cove. No other structures, craters, stressed vegetation, or other visual indicators were noted by the SVT. Table 4.2 of the SI report summarizes the QR findings for the Mill Cove Bombing Site.

ES.6 The collected sediment and surface water sample couples were packaged and shipped to TestAmerica, formerly Severn Trent Laboratories, in Arvada, Colorado for analysis. The samples were analyzed for explosives (Method SW8321A) and selected total indicator metals (Method SW6010B/SW6020). Any detection of explosives is considered potential MC contamination and is evaluated in the screening level risk assessment. The analytical results for total metals from the surface and sediment sample couples were compared to the average concentrations of elements in Clay County, Florida, identified by the United States Geological Survey (USGS), supplemented with the arithmetic means of element concentrations in the Conterminous United States, and also identified by the USGS. The analytical results were then compared to the following criteria to determine the need to perform a screening-level risk assessment (SLRA) and/or a screening level ecological risk assessment (SLERA) for each particular analyte:

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

Was the analyte detected above background screening levels?

ES.7 Five biased surface water samples and one duplicate sample were collected from the Bombing Range MRS. Explosive compounds *were not detected* in any of the surface water samples and therefore, both the SLRA and SLERA are for metals only. As shown in Table 5.8, six MC metals, aluminum, antimony, copper, iron, lead, and zinc, were detected above background concentrations, and retained for consideration in the SLRA and SLERA. Based on the results shown in Table 6.5 of the SI Report, the maximum detected concentrations of aluminum, copper, and iron exceeded the risk-based, human health screening values for the surface water at the Bombing

Range MRS. Therefore, based on the analytical results presented in this report, ***there is a potential unacceptable human health risk*** from metals due to exposure to the surface water at the Bombing Range MRS. As shown in Table 6.7 of the SI Report, when the maximum concentration of antimony, copper, and zinc were compared to the surface water ecological screening values, the HQ value was less than one. The HQ values for aluminum (3.8), iron (1.8), and lead (1.2) were greater than one, and therefore, ***there is a possible risk to ecological receptors*** from metals due to exposure to surface water.

ES.8 Five biased sediment samples and one duplicate sediment sample were collected from the Bombing Range MRS. Explosive compounds *were not detected* in any of the sediment samples and therefore, both the SLRA and SLERA are for metals only. As shown in Table 5.9 of the SI Report, four MC metals, aluminum, copper, iron, and zinc, were detected above background concentrations, and retained for consideration in the SLRA and SLERA. Based on the results shown in Table 6.6 of the SI Report, the maximum detected concentrations of aluminum, copper, iron, and zinc did not exceed the risk-based human health screening values for the sediment at the Bombing Range MRS. Therefore, based on the analytical results presented in this report, an unacceptable human health risk from metals is ***not expected*** due to exposure to the sediment at the Bombing Range MRS. As shown in Table 6.8 of the SI Report, when the maximum concentration of copper, iron, and zinc were compared to the sediment screening values, the HQ values were less than one. The maximum concentration of aluminum is greater that the ecological screening value for sediment, and therefore, ***there is a potential ecological risk*** *due to exposure to aluminum in sediment at the Bombing Range MRS.*

ES.9 During past site visits, including the SI conducted in April 2008, neither MEC nor MD indicative of MEC has been discovered at Mill Cove Bombing Site. Interviews of persons familiar with historic activities at Mill Cove report finding and removal of some MD from the bottom of Mill Cove during the 1970s. *The potential for future discoveries of MEC is considered possible.* The surface water and sediment pathways are considered complete for MC. ***An unacceptable risk from surface water to both human health and ecological receptors exists at Mill Cove Bombing Site. A slight risk to ecological receptors from sediments exists at Mill Cove Bombing Site. At the RI/FS phase of the project, contamination from other sources needs to be examined in greater detail to differentiate DoD contamination from other contamination.***

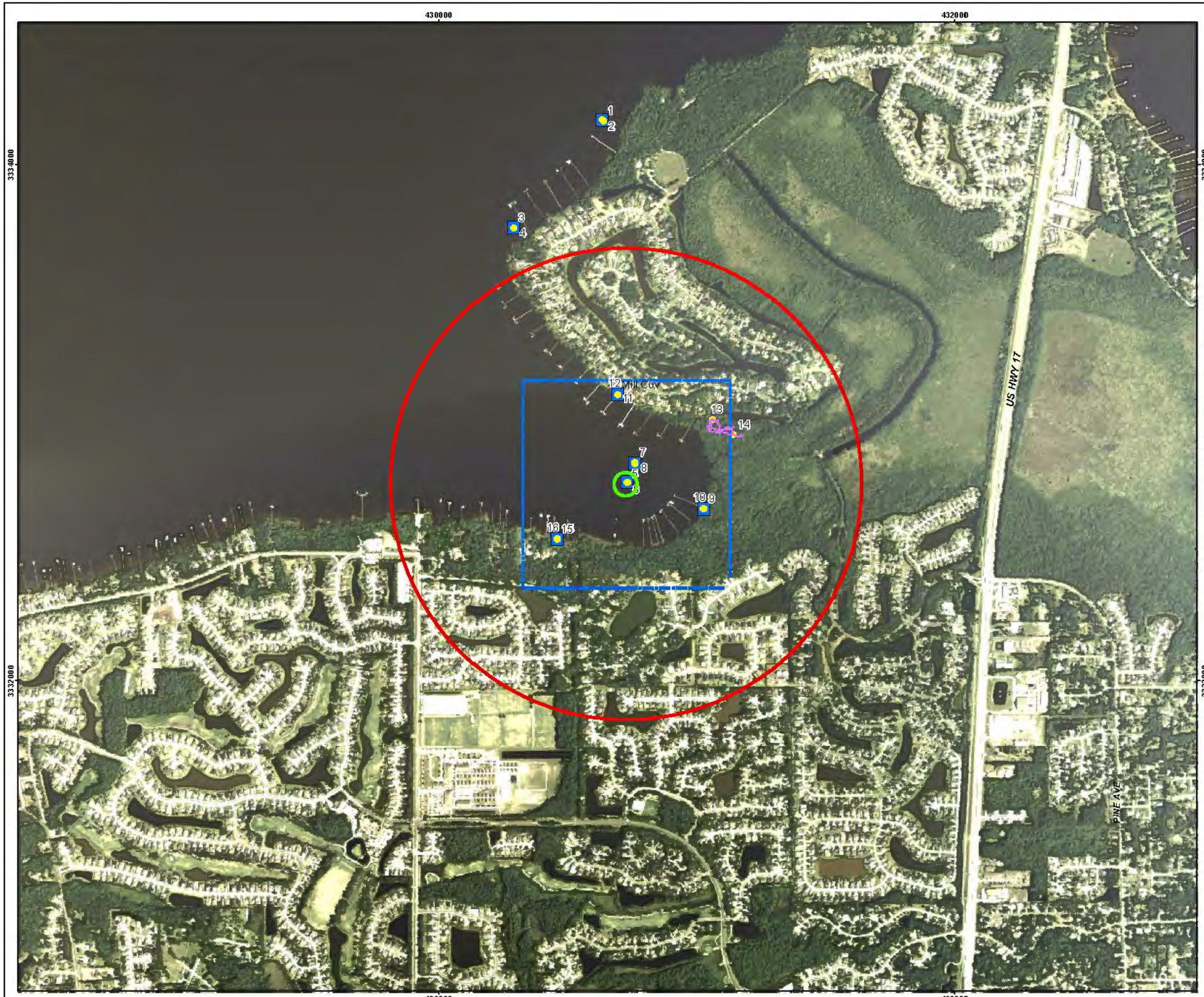
Table ES.1
Summary of Results
Mill Cove Bombing Site

MRS	Acres	MEC/MD Found	MC Contamination	Recommendation	Rationale
Bombing Range MRS	649	No	Yes	RI/FS. Additional MC sampling to confirm source of potential MC influences to surface water.	Mill Cove is a confirmed former military site used for bombing target practice. MD has been reported at the bottom of Mill Cove. MC metals in the surface water are a potential risk to human health. MC metals in the surface water and the sediment are a potential risk to ecological receptors at Mill Cove.

Figure ES.1

General Site Overview
Mill Cove Bombing Site
FUDS Project No. I04FL037701

Clay County, Florida



Legend

- Field Observation Location
- Surface Water and Sediment Sample Location
- MRS Boundary
- Bombing Target
- FUDS Boundary
- Qualitative Reconnaissance Track

Site Location in Florida

N

Image: 2006 Orthophoto
Projection: UTM Zone 17 NAD83, Map Units in Meters

1,000 500 0 1,000 Feet

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER	
DESIGNED BY: BT	General Site Overview	
DRAWN BY: BT	SCALE: As Shown	PROJECT NUMBER: 744647.70000
CHECKED BY: IN	DATE: September 2008	PAGE NUMBER: ES-5
SUBMITTED BY: DS	FILE: X:\GIS\Site_inspections_ne\Maps\millcove_FLFigES_1.mxd	

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 the Mill Cove Bombing Site Formerly Used Defense Site (FUDS) located in Clay County, Florida. This site consists of approximately 160 water-acres that are no longer owned or leased for government/military purposes. This site has been assigned FUDS project number **I04FL037701**.

1.1.2 The Mill Cove Bombing Site is located in Clay County, Florida. The site is located approximately 13 miles from Jacksonville, Florida. Figure 1.1 depicts the location and boundaries of the site. The figure shows the original FUDS property boundary (160 acres) and the FUDS-eligible MRS boundary (649 acres) depicting the typical bombing target safety fan. The Mill Cove Bombing Site is an open water cove within Doctors Lake located approximately four miles south of the town of Orange Park. The site was acquired by the U.S. Government in 1941 and was used by the Jacksonville Naval Air Station (NAS) for training missions. The site had a pyramid-shaped raft of palmetto logs, painted yellow. Use of the property ended in late 1945 or early 1946 (exact termination date not found). The site has one Munitions Response Site (MRS), the Bombing Range MRS. The coordinates for the center point of the MRS are listed in Table 1.1. The coordinates are in meters [Universal Transverse Mercator (UTM) Zone 17 North American Datum (NAD) 83].

Table 1.1
Mill Cove Bombing Site MRS Coordinates

MRS	MRS Acreage[1]	X-Coordinate (meters)	Y-Coordinate (meters)
Bombing Site	649	430725.18	3332760.06

1 - Acreage based on review of Annual Report to Congress (ARC), Archives Search Report (ASR) Supplement, and FUDS Management Information System (FUDSMIS).

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, 2004b) and the Management Guidance for the Defense Environmental Response Program (DERP) (Office of the Deputy Under Secretary of Defense [Installations and Environment], September 2001), USACE is conducting FUDS response activities in accordance with the DERP statute (10 United States Code [USC] 2701 et seq.), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC §9620), 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, the DERP statute provides DoD the authority to respond to releases of MEC/MC that pose an imminent and substantial endangerment and DoD policy states that such responses shall be conducted in accordance with CERCLA and the NCP.

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

1.2.5 The SI was performed as a result of the potential for MEC/MC contamination at the Range Complex No. 1 MRS. All work adhered to the DERP for FUDS and relevant U.S. Army regulations and guidance for MMRP programs. As specified in the task order, this report is prepared to summarize the SI sampling events and present an account of the MEC/MC contamination within the MRS at the Mill Cove Bombing Site.

1.3 PROJECT SCOPE

1.3.1 Due to the potential for MEC contamination at the Mill Cove Bombing Site, which included use of AN-Mk 5, An-Mk 23, and AN-Mk 43 Miniature Practice Bombs with AN-Mk 4 spotting charges; Mk 15 series practice bombs (100 lbs); Mk 6, Mk 7, Mk 4, and Mk 5 practice bomb signals; and .50-caliber ammunition during strafing practice runs, the Technical Project Planning (TPP) Team concurred that the SI would proceed in a manner to support an RI/FS.

1.3.2 To accomplish the primary SI project objective (anticipated RI/FS), the TPP Team has agreed that the SI data collection efforts would focus on the placement of munitions constituents (MC) sampling locations in and around areas that represent the

highest likelihood for the presence of MC contamination. Five biased sediment samples (MC-MRS01-SD-01 through MC-MRS01-SD-05) and five biased surface water samples (MC-MRS01-SW-01 through MC-MRS01-SW-05) were collected as couples from site locations with maximum bias for the presence of MC contamination. Two sediment samples (MC-OB-SD-06 and MC-OB-SD-07) and two surface water samples (MC-OB-SW-06 and MC-OB-SW-07) were collected from areas outside the MRS to serve as ambient metals data for comparison. All environmental samples collected during this SI were analyzed for explosives and a short list of metals as defined in the following report pages. The TPP Team agreed that the SI data collection efforts would focus on screening for MC contamination in surface water and sediment samples from within Mill Cove.

1.3.3 The primary project planning documents used to perform the SI include the Site-Specific Work Plan (SS-WP) Addendum for the Mill Cove Bombing Site (Parsons 2008b), the USACE Engineering and Support Center (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 for this project is in Appendix A.

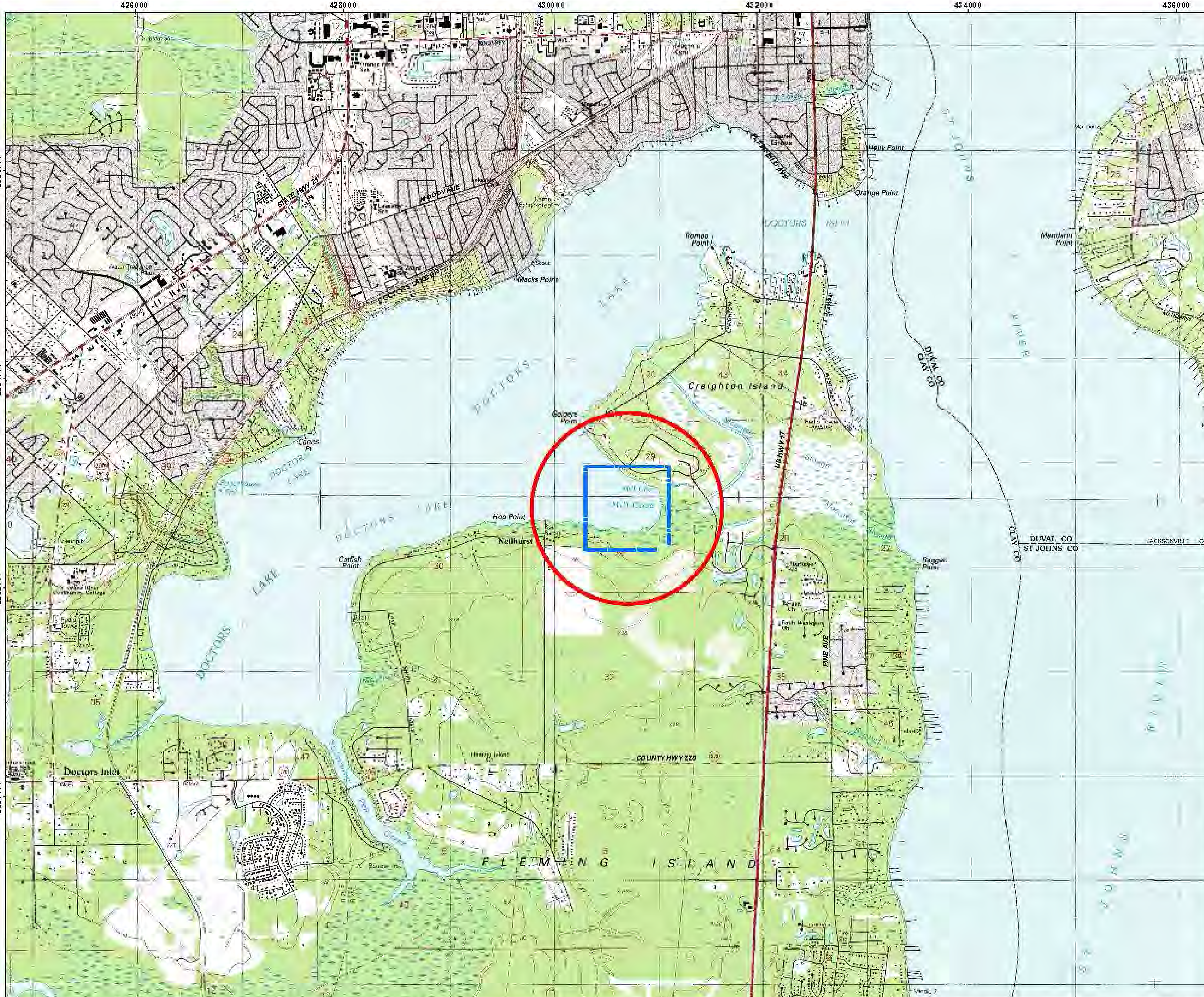


Figure 1.1

Site Location
Mill Cove Bombing Site
FUDS Property No. I04FL037701

Clay County, Florida

Legend

- MRS Boundary
- FUDS Boundary

Site Location in Florida

Image Source: USGS Topo Quadrangles, 1993
Projection: UTM Zone 17 NAD83, Map Units in Meters

4,000 2,000 0 4,000 Feet

N

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY: BT	Site Location	
DRAWN BY: BT		
CHECKED BY: IN	SCALE: As Shown	PROJECT NUMBER: 744647.70000
SUBMITTED BY: DS	DATE: September 2008	PAGE NUMBER: 1-4
	FILE: X:\GIS\Site_Inspections_new\Maps\millcove_FL\fig1_1.mxd	

CHAPTER 2
PROPERTY DESCRIPTION AND HISTORY

2.1 SITE DESCRIPTION

The Mill Cove Bombing Site (FUDS project number I04FL037701) is connected to Doctors Lake in Clay County, Florida. There is one MRS, Bombing Range, at Mill Cove Bombing Site covering a total acreage of 649 (mostly water or wetlands) which includes a large range safety fan around the target area that extends beyond the original FUDS project boundary (160 acres). During 1941, the US Navy acquired the site to be used as a training site for Jacksonville NAS. The site is a water target enclosed by wetlands and land on three sides, with the fourth side opening to Doctors Lake which connects to the St. Johns River. During use, the site had a pyramid-shaped raft of palmetto logs, painted yellow. Remnants of this target remain visible under the water. The target was used by the Navy until late 1945 or early 1946, when it was declared surplus. The exact date of termination of operations is not known. Munitions used on site included AN-Mk 5, An-Mk 23, and AN-Mk 43 Miniature Practice Bombs with AN-Mk 4 spotting charges; Mk 15 series practice bombs (100 lbs); Mk 6, Mk 7, Mk 4, and Mk 5 practice bomb signals; and .50-caliber ammunition during strafing practice. The property is currently owned by multiple private and government entities. Land use includes residential and recreational (boating, swimming, and fishing).

2.2 SITE LOCATION AND SETTING

The information in the following subchapters addressing site-specific details was obtained from the ASR (CEMVR, 2002), except where noted.

2.2.1 Topography and Vegetation

The Mill Cove Bombing Site is relatively flat. The target center and much of the site is covered by water or wetlands and connects through Doctors Lake to the St. Johns River. Vegetation on the shore includes cypress trees and marsh grasses at waters edge with palmettos, brush, and pine trees on drier portions of the land.

2.2.2 Geology and Soils

2.2.2.1 The Mill Cove Bombing Site is inland from the Atlantic coastline on the western part of Creighton Island. This area is within the Floridian section of the Coastal Plain Province. The land surface is typically marshy and is covered with water for most of the year. The area is underlain by an average of nearly 4,000 feet of sedimentary rock that ranges in age from the early Paleozoic era to the Recent, and is composed of quartz sand, clay and shell, that have not been accurately delineated and named. The Mill Cove

Bombing Site is located in the Eastern Valley physiographic region, which consists mostly of flatwoods and swamps with soils that are sandy and poorly drained.

2.2.2.2 The Mill Cove Bombing Site is within the lower section of the Atlantic Coastal Plain Province. The site lies in a region in northeastern Florida along the St Johns River which consists mostly of flatwoods and swamps with soils that are sandy and loamy, poorly drained soils containing organic accumulations. The land surface is a marine terrace composed of sediments of Recent or Pleistocene age, ranging from 50 to 150 feet thick. Recent deposits consist of alluvial sand and clay in the present stream valleys and isolated peat deposits in lakes and marshes. The Pleistocene sediments consist of fine to medium quartz sand and thin lenses of clay and shell. In general, the Pleistocene sediments are discontinuous and may vary in composition within short distances. Underlying the Recent/Pleistocene aged sediments are deposits of Pliocene or late Miocene which consist of interbedded lenses of marine, fine to medium sand, shell and green calcareous silty clay. The thickness of Pliocene/Late Miocene deposits range from 20 to 100 feet. The Hawthorne formation, also of Miocene age, unconformably underlies the late Pliocene/Late Miocene deposits. The general lithology for the Hawthorne formation consists of a gray to bluish-green, plastic, phosphatic, sandy clay and thin beds of sand and sandy limestone.

2.2.3 Climate

The Mill Cove Bombing Site area weather is characterized by long, warm, humid summers and mild winters. The normal daily maximum temperature in July is 92 degrees Fahrenheit. The normal daily minimum temperature in January is 43 degrees Fahrenheit. The atmosphere is moist, with an average relative humidity of about 75 percent, ranging from about 90 percent in the early morning to 55 percent during the afternoon. Rainfall is heaviest in the summer, typically from local thundershowers, with approximately 60 percent of the annual total occurring from June through October in an average year. Tropical storms can affect the area from early June through mid November.

2.2.4 Hydrology

Most of the terrain surrounding Mill Cove is wet, flat and marshy, with warm wet soils that are either permanently or seasonally saturated with water. Surface water flows directly into Doctors Lake, which drains into the St. Johns River immediately north of the site, at the northern tip of Creighton Island. The St. Johns River flows north and empties into the Atlantic Ocean about 30 miles downstream.

2.2.5 Groundwater

There are three aquifers in the site area. The first is the water-table aquifer, which consists of shallow sand or clayey sand that contain water under water-table conditions. This aquifer will yield sufficient water to most domestic wells, but is unpotable due to salt content. The second aquifer is the artesian aquifer, which consists of limestone and sand layers and produces enough water for domestic use and other small supplies. The third aquifer is the Floridan aquifer, which consists of hundreds of meters of soft, porous

limestone and hard, dense limestone and dolomite that act as a hydrologic unit. The Floridan aquifer has high permeability in a lateral direction and a low permeability in a vertical direction. Water in the Floridian aquifer is under artesian conditions in the site area, and has an extremely high recharge rate, as great as 35 cubic feet per day in some areas. Public water supply for the immediate area around Mill Cove is supplied from the Floridan aquifer with well depths from 900 to 1000 feet below land surface.

2.2.6 Significant Structures

There are nearby public boat ramps and the lake is open to public use for recreational purposes. An elementary school (Fleming Island Elementary School) is located outside the Bombing Range MRS, just to the southwest of the boundary (Figure 2.2). There are greater than 26 inhabited structures within a two-mile radius of the MRS.

2.2.7 Demographics

2.2.7.1 The Mill Cove Bombing Site is located in northeastern Clay County, Florida. The demographics information for Clay County was obtained from the 2000 United States Census Bureau website (Clay County - http://quickfacts.census.gov/qfd/states/12/12083.html and from the American Fact Finder Fast Access to Information link on the United States Census Bureau website (http://factfinder.census.gov/home/saff/main.html?_lang=en) (U.S. Census Bureau, 2000). Based on census data for the year 2006, the population of Clay County, Florida is approximately 178,899. Based on census data for the year 2000, Clay County had 234 persons per square mile.

2.2.7.2 The following demographic data are based on 2006 census data. The segment of the population in Clay County under the age of 18 is 24.27%, while 10.0% are over the age of 65. There are 50,243 households within the county with an average household size of 2.77 persons. The occupational breakdown, by number of persons, in the county is as follows:

- Management, professional, and related occupations –28,250
- Service occupations – 13,021
- Sales and office occupations – 26,482
- Farming, fishing, and forestry occupations – 194
- Construction, extraction, and maintenance occupations – 11,482
- Production, transportation, and material moving occupations – 8,997

2.2.7.3 As noted in Table 2.1, approximately 75,376 individuals live within a 4-mile buffer of Mill Cove Bombing Site. Figure 2.3 depicts the 2000 Census Bureau census blocks and population in the vicinity of the site.

Table 2.1
Population within 4-Mile Buffer of the Site

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
3,267	321	898	4,347	9,638	25,646	31,259	75,376

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 boundary, or buffer line.

2.2.8 Current and Future Land Use

The State of Florida owns the water area of Doctors Lake. The shoreline areas are owned by Pace Enterprises, a privately held company, or the individual homeowners in the subdivision. There are nearby public boat ramps and the lake is open to public use for recreational purposes. An elementary school (Fleming Island Elementary School) is located outside the Bombing Range MRS, just to the southwest of the boundary. The future land use is not expected to change

2.2.9 Site Ownership and History

The Mill Cove Bombing Site was used by Jacksonville NAS from April 1941 until late 1945, or early 1946 (exact termination date not found), as a practice bombing and strafing target. Mill Cove is located on the eastern side of Doctors Lake, Clay County, Florida, and to the south of the City of Jacksonville. The Mill Cove Bombing Site was a water target that consisted of approximately 160 acres. The target consisted of a pyramid-shaped raft of palmetto logs, painted yellow. Some of the property boundary extended onto the shoreline east and southeast from the target center. During late 1945 or early 1946, the practice bombing and strafing operations were terminated at the site in conjunction with an effort by nearby homeowners to have Doctors Lake declared a fish preserve. No evidence of a clearance memorandum was discovered by the ASR team. The waters of Mill Cove and adjacent Doctors Lake are managed by the State of Florida. Lands surrounding the cove are privately owned.

2.3 SITE OPERATIONS AND WASTE CHARACTERISTICS

2.3.1 Munitions Response Site-Specific Descriptions/Operations

The Mill Cove Bombing Target consists of a single MRS totaling 649 acres (CEMVS, 2004), as shown on Figures 2.1 and 2.2. The MRS (Bombing Range MRS) extends beyond the original FUDS boundary (160 water acres). A description of the MRS is summarized below. The ASR Supplement assigned a risk assessment code (RAC) score for the MRS based on the evaluation of hazard severity (type of munitions) and hazard probability.

- **Bombing Range MRS.** This 649-acre area, predominately water-covered, was used to by pilots and aircraft from Jacksonville NAS to train in air-to-

ground gunnery technique and practice bombing. Munitions used at the bombing and strafing range included AN-Mk 5, An-Mk 23, and AN-Mk 43 Miniature Practice Bombs with AN-Mk 4 spotting charges; Mk 15 series practice bombs (100 lbs); Mk 6, Mk 7, Mk 4, and Mk 5 practice bomb signals; and .50-caliber ammunition. No MEC has been reported or discovered since site closure; however, according to a 2007 interview with a local water-skier (Elliot, 2007), local divers have reportedly pulled MD (in the form of miniature lead practice bombs without spotting charges) out of Mill Cove. A RAC score of 4, indicating low risk, was assigned to the MRS.

2.3.2 Regulatory Compliance

The USACE conducted the SI at the Mill Cove Bombing Site as part of FUDS response activities pursuant to and in accordance with the guidance, regulations, and legislation listed in Subchapter 1.2.

2.4 PREVIOUS INVESTIGATIONS

Parsons performed a historical document review for the Mill Cove Bombing Site. Documents reviewed included the 1994 Inventory Project Reports (INPR, 1994), the 2002 ASR (CEMVS, 2002), and the 2004 ASR Supplement (CEMVS, 2004).

2.4.1 1994 Inventory Project Report

In September 1994, the CESAJ prepared an INPR and Findings and Determination Eligibility (FDE) that confirmed the location and historical use of the site and determined that the site was eligible for the FUDS program. The INPR team did not encounter MEC or MD during the 1994 site visit. However, the field team was not successful in gaining access to the shoreline surrounding Mill Cove. The INPR assigned the site a RAC score of 3, indicating moderate risk, based on the historical use of practice bombs with spotting charges.

2.4.2 2002 Archives Search Report

The ASR was completed by USACE, St. Louis District (CEMVS) in August 2002. The ASR was prepared after reviewing available records, interviews, site inspection, analysis and reports that documented the history of the site. The ASR documents a field visit, community interviews, and confirmation of a range at the site. The ASR team did not find MEC or MD. Again, access to the shoreline was not accomplished and the ASR focused on the anecdotal information and historical documents when assigning the site a RAC score of 4, indicating low risk.

2.4.3 2004 Archives Search Report Supplement

The ASR Supplement was prepared by CEMVS as a supplement to the 2002 ASR. The supplement provides site specific details such as range munitions used, periods of use, and site coordinates based on previous studies and investigations conducted on the Mill Cove Bombing Site. The 2004 ASR Supplement identified one MRS and increased

the suspected acreage from 160 to 649, which extends radially outward from the center of the target. Because a range safety fan is included when determining the MRS boundary and acreage, the boundary of the MRS falls outside the original property boundary and the MRS acreage exceeds that of the original property acreage. The ASR Supplement re-evaluated the site and agreed with the previously assigned RAC score of 4. No other investigations have been conducted to date. No MEC has been reported or discovered since site closure; however, according to a 2007 interview with a local water-skier (Elliot, 2007), local divers have reportedly pulled MD (in the form of miniature lead practice bombs without spotting charges) out of Mill Cove.

2.4.4 Defense Environmental Programs (DEP) Annual Report to Congress

The Defense Environmental Programs (DEP) Annual Report to Congress for fiscal year 2007 had no available data recorded in the MMRP Inventory (DEP, 2008) other than the concurring acreage (649 acres) and MRS listing.

Figure 2.1

Site Setting
Mill Cove Bombing Site
FUDS Project No. I04FL037701

Clay County, Florida

Legend

- MRS Boundary
- FUDS Boundary

Site Location in Florida

N

Image Source: USGS Topo Quadrangles, 1993
Projection: UTM Zone 17 NAD83, Map Units in Meters

2,000 1,000 0 2,000 Feet

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY: BT	**Site Setting**		
DRAWN BY: BT			
CHECKED BY: IN	SCALE: As Shown	PROJECT NUMBER: 744647.70000	
SUBMITTED BY: DS	DATE: September 2008	PAGE NUMBER: 2-7	
	FILE: X:\GIS\Site_inspections_ne\Maps\millcove_FL\Fig2_1.mxd		

Figure 2.2

Site Setting
Mill Cove Bombing Site
FUDS Project No. I04FL037701

Clay County, Florida

Legend

- MRS Boundary
- FUDS Boundary

Site Location in Florida

N

Image: 2006 Orthophoto
Projection: UTM Zone 17 NAD83, Map Units in Meters

2,000 1,000 0 2,000 Feet

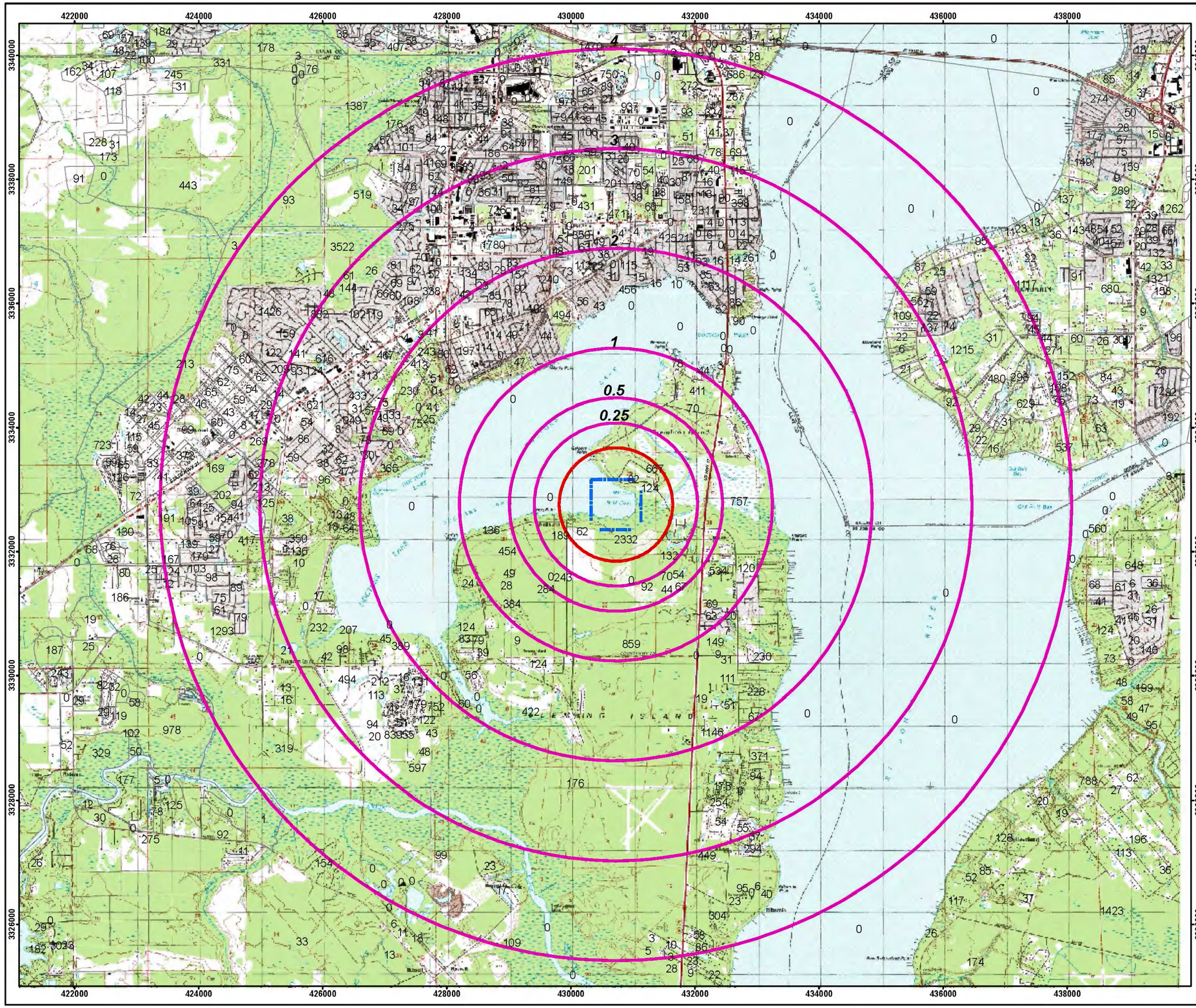
PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY: BT	Site Setting	
DRAWN BY: BT	SCALE: As Shown	PROJECT NUMBER: 744647.70000
CHECKED BY: IN	DATE: September 2008	PAGE NUMBER: 2-8
SUBMITTED BY: DS	FILE: X:\GIS\Site_inspections_ne\Maps\millcove_FLFig2_1.mxd	

Figure 2.3

2000 Census Data
Mill Cove Bombing Site
FUDS Project No. I04FL037701

Clay County, Florida



Legend

- 4 — 2000 Census Block Boundary with Total Population
- MRS Boundary
- FUDS Boundary
- Buffer (Mile)

Site Location in Florida

N

Image Source: USGS Topo Quadrangles, 1993
Projection: UTM Zone 17 NAD83, Map Units in Meters

1 0.5 0 1 Miles

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY: BT	2000 Census Data		
DRAWN BY: BT			
CHECKED BY: IN	SCALE: As Shown	PROJECT NUMBER: 744647.70000	
SUBMITTED BY: DS	DATE: September 2008	PAGE NUMBER: 2-9	
	FILE: X:\GIS\Site_inspections_new\Maps\millcove_FL\Fig2_3.mxd		

CHAPTER 3
SITE INSPECTION TASKS

3.1 HISTORICAL RECORD REVIEW

The existing body of information pertinent to the Mill Cove Bombing Site was thoroughly reviewed in advance of the TPP Meeting and summarized to the TPP Team as part of the development and concurrence of the selected Technical Approach for the site. Documents reviewed included the 1994 INPR (CESAJ, 1994), the 2002 ASR (CEMVS, 2002), and the 2004 ASR Supplement (CEMVS, 2004). Sampling locations and Qualitative Reconnaissance (QR) planning, as presented in the Site-Specific Work Plan (SS-WP) Addendum and implemented during the SI were the direct result of this review process. This information has been augmented with institutional knowledge and additional documentation provided by CESAJ or obtained by Parsons during coordination of the field effort. As part of mobilization preparation for the SI, the site visit team (SVT) became re-familiarized with all existing site information.

3.2 TECHNICAL PROJECT PLANNING

The Mill Cove Bombing Site falls under the purview of the CESAJ, which facilitated a TPP meeting on October 31, 2007. Participants included representatives of the CESAJ, USAESCH, Parsons, and the Florida Department of Environmental Protection (FDEP). The purpose of the TPP meeting was to develop the technical approach presented in the Final TPP Memorandum (Parsons, 2008a) (see Appendix B). Key TPP findings and decisions are summarized below:

- The TPP Team concurred with the Technical Approach (supporting an anticipated RI/FS) as presented and refined at the TPP meeting on October 31, 2007 inclusive of number, type, and location of samples as well as sampling methodology and laboratory analyses.

- The TPP Team agreed not to sample surface soil and groundwater during the SI. Surface water and sediment are the primary exposure media at this site and thus, would be the only media sampled during the SI.

- The TPP Team agreed not to analyze the samples for potassium because this MC is considered an essential nutrient. The TPP Team also agreed to not include perchlorate in the list of analytes because the surface water from Mill Cove is not used for drinking water.

- The sediment sampling technique used at the Mill Cove Bombing Site would be that which was implemented during the 2007 Ft. Lauderdale Bombing Target SIs.

- The TPP Team concurred with the location of the seven sediment samples and surface water samples, but agreed to allow flexibility for the SVT to move samples or QR paths due to unknown physical or natural obstacles or MD findings. The sample locations are shown on Figure 5.1.

- Mill Cove is subject to tidal flows and as such, the field work would be conducted at low tide.

- The TPP Team agreed that the Florida Administrative Code (FAC) 62-777, freshwater sediment and freshwater surface water screening levels and the Ecological Screening Values would be used in comparison to the sampling results in the Screening Level Risk Assessment.

- An explanation of the range configuration, including a detailed explanation of the range safety area, would be included in this SI Report to address potential concerns of the public. Additionally, this SI Report would emphasize that the sample locations are highly biased to finding potential MC contamination and do not necessarily reflect the conditions throughout the site.

- The safety officer at the Jacksonville NAS, Ron Williamson, is an unofficial historian and may have flight maps of the area showing the flight path of the bombing and strafing runs at the Mill Cove Bombing Site. Charles Fales was going to provide Mr. Williamson's contact information to Parsons so that Mr. Williamson can be contacted for any information that he may have about the Mill Cove target. However, this information was given to the USACE, St. Louis District and has already been incorporated into the ASR.

- The issue of dredging in Mill Cove was discussed at the TPP meeting. The FDEP Northeast District (NED) would be the agency with the knowledge of whom, if anyone, may have dredged Mill Cove. Tread Kissam agreed to check with the appropriate division to see if dredging has been conducted. Parsons has contacted FDEP in follow-up for this information. Mr. Kissam is no longer with FDEP and alternative contacts are being sought. Any relevant information will be included in the Draft Final SI report. No issue is expected that will affect the current recommendation.

- It was discussed during the TPP meeting that the Mill Cove Bombing Site is an ecologically important site given the potential for the presence of the West Indian (Florida) manatee, red-cockaded woodpecker, and bald eagle.

3.3 NON-MEASUREMENT DATA COLLECTION

3.3.1 The following sources were consulted for identifying environmental and cultural resources at Mill Cove Bombing Site:

- Topographic Map – U.S. Geological Survey (USGS)
- Wetlands Online Mapper – National Wetlands Inventory (NWI), U.S. Fish and Wildlife Service (USFWS)
- Threatened and Endangered Species System (TESS) – Endangered Species Program, U.S. Fish and Wildlife Service

- National Wildlife Refuge System (NWRS) – USFWS
- Florida Endangered and Threatened Species – Florida Fish and Wildlife Conservation Commission (FWC)
- Florida Fish and Wildlife Conservation Commission (FWC)
- Florida Department of Agriculture and Consumer Services (DOACS)
- Florida Natural Areas Inventory (FNAI) – Marion County
- National Register Information System (NRIS) – National Register of Historic Places (NRHP), National Park Service (NPS)
- List of National Historic Landmarks (NHL) – National Historic Landmarks Program, NPS
- List of National Heritage Areas (NHA) – National Heritage Areas Program, NPS
- Florida State Historic Preservation Office (FL SHPO) – Florida Office of Cultural and Historical Programs (OCHP)
- National Oceanic and Atmospheric Administration (NOAA) - Coastal Zone Management Program (CZMP)
- August 2002 ASR Findings for Mill Cove Bombing Site, Clay County, Florida

3.3.2 According to the NRIS, NHL, NRHP, and NHA databases, there are no recorded archaeological or cultural areas within the Mill Cove Bombing Site. Currently, according to the SHPO FMSF lists, there are no previously recorded cultural resources within the site boundaries. No cultural or archaeological resources were observed by the SVT.

3.3.3 Ecological resources are identified in Subchapter 5.1 of this report.

3.4 SITE-SPECIFIC WORK PLAN ADDENDUM

3.4.1 The SS-WP Addendum (Parsons, 2008b) 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, the environmental protection plan, and the health and safety plan specific to the Mill Cove Bombing Site. The field investigation plan developed a technical approach to guide sample collection and analysis for MEC and MC to ensure that the results were sufficient to determine whether additional investigations or implementation of a remedy are necessary for the site. Key elements of the technical approach included the CSEM to help determine types of samples and their locations, data quality objectives (DQOs) to ensure the data acquired are sufficient to characterize MEC and MC at the site, and QR to confirm known target locations and

evaluate the presence or absence of MEC/MC in remote portions of the site. The SS-WP Addendum included a sampling rationale for each sample location and the latitude and longitude of the final sample locations. The sampling rationale has been updated to show actual conditions observed by the SVT and is included in Table 3.1

3.4.4 The sampling and analysis plan discusses procedures for surface water and sediment sample acquisition from locations biased toward the highest potential for MC contamination; QC and QA for the sampling process; sample shipment to an approved, independent laboratory; and analysis of the samples by the laboratory. The environmental protection plan 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 supplements the programmatic accident prevention plan with site-specific emergency contact information and directions to the nearest hospital.

3.5 DEPARTURES FROM PLANNING DOCUMENTS

There were minor deviations from the approved planning documents (i.e. SS-WP Addendum) during the SI phase of the project. These deviations are described below.

- The SVT attempted to follow the proposed QR track as much as possible. Due to wetlands and thick vegetation, the land QR path was slightly modified during the SI field effort. The actual QR paths and locations of the samples collected are discussed in more detail in the MRS-specific sections in Chapter 5.
- The proposed location for the two ambient surface water and sediment samples were not accessible to the SVT due to vegetative growth along the shoreline of the cove. The field team leader moved the ambient sampling points to more accessible locations.
- Some of the ecological screening values in the SS-WP Addendum were incorrect (SSWP Tables 4.5a and 4.5b). The references cited by the Programmatic Sampling and Analysis Plan (USACE 2005) were used to obtain the appropriate Ecological Screening Values (ESVs) for surface water and when appropriate for sediment. ESVs were obtained using the sources indicated in the PSAP. All sources are cited in Subchapter 6.3.

TABLE 3.1
SAMPLING RATIONALE
MILL COVE BOMBING SITE, CLAY COUNTY, FLORIDA

Sample ID	Sample Coordinates Longitude	Latitude	Media	Analysis	Historical Use of Munitions in Area	Rationale
MC-MRS01-SD-01	-81.721912496	30.122245558	Sediment	Explosives, Select Metals	.50-caliber Small Arms Ammunition; An-Mk 5, AN-Mk 23, AN-Mk 43, Practice; Mk 15 series, Practice Bomb, 100 lbs; Signal, Practice Bomb, Mk 6; Signal, Practice Bomb, Mk 7; Signal, Practice Bomb, Mk 5; Signal, Practice Bomb, Mk 4	Along the shoreline of Mill Cove to reflect possible contamination from DoD bombing and strafing activities
MC-MRS01-SD-02	-81.719103661	30.124230086	Sediment	Explosives, Select Metals	Same as above	At the center of Mill Cove to reflect possible contamination from DoD bombing and strafing activities
MC-MRS01-SD-03	-81.716032214	30.123325007	Sediment	Explosives, Select Metals	Same as above	Along the shoreline of Mill Cove to reflect possible contamination from DoD bombing and strafing activities
MC-MRS01-SD-04	-81.718795932	30.124935268	Sediment	Explosives, Select Metals	Same as above	At the center of Mill Cove to reflect possible contamination from DoD bombing and strafing activities
MC-MRS01-SD-05	-81.719507224	30.127298699	Sediment	Explosives, Select Metals	Same as above	Along the shoreline of Mill Cove to reflect possible contamination from DoD bombing and strafing activities
MC-OB-SD-06	-81.723743663	30.133119615	Sediment	Explosives, Select Metals	None	Outside target area and outside Mill Cove; to serve as ambient metals data; explosives analysis to verify that the sample is ambient
MC-OB-SD-07	-81.72016992	30.136875659	Sediment	Explosives, Select Metals	None	Outside target area and outside Mill Cove; to serve as ambient metals data; explosives analysis to verify that the sample is ambient
MC-MRS01-SW-01	-81.721912496	30.122245558	Surface Water	Explosives, Select Metals	.50-caliber Small Arms Ammunition; An-Mk 5, AN-Mk 23, AN-Mk 43, Practice; Mk 15 series, Practice Bomb, 100 lbs; Signal, Practice Bomb, Mk 6; Signal, Practice Bomb, Mk 7; Signal, Practice Bomb, Mk 5; Signal, Practice Bomb, Mk 4	Along the shoreline of Mill Cove to reflect possible contamination from DoD bombing and strafing activities
MC-MRS01-SW-02	-81.71911114	30.124235323	Surface Water	Explosives, Select Metals	Same as above	At the center of Mill Cove to reflect possible contamination from DoD bombing and strafing activities
MC-MRS01-SW-03	-81.716007154	30.123326682	Surface Water	Explosives, Select Metals	Same as above	Along the shoreline of Mill Cove to reflect possible contamination from DoD bombing and strafing activities
MC-MRS01-SW-04	-81.718797278	30.124903981	Surface Water	Explosives, Select Metals	Same as above	At the center of Mill Cove to reflect possible contamination from DoD bombing and strafing activities
MC-MRS01-SW-05	-81.719521007	30.127309583	Surface Water	Explosives, Select Metals	Same as above	Along the shoreline of Mill Cove to reflect possible contamination from DoD bombing and strafing activities
MC-OB-SW-06	-81.72373432	30.133101137	Surface Water	Explosives, Select Metals	None	Outside target area and outside Mill Cove; to serve as ambient metals data; explosives analysis to verify that the sample is ambient
MC-OB-SW-07	-81.720203121	30.136901272	Surface Water	Explosives, Select Metals	None	Outside target area and outside Mill Cove; to serve as ambient metals data; explosives analysis to verify that the sample is ambient

CHAPTER 4
MEC FINDINGS

4.1 GENERAL INFORMATION

4.1.1 Based on a preliminary assessment of the FUDS-eligible MRS at Mill Cove Bombing Site, it was determined that this site potentially had MEC/MD at the bottom of the cove or potentially along the shoreline. As a result, QR was conducted. This chapter details the overall DQOs, MEC history, and inspection activities for the MRS.

4.1.2 The primary task of the SI is to determine whether MEC and MC may be present at the site. The field visit to Mill Cove Bombing Site took place from April 6 through 8, 2008. To assess the presence of MEC, the field team conducted QR in the accessible land areas within the FUDS-eligible boundary of the Bombing Range MRS. Mill Cove Bombing Site is a former water target. Site QR predominately consisted of limited visual reconnaissance, via boat, of Mill Cove, and a limited walking QR, totaling approximately 1,100 feet, of accessible shoreline to identify indicators of suspect areas, including earthen berms, distressed vegetation, stained soil, ground scars or craters, target remnants, and visible metallic debris. Most of the shoreline was inaccessible because of the presence of wetlands.

4.1.3 QR was primarily conducted along the route prescribed in the SS-WP Addendum (Parsons, 2008b). Some deviation from the proposed route occurred as a result of wetlands and terrain issues (thick vegetative growth along the shore). The team recorded field observations if debris or unique site features or visual indicators were observed or if a sample was collected. No MD was observed during the SI. Additionally, observations were recorded when there was a change in terrain or other barriers were encountered, or if there had been no variations since the last observation (approximately 15 minutes of no change). Figure 4.1 shows the QR routes and observation locations. The observation location numbers correspond to the photo station numbers documented in the photo documentation log (Appendix E). The QR route was not limited to the proposed path depicted in the SS-WP Addendum, but was determined in the field by the field team leader (FTL) based on considerations such as location, site size and complexity, vegetation, professional judgment, and areas of predetermined focus (Parsons, 2005). Table 4.1 presents the potential MEC anticipated to be present at the site based on the ASR and ASR Supplement (CEMVS, 2002 and CEMVS, 2004). The potential constituents of the supposed MEC are also listed in this table. The MEC CSM and conceptual site exposure model (CSEM) are included in Appendix J.

Table 4.1
Chemical Composition of MEC and Potential Munitions Constituents
Mill Cove Bombing Site, Clay County, Florida

General Munitions Type	Type/Model	Case Composition	Filler	Potential Constituent
Small Arms Ammunition .50-cal. with gilding metal jacket	M2 Ball M2 Armor Piercing (AP M1 Tracer M10 Tracer M17 Tracer M21 Tracer M1Incendiary M23 Incendiary M1 Blank Propellant Primer, Percussion	Brass, steel, aluminum	Lead antimony Tungsten chrome steel Tracer Composition Tracer Composition Tracer Composition Tracer Composition Incendiary Composition Incendiary composition Single based powder Primer Composition	Calcium, iron, strontium, lead, magnesium, molybdenum, antimony, potassium, perchlorate
Miniature Practice Bomb	AN-Mk 5, AN-Mk 23, AN-Mk 43	Cast Iron, Cast Lead, Zinc Alloy, Aluminum,	Inert	Lead, iron, aluminum, zinc
100 lbs Practice Bomb	Mk 15 Series Mod 2 uses no signal Mod 3 uses Mk 7 signal Mod 4 uses Mk 4 signal		Wet sand or water	Iron
Practice Bomb Signal	Mk 6	Steel	Black Powder, Smokeless Powder	Potassium, iron
Practice Bomb Signal	Mk 7	Steel	Black Powder, Smokeless Powder	Potassium, iron
Miniature Practice Bomb Signal	Mk 5	Plastic	Fluorescein Dye	

Table 4.1
Chemical Composition of MEC and Potential Munitions Constituents
Mill Cove Bombing Site, Clay County, Florida

General Munitions Type	Type/Model	Case Composition	Filler	Potential Constituent
Miniature Practice Bomb Signal	AN-Mk 4	Cardboard/ aluminum	Titanium Tetrachloride, Smokeless Powder, Red Phosphorus, Zinc Oxide	Dinitrotoluene, dibutylphalate, diphenylamine, zinc

(1) – For this site, lead, antimony, and copper will be the primary constituents used to identify small arms ammunition contamination. This approach was agreed to by the TPP Team.

(2) – Explosives constituents in small arms are confined to the cartridge only and are expended to project the bullets.

4.1.4 The SVT initiated the QR by guiding the boat to a private dock within Mill Cove and walking to the dry land where Parsons had approved rights of entry (ROE). The SVT used a Schonstedt GA-92XT*i* magnetometer for safety purposes while traversing the land QR. The SVT did not observe MEC or MD during the site visit to the Bombing Range MRS. What appears to be a remnant of the wooden target was observed near the target center in the cove. No other structures, craters, stressed vegetation, or other visual indicators were noted by the SVT. Table 4.2 summarizes the findings for the Mill Cove Bombing Site.

Table 4.2
Summary of Qualitative Reconnaissance Observations
Mill Cove Bombing Site, Clay County, Florida

MRS	MEC	Munitions Debris	Munitions-Related Features
Bombing Range MRS	**None**	None	Possible target remnant near center of cove.

4.1.5 Five biased surface water and sediment samples were collected in areas of the cove believed to be most likely impacted by disposal or munitions-related training activities. Two surface water and sediment samples were collected outside Mill Cove in areas believed to be least likely impacted by training activities, to represent ambient site conditions. Sample locations are shown on Figure 5.1. Sampling results are presented in Chapter 5.

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, 2005), Parsons followed the *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4, EPA/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 approved the Mill Cove Bombing Site DQOs at the TPP meeting on October 31, 2007. Appendix B presents TPP documentation. Tables 4.3 through 4.6 present the DQO worksheets. *All the DQOs for the MRS have been met.*

4.2.1.3 As stated in Subchapter 1.2, Paragraph 1.2.4 of this SI Report, data must be sufficient to do the following: 1) determine the potential need for a removal action; 2) enable HRS scoring by USEPA; 3) characterize the release for initiation of RI/FS, if necessary; 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 DQO

The MEC DQO was achieved by evaluating potential presence of MEC at Mill Cove Bombing Site. The QR team searched for visual evidence of MEC/MD including non-direct evidence of range activity such as the visual indicators listed in paragraph 4.1.2. No MEC or MD was found within the Bombing Range MRS by the SVT. What appears to be a remnant of the wooden target was observed near the target center in the cove. No other structures, craters, stressed vegetation, or other visual indicators were noted by the SVT. Appendix D contains the field notes detailing the specific observations by the SVT. Appendix E contains photograph documentation of observations made by the SVT.

4.2.3 Munitions Constituents DQO

The MC DQO was achieved by evaluating potential presence of MC in and around Mill Cove. Explosives and indicator metals identified in the SS-WP Addendum were analyzed as agreed in the TPP Meeting on October 31, 2007. A summary of the MC known to occur in the MEC known or suspected used at Mill Cove Bombing Site is provided in Table 4.1. Chapter 5 presents the MC sampling results.

4.2.4 Munitions Response Site Prioritization Protocol DQO

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

4.2.5 Hazard Ranking System DQO

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, ASR, 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.

4.3 BOMBING RANGE MUNITIONS RESPONSE SITE

4.3.1 Historical MEC Information

Information provided in the INPR, ASR, ASR Supplement, reported findings, visual observations, and other sources was used to develop the list of known or potential MEC items for Mill Cove Bombing Site. Munitions used at the bombing and strafing range included AN-Mk 5, An-Mk 23, and AN-Mk 43 Miniature Practice Bombs with AN-Mk 4 spotting charges; Mk 15 series practice bombs (100 lbs); Mk 6, Mk 7, Mk 4, and Mk 5

practice bomb signals; and .50-caliber ammunition (Table 4.1). Possible MD was reported by citizens as removed from the site by divers in the past. Charles D. Fales gave a statement that, as a kid, he found several small practice bombs at the bottom of Mill Cove. He would collected these inert practice bombs and sell them for scrap (Fales, Charles D., 2008).

4.3.2 Inspection Activities

The SI effort for Mill Cove Bombing Site was conducted from April 6 through 8, 2008. Five biased surface water and sediment samples and two ambient surface water and sediment samples were collected from this MRS. Three field team members completed QR in the small area of accessible shoreline where ROE was granted. No MD or MEC was observed. Figure 4.1 illustrates the completed QR path as well as observation locations. Appendix E contains photo documentation of the findings. The sample locations are shown on Figure 5.1.

Table 4.3
MEC DATA QUALITY OBJECTIVE WORKSHEET

SITE: **Mill Cove Bombing Range, Clay County, FL**
PROJECT: **MMRP Site Inspection / FUDS No. I04FL037701**

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 MEC.	Y
Intended Need Requirements:			
2	Data User Perspective(s)	Risk, Remedy	Y
3	Contaminant or Characteristic of Interest	MEC, Munitions Debris	Y
4	Media of Interest	N/A	N/A
5	Required Sampling Locations or Areas and Depths	Focus on shoreline, where ROE can be obtained and outside of the marshy areas	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	Y

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

Table 4.4
MC DATA QUALITY OBJECTIVE WORKSHEET

SITE: **Mill Cove Bombing Range, Clay County, FL**
PROJECT: **MMRP Site Inspection / FUDS No. I04FL037701**

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	Explosives and specific metals.	Y
4	Media of Interest	Sediment / surface water	Y
5	Required Sampling Locations or Areas and Depths	As determined by the TPP Team, see Figures 5.1 and 5.2.	Y
6	Number of Samples Required	7 surface water sample and sediment sample couples (including 2 ambient couples) plus associated QC samples	Y
7	Reference Concentration of Interest or Other Performance Criteria	Sediment screening levels to include the Florida Administrative Code (FAC) 62-777 freshwater sediment screening levels and Ecological Screening Levels. Surface Water screening levels to include the Florida Administrative Code (FAC) 62-777 freshwater surface water screening levels and the Ecological Screening Levels.	Y
Appropriate Sampling and Analysis Methods:			
8	Sampling Method	Discrete samples in accordance with the FDEP and TPP Team concurrence	Y
9	Analytical Method	Explosives - SW8321A; Metals -SW6010B or SW6020	Y

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

TABLE 4.5
MRSPP DATA QUALITY OBJECTIVE WORKSHEET

Site: Mill Cove Bombing Site
Project: MMRP Site Inspection / FUDS No. I04FL037701

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
		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

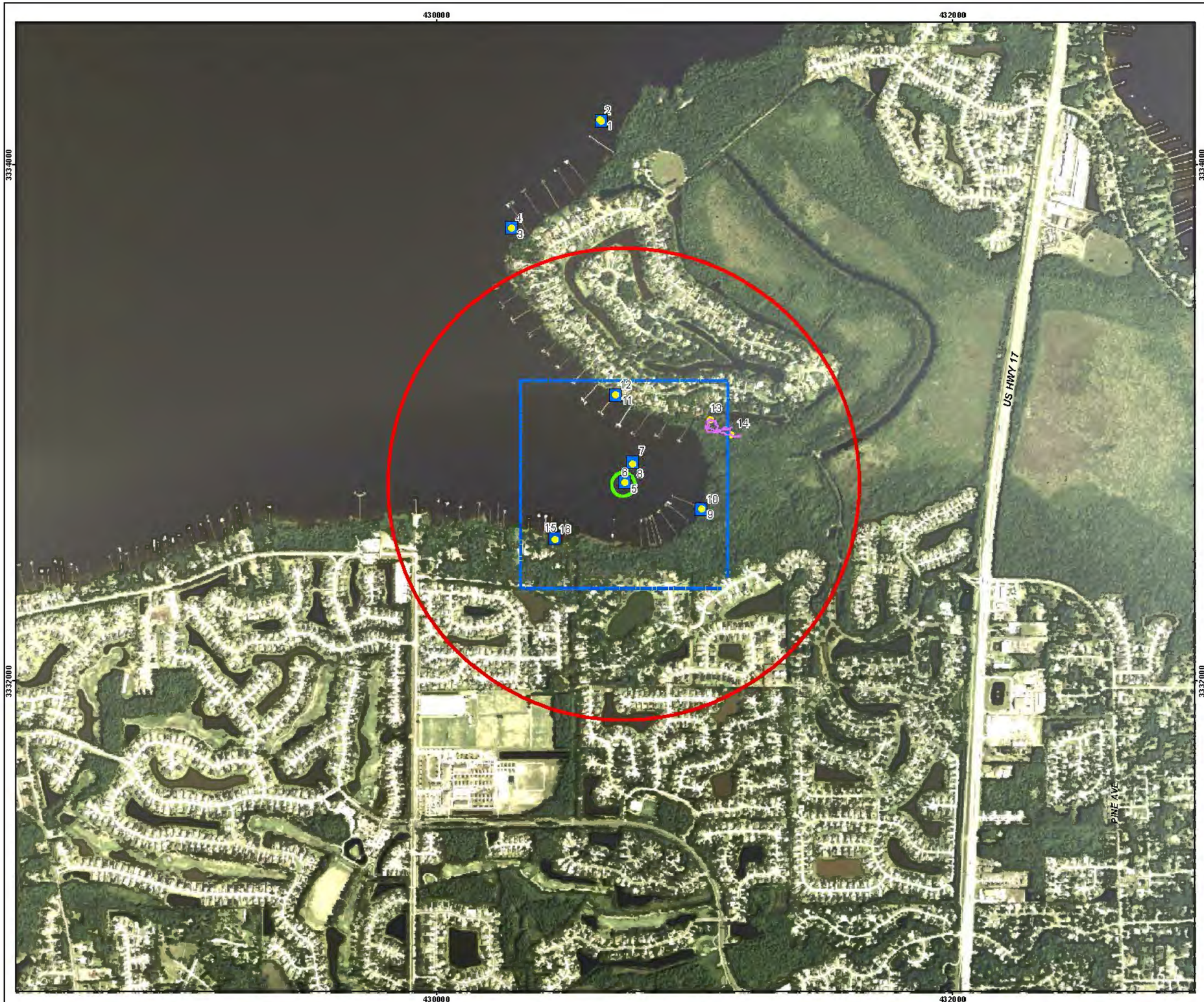
Site: Mill Cove Bombing Site
Project: MMRP Site Inspection / FUDS No. I04FL037701
DQO Statement Number: 4 of 4

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		N/A
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 4.1

Qualitative Reconnaissance and Field Observation Locations
Mill Cove Bombing Site
FUDS Project No. I04FL037701

Clay County, Florida



Legend

- Field Observation Location
- Surface Water and Sediment Sample Location
- MRS Boundary
- Bombing Target
- FUDS Boundary
- Qualitative Reconnaissance Track

Site Location in Florida

N

Image: 2006 Orthophoto
Projection: UTM Zone 17 NAD83, Map Units in Meters

1,000 500 0 1,000 Feet

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY: BT	Qualitative Reconnaissance and Field Observation Locations	
DRAWN BY: BT		
CHECKED BY: IN	SCALE: As Shown	PROJECT NUMBER: 744647.70000
SUBMITTED BY: DS	DATE: September 2008	PAGE NUMBER: 4-11
	FILE: X:\GIS\Site_inspections_ne\Maps\millcove_FUDFig4_1.mxd	

CHAPTER 5
MIGRATION/EXPOSURE PATHWAYS AND RECEPTORS

5.1 INTRODUCTION

5.1.1 This chapter of the SI report evaluates the potential presence or absence of migration/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 conceptual site exposure model (CSEM) for the former Mill Cove Bombing Site (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 elements 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 described above, all four factors are present and, therefore, the groundwater exposure pathway is complete. If any single factor was absent (e.g., the MC contamination was not present in soil, or the resident obtained drinking water from another source), then the pathway would be incomplete.

5.2 GENERAL INFORMATION

General information regarding the geology, hydrogeology, and hydrology of the Mill Cove Bombing Site presented below was obtained from the ASR (CEMVS, 2002), except where noted. Regional information is followed by a discussion of MRS-specific characteristics and sampling results for the MRS investigated as part of the SI.

5.2.1 Regional Geologic and Hydrogeologic Setting

5.2.1.1 The Mill Cove Bombing Site is inland from the Atlantic coastline on the western part of Creighton Island. This area is within the Floridian section of the Coastal

Plain Province. The land surface is typically marshy and is covered with water for most of the year. The area is underlain by an average of nearly 4,000 feet of sedimentary rock that ranges in age from the early Paleozoic era to the Recent, and is composed of quartz sand, clay and shell, that have not been accurately delineated and named. The Mill Cove Bombing Site is located in the Eastern valley physiographic region, which consists mostly of flatwoods and swamps with soils that are sandy and poorly drained.

5.2.1.2 There are three aquifers in the site area. The first is the water-table aquifer, which consists of shallow sand or clayey sand that contain water under water-table conditions. This aquifer will yield sufficient water to most domestic wells, but is not potable due to salt content. The second aquifer is the artesian aquifer, which consists of limestone and sand layers and produces enough water for domestic use and other small supplies. The third aquifer is the Floridan aquifer, which consists of hundreds of meters of soft, porous limestone and hard, dense limestone and dolomite that act as a hydrologic unit. The Floridan aquifer has high permeability in a lateral direction and a low permeability in a vertical direction. Water in the Floridan aquifer is under artesian conditions in the site area, and has an extremely high recharge rate, as great as 35 cubic feet per day in some areas.

5.2.2 Regional Groundwater Use

Twenty-eight active groundwater water wells are known to exist within a 4-mile buffer zone from the site, as shown in Table 5.1 and Figure 5.2. There are two active, public water supply wells within the MRS (FUDS-eligible boundary). Drinking water for the area of the MRS is supplied by the Clay County Utility Authority (CCUA) and takes the water at a depth of 900 to 1000 feet from the Floridan aquifer. The population in the vicinity of the Mill Cove Bombing Site is detailed in Table 5.2.

Table 5.1
Active Groundwater Wells in the Vicinity of the Mill Cove Bombing Site

Distance from MRS	Total
On-site	0
0 to ¼ mile	0
¼ to ½ mile	2
½ to 1 mile	0
1 to 2 miles	5
2 to 3 miles	7
3 to 4 miles	14
On-site to 4 miles	28

Table 5.2
Population Information in the Vicinity of the Mill Cove Bombing Site

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
3,267	321	898	4,347	9,638	25,646	31,259	75,376

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 boundary, or buffer line.

5.2.3 Regional Hydrologic Setting

Most of the terrain surrounding Mill Cove is wet, flat and marshy, with warm wet soils that are either permanently or seasonally saturated with water. Surface water from the site flows directly into Doctors Lake (flow is in the opposite direction as well), which drains into the St. Johns River immediately north of the site, at the northern tip of Creighton Island. The St. Johns River flows north, and empties into the Atlantic Ocean about 30 miles downstream.

5.2.4 Regional Sensitive Ecological Resources

5.2.4.1 Mill Cove Bombing Site is not located within a national wildlife refuge, national park, national forest, or state park and there are no identified or designated ecological resources located on the site. However, according to the NOAA Coastal Zone Management Program CZMP, the Mill Cove Bombing Site is within a coastal zone management area. The State of Florida supports 114 federally-listed Threatened and Endangered (T&E) species consisting of 59 animals and 55 plants. According to FNAI and USFWS, seven of these federally listed species are known to exist in Clay County and potentially occurring within the FUDS or bombing range boundary. These seven species are the Florida scrub jay *(Aphelocomma coerulescens)*, wood stork *(Mycteria Americana)*, red-cockaded woodpecker *(Picoides borealis)*, Eastern indigo snake *(Drymarchon couperi)*, West Indian (Florida) manatee *(Trichechus manatus latirostris)*, Shortnose sturgeon *(Acipenser brevirostrum)*, and Chapman's rhododendron *(Rhododendron chapmanii)*. These T&E species potentially occurring on site are shown in Table 5.3. The SVT did not observe any of these species during the field effort.

5.2.4.2 The USFWS Wetlands Online Mapper, through the NWI, was used to identify wetlands within the Mill Cove Bombing Site. These wetland areas are shown in Figure 5.3. The two main wetland types located within the site and nearest to the sample locations are:

- PFO1C - Palustrine, forested, broad leaved deciduous, seasonally flooded, and
- PEM1A/C - Palustrine, emergent, persistent, temporarily flooded/seasonally flooded

5.2.4.3 Other wetlands not identified in the Wetland Online Mapper may be present on the site.

5.2.4.4 Based on the above information and a review of the Army Checklist for Important Ecological Places (USACE, 2006), the Mill Cove Bombing Site is an important ecological place due to the presence of habitat for T&E species and wetlands, and the inclusion of the site in a Coastal Zone Management area. Therefore, ecological receptors are potential receptors for exposure pathways at this site.

5.2.5 Sample Locations/Methods

5.2.5.1 The field work for the Mill Cove Bombing Site SI was conducted on April 7th and 8th, 2008 and included both MC sampling and QR. No intrusive MEC investigations, explosives handling, or MEC detonations were conducted. Extensive QR of the parcels was not conducted beyond a visual assessment to further evaluate the condition of the site. Preliminary QR routes were identified by the TPP Team with the understanding that the SVT may determine alternate routes to accommodate conditions on the ground. Most of the QR occurred using a boat on Mill Cove, proper. The SVT had to slightly alter the shoreline QR path because of swampy areas and thick vegetation that did not allow passage.

5.2.5.2 Based on TPP Team concurrence, surface water and sediment sample "couples" were collected from seven locations (Figure 5.1). Five of the sample locations were selected to represent areas with the highest likelihood for the presence of MEC or MC contamination, per the SS-WP Addendum (Parsons, 2008). Two of the biased samples were collected closest to the center of the target and three biased samples were collected along the shoreline. Two ambient surface water and sediment samples were collected outside the MRS to represent ambient metals concentrations in surface water and sediment (Figure 5.1). The biased sediment samples were collected from planned locations using a disposable plastic scoop attached to a 4-foot plastic handle. Surface water samples were collected directly into glass sample containers from just under the water surface at each location. One field duplicate coupled sample was also collected.

5.2.5.3 Sample locations were guided by the preliminary sample locations identified before the SI team arrived on site. The two ambient sample locations were moved approximately 200 feet from their proposed locations due to accessibility issues for the small boat. Each of the sample locations was recorded with a global positioning system (GPS) unit for later reference.

5.2.5.4 No groundwater, soil, or air samples were collected from the Mill Cove Bombing Site.

5.2.5.5 The collected sediment and surface water samples were packaged and shipped to TestAmerica, formerly Severn Trent Laboratories, in Arvada, Colorado for analysis. The samples were analyzed for explosives (Method SW8321A) and selected total indicator metals (Method SW6010B/SW6020).

5.2.5.6 With the exception of the departures discussed above and in the paragraph 3.5, the sample collection procedures presented in the Sampling and Analysis Plan (USACE, 2005b), the Parsons Final PSAP Addendum (Parsons, 2006b), and in the PWP (USACE, 2005a) were followed.

Table 5.3
Federally and State Listed Threatened and Endangered Species
Potentially Within the Mill Cove Bombing Site FUDS

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat	Habitat potentially present on site?
Shortnose Sturgeon 	*Acipenser brevirostrum*	Endangered	Endangered	Shortnose sturgeon inhabit rivers and estuaries. It is an anadromous fish that spawns in the coastal rivers along the east coast of North America from the St. John River in Canada to the St. Johns River in Florida. It prefers the near shore marine, estuarine and riverine habitat of large river systems. They are benthic feeders. Juveniles are believed to feed on benthic insects and crustaceans. Mollusks and large crustaceans are the primary food of adult shortnose sturgeon.	Yes
Florida Manatee 	*Trichechus manatus*	Endangered	Endangered	Manatees are widely dispersed in summer. Many can be found in estuaries, lagoons, bays and the lower reaches of rivers and canals. On the Gulf Coast they typically roam the waters from the Suwannee River south. On the Atlantic, from coastal Georgia south to Biscayne Bay, especially in the St. Johns River and the Indian River Lagoon system of north and central Florida. In winter the entire U.S. population of manatees resides in Florida waters. During cold snaps that push ocean temperatures below 68°F, manatees seek the warmth of inland waters, natural springs and the warm-water discharge of electric power plants.	Yes

Table 5.3
Federally and State Listed Threatened and Endangered Species
Potentially Within the Mill Cove Bombing Site FUDS

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat	Habitat potentially present on site?
Eastern Indigo Snake 	*Drymarchon couperi*	Threatened	Threatened	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.	Yes
Wood Stork 	*Mycteria americana*	Endangered	Endangered	Areas of freshwater including riparian and wetland habitats. Nests in cypress, mangroves, and dead hardwood trees. Year-round resident.	Yes

Table 5.3
Federally and State Listed Threatened and Endangered Species
Potentially Within the Mill Cove Bombing Site FUDS

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat	Habitat potentially present on site?
Red-Cockaded Woodpecker 	*Picoides borealis*	Endangered	Species of Concern	Live in old-growth (60-70+ years) loblolly, shortleaf, and especially slash and longleaf pine forests. Nesting and roosting cavities are made only in living pine trees over 60 years old, often trees with red-heart disease. These trees produce large amounts of resin around the woodpeckers' cavities. The sap-encrusted tree can resemble a large candle and is often easier to identify than the bird. Ideal colony sites are located in park like stands of pines with little or no understory growth.	Yes
Florida Scrub Jay 	*Aphelocoma coerulescens*	Threatened	Threatened	The Florida scrub-jay is found only in Florida Scrub habitat, an ecosystem found only in central Florida. It is characterized by nutrient-poor soil, occasional drought and frequent wildfires. Because of this somewhat harsh weather pattern, it is host to a small assortment of very specific plants, including sand pines, sand live oak, myrtle oak, Chapman's oak, scrub oak, and various other hardy plants such as cacti.	No

Table 5.3
Federally and State Listed Threatened and Endangered Species
Potentially Within the Mill Cove Bombing Site FUDS

Common Name	Scientific Name	Federal Status	State Status	Preferred Habitat	Habitat potentially present on site?
Chapman's rhododendron 	*Rhododendron chapmanii*	Endangered	Endangered	Low swale in shrubby unburned slash pine [Pinus elliottii] plantation; associates include Lyonia ferruginea, Vaccinium atrococcum [V. corymbosum], V. darrowii, V. myrsinites, Ilex coriacea, I. glabra, Cliftonia monophylla, Serenoa repens, Symplocos tinctoria, Gaylussacia dumosa, and Hypericum microsepalum. Soils - Plummer (Grossarenic Paleaquults).	No

5.2.6 Background Concentrations

5.2.6.1 No site-specific statistical evaluation of background metals concentrations is available. Due to the limited scope of the SI, conducting a site-specific statistical background evaluation of total metals concentrations (which typically requires collection of at least 10 background samples) was not considered practical or warranted at this stage of investigation.

5.2.6.2 To provide an indication of the concentration of metals naturally present in surface water at the site, two ambient surface water (MC-MRS01-SW-06 and MC-MRS01-SW07) samples, as shown in Figure 5.1, were collected during the SI. These ambient samples provide an indication of the range of naturally occurring metals concentrations. These samples were collected outside the target area. No MEC or MD was observed in the vicinity of the ambient sample locations, which suggests that these samples are likely representative of the naturally occurring surface water and sediment in the area. No explosives were detected in the ambient samples. The maximum detected ambient concentration of metals in surface water samples collected at the site was used as the selected background concentrations (Table 5.4).

5.2.6.3 To provide an indication of the concentration of metals naturally present in sediment at the site, two sources of information were used, the USGS Background Concentrations within Clay County, and ambient sediment samples collected at the site.

5.2.6.4 The nationwide Mineral Resources Data System (MRDS) database of concentrations of elements provides county-specific background values for selected total metals. The MRDS includes mineral resource occurrence data covering the world, most thoroughly within the United States. This database contains the records previously provided in the MRDS of USGS and the Mineral Availability System/Mineral Industry Locator System originated by the U.S. Bureau of Mines, which is now part of the USGS. According to the USGS, the MRDS is a large and complex relational database developed over several decades by hundreds of researchers and reporters (USGS, 2006). This dataset is considered to likely be more representative of conditions within Clay County. The USGS Background Concentrations for Clay County are defined as the mean plus two times the standard deviation and the USGS Background Concentrations were used as one of the criteria used to evaluate whether or not potential MC contamination is present in sediment (Section 5.1.8). USGS background concentrations were available for all metals considered in this SI.

5.2.6.5 In addition to the USGS data described above, two ambient sediment (MC-MRS01-SD-06 and MC-MRS01-SD-07), as shown in Figure 5.1, were collected during the SI. These samples were collected outside the MRS. No MEC or MD was observed in the vicinity of the sample locations, which suggests that these samples are likely representative of the naturally occurring soils in the area. No explosives were detected in the ambient samples. Although ambient samples were collected, the USGS Background Concentrations were used for sediment in this SI report.

Table 5.4
Surface Water Ambient Concentrations at the Mill Cove Bombing Site

Analyte	Units	Maximum Ambient Concentration
Metals		
Aluminum	µg/L	170
Antimony	µg/L	0.096
Copper	µg/L	1.10
Iron	µg/L	260
Lead	µg/L	0.63
Zinc	µg/L	4.20

Table 5.5
Sediment Ambient/Background Concentrations at the Mill Cove Bombing Site

Analyte	Units	Clay County USGS Background Concentration [a]	Maximum Ambient Concentration	Selected Background Concentration [b]
Metals				
Aluminum	mg/kg	7,280	320	7,280
Antimony	mg/kg	NA	< 0.39	< 0.39
Copper	mg/kg	3	0.96	3.0
Iron	mg/kg	8,020	400	8,020
Lead	mg/kg	26	1.3	26
Zinc	mg/kg	13	3.1	13

a - USGS derived background concentration for Clay County. Value equals the mean + 2xSD (http://tin.er.usgs.gov/geochem/doc/averages/countydata.htm)

b - The background concentrations are selected from those available in the column order shown (i.e., the USGS value is used if there is one; if there is no USGS value, then the site-specific value is used).

< - Analyte was analyzed for but not detected above the practical quantitation limit (PQL).

5.2.7 Source Evaluation

5.2.7.1 As explained earlier in this chapter, an exposure pathway is not considered to be complete unless there is potential MC contamination present. To make this determination, analytical results for MC are screened against several criteria to evaluate whether or not potential MC contamination is present. In order for a chemical to be considered as potential MC contamination that is related to a release from munitions-related activities at the site, it is necessary for the following conditions to be true:

- The chemical is detected in the sample medium, and
- The chemical is present above the selected background concentration (see subchapter 5.2.6), and
- The chemical is a potential constituent of the munitions formerly used at the range (Table 4.1).

5.2.7.2 Each of the MC analyzed at the Mill Cove Bombing Site was evaluated against these criteria to determine whether or not potential MC contamination was present at the MRS. Only detections of metals that meet the conditions above are evaluated further in the screening level risk assessments in Chapter 6. Any detection of explosives at the range is considered to be potential MC contamination and is evaluated in the screening level risk assessment.

5.2.7.3 Analytical data and a determination regarding the presence of potential MC contamination at the MRS are provided below.

5.3 BOMBING RANGE MUNITIONS RESPONSE SITE

This subchapter of the SI Report evaluates exposure pathways for the Bombing Range MRS. 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

To date, no historical MC-related groundwater, surface water, sediment, soil or air sampling has been documented at this MRS.

5.3.2 Groundwater Migration Pathway

5.3.2.1 Geologic and Hydrogeologic Setting

There are no known differences between the geologic and hydrogeologic setting at the Bombing Range MRS and the setting described for the overall range in subchapter 5.2.

5.3.2.2 Releases and Potential Releases to Groundwater

There are no known releases or potential releases of MC to groundwater at the Bombing Range MRS. Potable groundwater would not have been directly affected by bombing activities because it is unlikely that munitions would have penetrated to the groundwater, and it is unlikely that surface contamination would have leached to the potable groundwater at a depth of greater than 900 feet bgs. There are two registered public water supply wells at the southeastern boundary of the MRS.

5.3.2.3 Groundwater Migration Pathways and Receptors

The regional groundwater use setting of the Mill Cove Bombing Site is described in subchapter 5.2.2. As shown in Table 5.1 and Figure 5.2, there are no registered wells within the Bombing Range MRS. Based on the current and future land use of the Bombing Range MRS, potential receptors in this MRS would include residents, commercial or industrial workers (for example, dredging projects, dock installation), and site visitors or recreational users. While this site is an important ecological place, the groundwater pathway is not considered to be a complete exposure route for ecological receptors, since ecological receptors generally do not have access to groundwater.

5.3.2.4 Groundwater Sample Locations and Methods

No known groundwater sampling has been previously performed at the Bombing Range MRS and no groundwater samples were collected during the SI at the Mill Cove Bombing Site.

5.3.2.5 Groundwater Analytical Results

Not applicable.

5.3.2.6 Groundwater Migration Pathway Conclusions

Two public water supply wells are located at the southeastern boundary of the 649-acre Bombing Range MRS. These two wells collect water from the Floridan aquifer at a depth of 900-1000 feet below land surface. Impermeable barriers lie between the surface and the water supply aquifer. No explosives were detected in the surface water or sediment at this MRS (subchapter 5.3.4). MC metals were detected above background concentrations both in surface water and sediments, however the depth to groundwater and impermeable barriers preclude leaching of contamination from the surface. Therefore, the groundwater migration pathway is incomplete for receptors present.

5.3.3 Surface Water and Sediment Migration Pathways

5.3.3.1 Hydrologic Setting

The hydrologic setting of the Mill Cove Bombing Site is described in subchapter 5.2.3. As shown in Figure 5.3, there are wetlands and surface water within the Bombing Range MRS, and the bomb target was within the Mill Cove, in the water.

5.3.3.2 Releases and Potential Releases to Surface Water and Sediment

There is a potential direct release of MC (metals) to surface water or sediment at the Bombing Range MRS, because the target was a floating raft located in the center of Mill Cove. In addition, there is a possible direct release to soil, if the target was missed and munitions were dropped on the surrounding coastline. Contamination in soil could have been transported to surface water and sediment via erosion and runoff.

5.3.3.3 Surface Water and Sediment Migration Pathways and Receptors

Appendix J contains the CSM and CSEM for the site. The bombing target at the MRS was a floating raft located in the center of the waters of Mill Cove, and therefore, it is likely that MC were released to surface water and sediment. Based on the current and future land use of the Bombing Range MRS, potential receptors in these areas include

residents, commercial or industrial workers (e.g., dredging projects, dock installations), and site visitors or recreational users, as well as ecological receptors. These receptors may be exposed to MC in surface water or sediment via incidental ingestion or dermal exposure. Additionally, ecological receptors could be exposed to MC in surface water through direct ingestion as a drinking water source.

5.3.3.4 Surface Water and Sediment Sample Locations and Methods

The surface water and sediment samples were collected at the locations shown on Figure 5.1. Two surface water samples and two sediment sample were collected from locations away from the target area to estimate ambient conditions. Five biased surface water and sediment coupled samples were collected at the Bombing Range MRS on April 7 and 8, 2008. These samples were analyzed for explosives (Method SW8321A) and aluminum, antimony, copper, iron, lead, and zinc (Method SW6010B/SW6020). The sample collection procedures presented in the Sampling and Analysis Plan (USACE, 2005b), the Parsons Final PSAP Addendum (Parsons, 2006), and in the PWP (USACE, 2005a) were followed.

5.3.3.5 Surface Water and Sediment Analytical Results

5.3.3.5.1 The analytical results for the surface water and sediment samples collected from the Bombing Range MRS are presented in Tables 5.6 and 5.7, respectively. As described in Subchapter 5.2.8, these results were evaluated to determine whether or not a source of contamination is present.

5.3.3.5.2 The source evaluation for surface water is presented in Table 5.8. There were no explosives detected in the surface water samples, so this evaluation is for metals only. As shown in this table, six MC metals (aluminum, antimony, copper, iron, lead, and zinc) were detected above the selected background concentrations. Therefore, based on the sample results, there is potential MC contamination present in the surface water at the site.

5.3.3.5.3 The source evaluation for sediment is presented in Table 5.9. There were no explosives detected in the sediment samples, so this evaluation is for metals only. As shown in this table, four MC metals (aluminum, copper, iron, and zinc) were detected above the selected background concentrations. Therefore, based on the sample results, there is potential MC contamination present in the sediment at the site.

5.3.3.6 Surface Water and Sediment Migration Pathway Conclusions

Based on the information available, the surface water and sediment migration pathways are complete for the Bombing Range MRS. Six MC metals, aluminum, antimony, copper, iron, lead, and zinc, will be retained for consideration in the surface water SLRA presented in Chapter 6. Four MC metals, aluminum, copper, iron, and zinc, will be retained for consideration in the sediment SLRA in Chapter 6.

Table 5.6
Summary of Validated Analytical Results for Mill Cove Bombing Site , Surface Water Samples Collected In April 2008

SAMPLE ID:		MC-OB-SW-06*		MC-OB-SW-07*		MC-MRS01-SW-01		MC-MRS01-SW-08**		MC-MRS01-SW-02		MC-MRS01-SW-03		MC-MRS01-SW-04		MC-MRS01-SW-05	
DATE SAMPLED:		04/07/08		04/07/08		04/08/08		04/08/08		04/07/08		04/07/08		04/07/08		04/07/08	
LAB SAMPLE ID:		D8D080305002		D8D080305001		D8D090337001		D8D090337004		D8D080305003		D8D090337002		D8D080305004		D8D090337003	
	Units																
Explosives - SW8321A																	
1,3,5-Trinitrobenzene	µg/L	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U
1,3-Dinitrobenzene	µg/L	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U
2,4,6-Trinitrotoluene (TNT)	µg/L	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U
2,4-Dinitrotoluene	µg/L	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U
2,6-Dinitrotoluene	µg/L	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U
2-Amino-4,6-dinitrotoluene	µg/L	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U
2-Nitrotoluene	µg/L	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
3-Nitrotoluene	µg/L	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
4-Amino-2,6-dinitrotoluene	µg/L	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U
4-Nitrotoluene	µg/L	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	µg/L	0.48	U	0.48	U	0.48	U	1.2	U	0.48	U	0.48	U	0.48	U	0.48	U
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	µg/L	1.2	U	1.2	U	1.2	U	0.12	U	1.2	U	1.2	U	1.2	U	1.2	U
Nitrobenzene	µg/L	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U
Nitroglycerin	µg/L	0.15	U	0.15	U	0.15	U	0.15	U	0.15	U	0.15	U	0.15	U	0.15	U
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	µg/L	0.48	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U
Pentaerythritol Tetranitrate (PETN)	µg/L	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U	0.12	U
Total Metals - SW6010B/6020																	
Aluminum	µg/L	**140**	J	**170**	J	**140**	J	**140**	J	**100**	J	**330**		**100**	J	**150**	J
Antimony	µg/L	**0.083**	J	**0.096**	J	**0.083**	J	**0.11**	J	**0.081**	J	**0.094**	J	**0.082**	J	**0.087**	J
Copper	µg/L	**1.1**	J	**1.1**	J	**2.3**		**2.4**		**1.3**	J	**5.8**		**1.1**	J	**1.3**	J
Iron	µg/L	**220**		**260**		**370**		**370**		**190**		**1800**		**170**		**260**	
Lead	µg/L	**0.54**	J	**0.63**	J	**0.59**	J	**0.66**	J	**0.52**	J	**3.0**		**0.48**	J	**0.59**	J
Zinc	µg/L	**4.2**	J	**2.2**	J	**3.2**	J	**2.7**	J	20	U	**9.1**	J	20	U	**4.3**	J

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 5.7
Summary of Validated Analytical Results for Mill Cove Bombing Site, Sediment Samples Collected In April 2008

SAMPLE ID:		MC-OB-SD-06*		MC-OB-SD-07*		MC-MRS01-SD-01		MC-MRS01-SD-02		MC-MRS01-SD-03		MC-MRS01-SD-04		MC-MRS01-SD-05		MC-MRS01-SD-08**	
DATE SAMPLED:		04/07/08		04/07/08		04/08/08		04/07/08		04/07/08		04/07/08		04/07/08		04/07/08	
LAB SAMPLE ID:		D8D080305006		D8D080305005		D8D090337005		D8D080305007		D8D080305009		D8D080305008		D8D080305010		D8D080305011	
	Units																
Explosives - SW8321A																	
1,3,5-Trinitrobenzene	µg/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
1,3-Dinitrobenzene	µg/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
2,4,6-Trinitrotoluene (TNT)	µg/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
2,4-Dinitrotoluene	µg/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
2,6-Dinitrotoluene	µg/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
2-Amino-4,6-dinitrotoluene	µg/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
2-Nitrotoluene	µg/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
3-Nitrotoluene	µg/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
4-Amino-2,6-dinitrotoluene	µg/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
4-Nitrotoluene	µg/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	µg/kg	180	U	180	U	180	U	180	U	180	U	180	U	180	U	180	U
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	µg/kg	300	U	300	U	300	U	300	U	300	U	300	U	300	U	300	U
Nitrobenzene	µg/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
Nitroglycerin	µg/kg	500	U	500	U	500	U	500	U	500	U	500	U	500	U	500	U
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	µg/kg	120	U	120	U	120	U	120	U	120	U	120	U	120	U	120	U
Pentaerythritol Tetranitrate (PETN)	µg/kg	500	U	500	U	500	U	500	U	500	U	500	U	500	U	500	U
Metals - SW6010B/6020																	
Aluminum	mg/kg	**280**		**320**		**150**		**7700**		**1700**		**6100**		**500**	J	**350**	
Antimony	mg/kg	0.36	U	0.39	U	0.36	U	1.7	U	1.1	U	1.6	U	0.36	UJ	0.37	U
Copper	mg/kg	**0.46**	J	**0.96**		**0.63**		**17**		**4.5**		**14**		**2.1**	J	**1.0**	J
Iron	mg/kg	**370**		**400**		**180**		**11000**		**4300**		**8600**		**820**		**410**	
Lead	mg/kg	**0.95**		**1.3**		**1.0**		**17**		**6.5**		**14**		**2.4**		**1.7**	
Zinc	mg/kg	**1.5**	J	**3.1**	J	**1.6**	J	**44**		**8.6**	J	**36**		**3.4**	J	**2.3**	J

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 5.8
Bombing Range Munitions Response Site
Surface Water Source Evaluation
Mill Cove Bombing Site

Analyte	Units	Maximum Detected Site Concentration	Background Concentration [a]	Exceeds Background Concentration?	Potential MC? [b]	SLRA Required?	Primary reason for exclusion from SLRA
Metals							
Aluminum	µg/L	330	170	**Yes**	**Yes**	**Yes**	--
Antimony	µg/L	0.11	0.096	**Yes**	**Yes**	**Yes**	--
Copper	µg/L	5.8	1.1	**Yes**	**Yes**	**Yes**	--
Iron	µg/L	1,800	260	**Yes**	**Yes**	**Yes**	--
Lead	µg/L	3.0	0.63	**Yes**	**Yes**	**Yes**	--
Zinc	µg/L	9.1	4.2	**Yes**	**Yes**	**Yes**	--

a - Background Concentrations as established in Table 5.4.

b - Potential MCs as listed in Table 4.1.

Table 5.9
Bombing Range Munitions Response Site
Sediment Source Evaluation
Mill Cove Bombing Site

Analyte	Units	Maximum Detected Site Concentration	Background Concentration [a]	Exceeds Background Concentration?	Potential MC? [b]	SLRA Required?	Primary reason for exclusion from SLRA
Metals							
Aluminum	mg/kg	7,700	7,280	**Yes**	**Yes**	**Yes**	--
Antimony	mg/kg	< 1.70	< 0.39	No	**Yes**	No	Not detected at MRS
Copper	mg/kg	17	3	**Yes**	**Yes**	**Yes**	--
Iron	mg/kg	11,000	8,020	**Yes**	**Yes**	**Yes**	--
Lead	mg/kg	17	26	No	**Yes**	No	Not detected above background
Zinc	mg/kg	44	13	**Yes**	**Yes**	**Yes**	--

a - Background Concentrations as established in Table 5.5.

b - Potential MCs as listed in Table 4.1.

5.3.4 Soil Exposure Pathway

5.3.4.1 Physical Source Access Conditions

The Bombing Range MRS is primarily located in Mill Cove, which is an open water cove within Doctors Lake. The State of Florida owns the waters of Doctors Lake, and the shoreline is owned by Pace Enterprises and private homeowners. Land use includes residential and recreational. There are no access restrictions to the site, except on private residential property.

5.3.4.2 Actual or Potential Contamination Areas

No known contamination areas lie within the land portions of the Bombing Range MRS. However, the MRS formerly included a water target that was used by the DoD from April 1941 until late 1945 or early 1946. An exact date that operations terminated is not recorded. Munitions used on site included practice bombs (AN-Mk 5, AN-Mk 23, AN-Mk 43, and -Mk 15) with spotting charges (AN-Mk 4, Mk 5, Mk 6, and Mk 7) and 0.50-caliber ammunition. Munitions activities could have directly affected the surface water and sediment, but no MC sampling had been conducted prior to this SI. The most likely location for contamination is considered to be the sediment at target center. MD was found at the site in the past by recreational scuba divers in the form of practice bombs. During the SI, neither MEC nor MD was observed by the SVT. At the center of the target, the SVT observed what appeared to be remnants of the old target. In addition, soil could have been directly affected by target misses during operations.

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 Bombing Range MRS who may come into contact with potentially contaminated soil via dermal contact, incidental ingestion, and inhalation of re-suspended particulate matter. Based on the location of the water target and known current and future uses of the land, the soil exposure pathway is potentially complete, but not quantitatively assessed by this SI. Although the target was located within the cove, it is possible that target misses might have affected soil at the MRS. Possible receptors at the Bombing Range MRS would be residents, commercial or industrial workers (e.g., dredging operations, dock installations), and site visitors or recreational users, as well as ecological receptors.

5.3.4.4 Soil Sample Locations and Methods

Soil samples were not collected at this MRS.

5.3.4.5 Soil Analytical Results

Soil samples were not collected at this MRS.

5.3.4.6 Soil Exposure Pathway Conclusions

The soil migration pathway is potentially complete, but not quantitatively assessed for the Bombing Range MRS. There are no reports of MEC or MD by the local residents on the limited soil areas adjacent to Mill Cove.

5.3.5 Air Migration Pathway

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 Bombing Range MRS. The occurrence of windblown dust would be from soil. Because the site is primarily covered by surface water and sediment, windblown dust is unlikely at this site; therefore, exposure via this pathway is possible, but not expected.

5.3.5.3 Air Migration Pathway and Receptors

Receptor populations potentially affected by the air pathway consist of people who reside, work, or go to school within the target distance limit of 4 miles around the range. Theoretically, receptors could be exposed to MC in air through inhalation of fugitive dust. However, the majority of the site is water or wetlands. The total population onsite and within four miles is approximately 70,000 people. Based on the known current and future uses of the land, the potential air migration pathway receptors at the Bombing Range MRS would be residents, commercial or industrial workers (e.g. dredging operations, dock installations), and site visitors or recreational users, as well as ecological receptors.

5.3.5.4 Air Sample/Monitoring Locations and Methods

No air sampling is known to have been previously performed at Mill Cove Bombing Site 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 Migration Pathway Conclusions

If fugitive dust were present at the site, it would be evaluated through the surface soil exposure pathway. As discussed in subchapter 5.3.4, no soil samples were collected from the Bombing Range MRS. The site is predominately covered by surface water and/or wetlands. Based on the current information available for the site, because no soil was sampled at the site, the air migration pathway is potentially complete but not quantitatively assessed for this SI.

Figure 5.1

Qualitative Reconnaissance and Sample Locations
Mill Cove Bombing Site
FUDS Project No. I04FL037701

Clay County, Florida

Legend

- Surface Water and Sediment Sample Location
- MRS Boundary
- Bombing Target
- FUDS Boundary
- Qualitative Reconnaissance Track

Site Location in Florida

N

Image: 2006 Orthophoto
Projection: UTM Zone 17 NAD83, Map Units in Meters

1,000 500 0 1,000 Feet

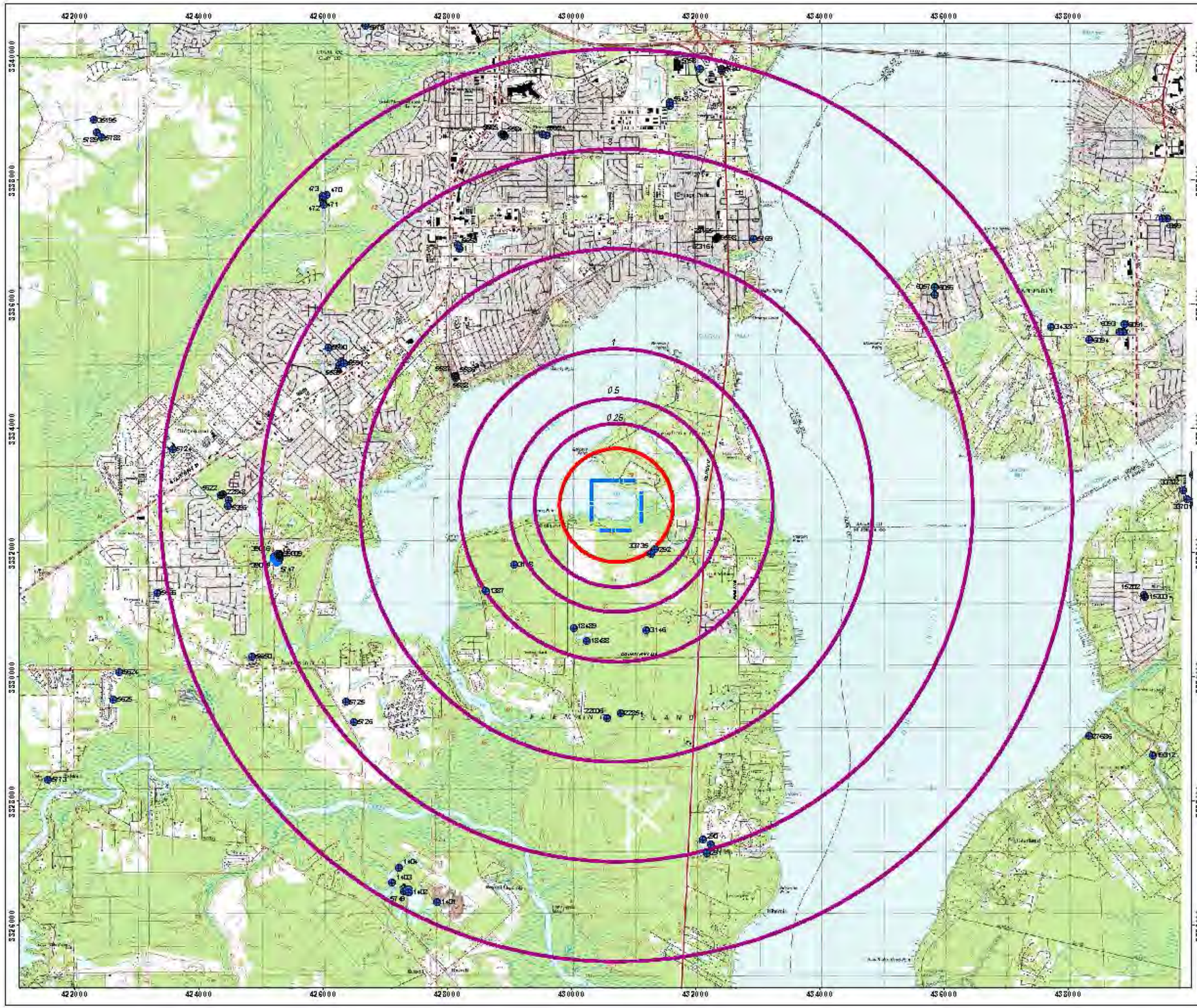
PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY: BT	Qualitative Reconnaissance and Sample Locations		
DRAWN BY: BT			
CHECKED BY: IN	SCALE: As Shown	PROJECT NUMBER: 744647.70000	
SUBMITTED BY: DS	DATE: September 2008	PAGE NUMBER: 5-19	
	FILE: X:\GIS\Site_inspections_ne\Maps\millcove_FL\Fig5_1.mxd		

Figure 5.2

Water Wells within 4-Mile Buffer
Mill Cove Bombing Site
FUDS Property No. I04FL037701

Clay County, Florida



Legend

- Drinking Water Well Location
- MRS Boundary
- FUDS Boundary
- Buffer (Mile)

Site Location in Florida

Image Source: USGS Topo Quadrangles, 1993
Projection: UTM Zone 17 NAD83, Map Units in Meters

1 0.5 0 1 Miles

N

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER
DESIGNED BY: BT	Water Wells within 4-Mile Buffer
DRAWN BY: BT	
CHECKED BY: IN	SCALE: As Shown — PROJECT NUMBER: 744647.70000
SUBMITTED BY: DS	DATE: September 2008 — PAGE NUMBER: 5-20
	FILE: XXGISSite_Inspections_reMaps\millcove_FLFig5_2.mxd

Figure 5.3

Wetlands
Mill Cove Bombing Site
FUDS Property No. I04FL037701

Clay County, Florida

Legend

- Surface Water and Sediment Sample Location
- Qualitative Reconnaissance Track
- MRS Boundary
- FUDS Boundary
- Wetland (Obtained from U.S. Fish & Wildlife Service)

Predominant Wetland Types:

PFO1C – Palustrine, forested, broad-leaved deciduous, seasonally flooded
PEM1A/C – Palustrine, emergent, persistent, temporarily flooded/seasonally flooded

Site Location in Florida

Image Source: USGS Topo Quadrangles, 1993
Projection: UTM Zone 17 NAD83, Map Units in Meters

2,000 1,000 0 2,000 Feet

N

PARSONS	U.S. ARMY CORPS OF ENGINEERS HUNTSVILLE CENTER

DESIGNED BY: BT	Wetlands		
DRAWN BY: BT			
CHECKED BY: IN	SCALE: As Shown	PROJECT NUMBER: 744647.70000	
SUBMITTED BY: DS	DATE: September 2008	PAGE NUMBER: 5-21	
	FILE: X:\GIS\Site_inspections_ne\Maps\millcove_FLFig5_3.mxd		

CHAPTER 6
SCREENING-LEVEL RISK ASSESSMENT

6.1 MUNITIONS AND EXPLOSIVES OF CONCERN SCREENING-LEVEL RISK ASSESSMENT

6.1.1 Conceptual Site Model

The CSM for Mill Cove Bombing Site, 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 Mill Cove Bombing Site. 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 (e.g., 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 on the presence of three critical elements:

- a source (*i.e.,* presence of MEC), AND
- a human receptor (*i.e.,* a person), AND
- the potential for interaction between the source and receptor (i.e., the possibility 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 (e.g., 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 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 (e.g., INPR, ASR, and ASR Supplement) and observations made during the SI QR. Table 6.2 lists the three possible categories used to describe MEC Type 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 (e.g., 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 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, visitors, or trespassers 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 (i.e., 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 single MRS at Mill Cove Bombing Site using 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 or not further evaluation is justified at each MRS.

6.1.4 Munitions and Explosives of Concern Risk Assessment – Bombing Range MRS

6.1.4.1 The SVT did not observe any MEC or MD items at the Bombing Range MRS during the SI field activities in April 2008. The MRS is predominately covered by surface water and wetlands. The SVT observed what appeared to be remnants of the wooden target underwater, near the center of the MRS. Photographs were taken for documentation and are included in Appendix E. The INPR team did not encounter MEC or MD during the 1994 site visit. However, the field team was not successful in gaining access to the shoreline surrounding Mill Cove. The ASR team did not find MEC or MD during the site visit in 2002. Again, access to the shoreline was not accomplished and the ASR focused on the anecdotal information and historical documents when assigning the site a RAC score of 4, indicating low risk. No MEC has been confirmed reported or discovered since site closure; however, according to a 2007 interview with a local water-skier (Elliot, 2007), local divers have reportedly pulled MD (in the form of miniature lead practice bombs without spotting charges) out of Mill Cove. Based on this information and the known historical use of the Bombing Range MRS, the presence of MEC is assessed to be "confirmed or suspected."

6.1.4.2 The ASR (USACE 2002) and ASR Supplement (USACE 2004) reported that munitions used at the Mill Cove Bombing Site included use of AN-Mk 5, An-Mk 23, and AN-Mk 43 Miniature Practice Bombs with AN-Mk 4 spotting charges; Mk 15 series practice bombs (100 lbs); Mk 6, Mk 7, Mk 4, and Mk 5 practice bomb signals; and .50-caliber ammunition. Based on this information, the MEC Type at the Bombing Range MRS is assessed to be "potentially hazardous."

6.1.4.3 The Mill Cove Bombing Site is an open water cove within Doctors Lake located approximately four miles south of the town of Orange Park. The cove is named Mill Cove and is surrounded on three sides by wetlands and residential dwellings with docks leading to the cove. Access to the site from landward is somewhat restricted by private property. However, the cove is open water access into Doctor Lake. The site is accessible by landowners, workers hired for dock repair or construction, and recreational water users. Based on this information, the Site Accessibility at the Bombing Range MRS is considered to be "Accessible."

6.1.5 Risk Summary

6.1.5.1 The qualitative MEC risk evaluation for the Mill Cove Bombing Site is summarized in Table 6.4.

Table 6.4
MEC Risk Evaluation
Mill Cove Bombing Site, Clay County, Florida

MRS	MEC Presence	MEC Type [1]		Site Accessibility	Further Evaluation ?
Bombing Range MRS	Confirmed or suspected	Signal, Practice Bomb, Mk 6; Signal, Practice Bomb, Mk 7; Signal, Practice Bomb, Mk 5; Signal, Practice Bomb, Mk 4	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.

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 Bombing Site MRS and, therefore, there is the potential for an explosive safety risk at this MRS.

6.2 MUNITIONS CONSTITUENT HUMAN HEALTH SCREENING LEVEL RISK ASSESSMENT

6.2.1 Conceptual Site Model

The Mill Cove Bombing Site is within Clay County. The bomb target for the site was located in Mill Cove, an open water cove within Doctors Lake. The waters of Doctors Lake are owned by the State of Florida, and the shoreline of Mill Cove is owned by Pace Enterprises and private homeowners. The site is used for residential and recreational purposes. Land use is not expected to change. Potential human receptors for the Bombing Range MRS include current and future residents, commercial and industrial workers (e.g., dredging operations, dock installations), and site visitors or recreational users. These receptors may be exposed to MC through direct contact with soil (incidental ingestion, dermal contact, and inhalation of fugitive dust). Receptors may also be exposed to MC through direct contact with surface water and sediment (incidental ingestion and dermal contact). The surface water in the area is not used as drinking water, therefore, only ecological receptors are exposed to surface water through ingestion as a drinking water supply. The MC CSEM presented in Appendix J identifies source media, transport mechanisms, exposure routes, and potential receptors.

6.2.2 Affected Media

6.2.2.1 Direct release of MC from munitions-related activities within the MRS would be primarily to surface water and sediment, as the target was located in the center of Mill Cove. Direct release of MC could also have been to soil, if the bomb target were missed during operations. In addition to potential direct release to surface water and sediment, if there were releases of MC to surface soil as a result of the munitions-related activities, MC could migrate to surface water and sediment through runoff and erosion. MC is unlikely to reach the groundwater resources from the surface due to the depth to potable groundwater of greater than 900 feet bgs.

6.2.2.2 Based on decisions made at the TPP Meeting, surface water and sediment were the media determined to be most likely affected by MC. Surface water and sediment were designated as the primary indicator of potential contamination at this site. Soil and groundwater were not sampled during this SI.

6.2.3 Screening Levels

6.2.3.1 The SLRA surface water human health screening values selected by the TPP Team are the more conservative of the Florida Administrative Code 62-777, freshwater surface water cleanup target levels and Florida Administrative Code 62-302, criteria for surface water quality standards.

6.2.3.2 The SLRA sediment human health screening values selected by the TPP Team for this SI are the Florida Administrative Code 62-777, cleanup target levels for freshwater sediment.

6.2.4 Risk Characterization

6.2.4.1 As discussed in Subchapter 5.1.8, the source evaluation is used to determine which analytes are retained for consideration in a SLRA. Only those analytes retained for consideration in the SLRA following the source evaluation are evaluated in this chapter.

6.2.4.2 To complete the human health risk characterization for surface water and sediment at this site, the maximum detected concentration of each analyte retained for consideration in the SLRA (Tables 5.8 and 5.9) were compared with the screening levels selected during the TPP process (Subchapter 6.2.3). For an analyte to be considered as a possible health concern related to a release from munitions activities at the Mill Cove Bombing Site, the following conditions must be true:

- The analyte is present above background concentrations, and
- The analyte is a potential constituent of the formerly used munitions, and
- The analyte is present above human health screening levels.

6.2.5 Bombing Range MRS

6.2.5.1 Five biased surface water samples and one duplicate sample were collected from the Bombing Range MRS. Explosive compounds were not detected in any of the surface water samples and therefore, this SLRA is for metals only. As shown in Table 5.8, six MC metals, aluminum, antimony, copper, iron, lead and zinc, were detected above background concentrations, and retained for consideration in the SLRA. Based on the results shown in Table 6.5, the maximum detected concentrations of aluminum, copper, and iron exceeded the risk-based screening values for the surface water at the Bombing Range MRS.

6.2.5.2 Five biased sediment samples and one duplicate sample were collected from the Bombing Range MRS. Explosive compounds were not detected in any of the sediment samples and therefore, this SLRA is for metals only. As shown in Table 5.9, four MC metals, aluminum, copper, iron, and zinc, were detected above background concentrations, and retained for consideration in the SLRA. Based on the results shown in Table 6.6, the maximum detected concentrations of aluminum, copper, iron, and zinc did not exceed the risk-based screening values for the sediment at the Bombing Range MRS.

Table 6.5
Bombing Range Munitions Response Site
Surface Water Human Health Screening Level Risk Assessment
Mill Cove Bombing Site

Analyte	Units	Maximum Detected Site Concentration	Residential Surface Water Screening Value [a]	Exceeds Screening Level?
Metals				
Aluminum	µg/L	330	13	**Yes**
Antimony	µg/L	0.110	4,300	No
Copper	µg/L	5.8	3.7[b]	**Yes**
Iron	µg/L	1,800	1,000	**Yes**
Lead	µg/L	3.0	8.5[b]	No
Zinc	µg/L	9.1	86[b]	No

a - Florida Administrative Code (FAC) 62-777, cleanup target levels for freshwater surface water
http://www.dep.state.fl.us/waste/quick_topics/publications/wc/FinalGuidanceDocumentsFlowCharts_April 2005/TechnicalReport2FinalFeb2005(Final3-28-05).pdf

b – FAC 62-302 Criteria for Surface Water Quality Classifications, July 1, 2008
http://www.dep.state.fl.us/water/wqssp/docs/tr_review/62-302_530-draft-table.pdf

Table 6.6
Bombing Range Munitions Response Site
Sediment Human Health Screening Level Risk Assessment
Mill Cove Bombing Site

Analyte	Units	Maximum Detected Site Concentration	Residential Soil Screening Value [a]	Exceeds Screening Level?
Metals				
Aluminum	mg/kg	7,700	80,000	No
Copper	mg/kg	17	150	No
Iron	mg/kg	11,000	53,000	No
Zinc	mg/kg	44	26,000	No

a - Florida Administrative Code (FAC) 62-777, cleanup target levels for freshwater surface water
http://www.dep.state.fl.us/waste/quick_topics/publications/wc/FinalGuidanceDocumentsFlowCharts_April 2005/TechnicalReport2FinalFeb2005(Final3-28-05).pdf

6.2.6 Discussion

6.2.6.1 The maximum detected concentrations of aluminum, copper, and iron exceeded the risk-based human health screening values for surface water. Therefore, based on the analytical results presented in this report, there is a potential unacceptable human health risk from metals due to exposure to the surface water at the Bombing Range MRS.

6.2.6.2 The maximum detected concentrations of aluminum, copper, iron, and zinc did not exceed the risk-based human health screening values for sediment. Therefore, based on the analytical results presented in this report, an unacceptable human health risk from metals is not expected due to exposure to the sediment at the Bombing Range MRS.

6.3 MUNITIONS CONSTITUENT ECOLOGICAL SCREENING LEVEL RISK ASSESSMENT

Based on the information presented in Subchapter 5.2.5, Mill Cove Bombing Site may be an important ecological place based on the presence of wetlands, the site inclusion in a Coastal Management Zone, and review of U.S. Army Biological Technical Assistance Group *Technical Document for Ecological Risk Assessment: Process for Developing Management Goals* (BTAG, 2005).

6.3.1 Conceptual Site Model

Because the site is considered an important ecological place, exposure of wildlife to MC could occur through direct exposure to contaminated surface water and sediment as well as through ingestion of wild foods that have been exposed to MC. The MC CSEM identifies affected media, transport mechanisms, exposure routes, and potential receptors.

A CSEM has been developed for the Bombing Range MRS and is included in Appendix J.

6.3.2 Affected Media

Direct release of MC from munitions activities within the MRS would be primarily to surface water and sediment, because the bomb target was located in the center of Mill Cove. Direct release of MC to soil is possible, if the target were missed during operations. In addition to potential direct release to surface water and sediment, if there were releases of MC to surface soil as a result of the munitions-related activities, MC could migrate to surface water and sediment through runoff and erosion. MC contamination is unlikely to migrate from the surface to groundwater resources due to the depth to groundwater at the site at more than 900 feet bgs.

6.3.3 Screening Values

6.3.3.1 The references cited by the Programmatic Sampling and Analysis Plan (USACE 2005) were used to obtain the appropriate Ecological Screening Values (ESVs) for surface water. ESVs were obtained using the sources indicated in the PSAP which include values from the San Francisco Bay Regional Water Quality Control Board. An ecological screening value for aluminum was not available for surface water in the PSAP, and therefore, the USEPA Region 4 Freshwater Surface Water Screening value for aluminum was used.

6.3.3.2 The sediment screening values selected by the TPP Team for this SI are the Florida Department of Environmental Protection; Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters supplemented with ESVs obtained using the sources indicated in the PSAP (USACE 2005) which include values from the USEPA Region 4 Sediment ESVs and the Texas Commission on Environmental Quality Ecological Benchmark for Sediment.

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

6.3.4 Ecological Risk Characterization for Surface Water and Sediment

6.3.4.1 As discussed in Subchapter 5.1.8, the source evaluation is used to determine which analytes are retained for consideration in a SLERA. Only those analytes retained for consideration in the SLERA following the source evaluation are evaluated in this chapter.

6.3.4.2 In order to complete the ecological risk characterization for this site, the maximum detected concentration of each selected analyte was evaluated against the screening values (Subchapter 6.3.4). This comparison resulted in the calculation of hazard quotients (HQ) for each analyte. The HQ was calculated by determining the ratio

of the maximum detected site concentration to the screening value (in this case, ecological medium-specific screening value). If the HQ was equal to or less than one, the potential for ecological risk for that medium was considered to be negligible. If the HQ was greater than one, then unacceptable ecological risks cannot be ruled out based on the screening comparison alone. HQs greater than one should be reviewed to evaluate the significance of the exceedance. An ecological risk due to exposure to explosives is not considered to be present at this site since no explosives were detected in any samples collected from the site.

6.3.5 Bombing Range MRS

6.3.5.1 Five biased surface water samples and a duplicate sample were collected at the Bombing Range MRS. Explosive compounds were not detected in the samples, so this evaluation is for metals only. As shown in Table 5.8, six MC metals (aluminum, antimony, copper, iron, lead, and zinc) exceeded their background concentrations in surface water and were retained for the SLERA.

6.3.5.2 As shown in Table 6.7, when the maximum concentration of antimony, copper, and zinc were compared to the surface water screening values, the HQ value was less than one. The HQ values for aluminum (3.8), iron (1.8), and lead (1.2) were greater than one, and therefore, there is a possible risk to ecological receptors due to exposure to surface water.

6.3.5.3 Five biased sediment samples and a duplicate sample were collected at the Bombing Range MRS. Explosive compounds were not detected in the samples, so this evaluation is for metals only. As shown in Table 5.9, four MC metals (aluminum, copper, iron, and zinc) exceeded their background concentrations in sediment and were retained for the SLERA.

6.3.5.4 As shown in Table 6.8, when the maximum concentration of copper, iron, and zinc were compared to the sediment screening values, the HQ values were less than one. The maximum concentration of aluminum is greater that the ecological screening value for sediment, and therefore, there is a potential ecological risk due to exposure to aluminum in sediment at the Bombing Range MRS.

Table 6.7
Bombing Range Munitions Response Site
Surface Water Screening Level Ecological Risk Assessment
Mill Cove Bombing Site

Analyte	Units	Maximum Detected Site Concentration	Ecological Receptors	
			ESV [a]	HQ
Metals				
Aluminum	µg/L	330	87 [b]	3.8
Antimony	µg/L	0.110	6[c]	≤1
Copper	µg/L	5.8	9 [c]	≤1
Iron	µg/L	1,800	1,000[b]	1.8
Lead	µg/L	3.0	2.5 [c]	1.2
Zinc	µg/L	9.1	120 [c]	≤1

a - ESVs obtained from primary reference cited in USACE PSAP, September 2005.

b- USEPA Region 4 Ecological Screening Values obtained from http://www.epa.gov/region04/waste/ots/ecolbul.htm#tbl1 (LAST REVISED: November 30, 2001)

c - San Francisco Bay Regional Water Qnality Control Board, Final Surface Water Screening Level, November, 2007 http://www.waterboards.ca.gov/sanfranciscobay/water_issues/available_documents/ESL_May_2008.pdf

Table 6.8
Bombing Range Munitions Response Site
Sediment Screening Level Ecological Risk Assessment
Mill Cove Bombing Site

Analyte	Units	Maximum Detected Site Concentration	Ecological Receptors	
			ESV [a]	HQ
Metals				
Aluminum	mg/kg	7,700	50[b]	154
Copper	mg/kg	17	36	≤1
Iron	mg/kg	11,000	20,000[c]	≤1
Zinc	mg/kg	44	120	≤1

a - Florida Department of Enviroumental Protection (FDEP); Development and Evaluation of Numerical Sediment Quality Assessment Guidelines for Florida Inland Waters, January 2003 http://www.cerc.usgs.gov/pubs/sedtox/SQAGs_for_Florida_Iuland_Waters_01_03.PDF

b – No FDEP ESV available. ESV obtained from primary reference cited in USACE PSAP, September 2005 which consists of USEPA Region 4 Ecological Screening Values obtained from http://www.epa.gov/region04/waste/ots/ecolbul.htm#tbl1 (LAST REVISED: November 30, 2001)

c – No FDEP ESV or USEPA Region 4 ESV available. ESV obtained from the TCEQ Ecological Benchmark for Sediment as stated in Update to Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas, Regulatory Guidance (RG)-263, Revised (January 2006) .(http://www.tceq.state.tx.us/assets/public/remediation/eco/0106eragupdate.pdf). Use of this source is directed by USEPA Region 6.

6.3.6 Discussion

6.3.6.1 The maximum detected concentrations of antimony, copper, and zinc in surface water at the Bombing Range MRS did not exceed their respective ESVs. Therefore, an unacceptable risk to ecological receptors due to exposure to antimony, copper, and zinc in surface water is not expected. The maximum detected concentrations of aluminum, iron, and lead exceed their respective ESVs, and the HQ values are greater than one. Therefore, based on the analytical results presented in this report, there is a possibility of unacceptable risk to ecological receptors due to exposure to aluminum, iron, and lead in surface water at the Bombing Range MRS.

6.3.6.2 The maximum detected concentrations of copper, iron, and zinc in sediment at the Bombing Range MRS did not exceed their respective ESVs. Therefore, an unacceptable risk to ecological receptors through exposure to copper, iron, and zinc in sediment is not expected. The maximum detected concentration of aluminum in sediment exceeded the ESV, and the HQ value was greater than one. Therefore, based on the results presented in this report, there is a possibility of unacceptable risk to ecological receptors due to exposure to aluminum in sediment at the Bombing Range MRS.

6.3.6.3 Although there is a potential unacceptable risk to ecological receptors due to exposure to aluminum, iron, and lead in surface water and aluminum in sediment at the site, the maximum concentration of aluminum in sediment (7,700 mg/kg) is only slightly higher than the Clay County USGS background concentration (7,280 mg/kg), and further, aluminum is not a CERCLA-hazardous substance and, therefore, the FUDS program is limited in its authority to respond to aluminum contamination. The maximum detected concentrations of iron and lead in surface water at the Bombing Range MRS did exceed the ESV, and the resulting HQ values for iron and lead are greater than one. However, due to the slight exceedance of the screening value, in only one sample, the possibility of an unacceptable ecological risk is slight.

CHAPTER 7
SUMMARY AND CONCLUSIONS

7.1 SUMMARY

7.1.1 The Bombing Range MRS at the Mill Cove Bombing Site was identified and evaluated to determine its potential to cause significant contamination to the environment or to adversely affect human and ecological receptors. The evaluation included the collection of surface water and sediment samples as well as the implementation of QR within the MRS.

7.1.2 During the QR conducted on April 7 and 8, 2008, ***no MD or MEC were discovered*** within the MRS. The field team observed the possible remnants of the wooden target near the center of Mill Cove. ***No other visual indicators (distressed vegetation, stained soil, ground scars or craters) of potential MC contamination were identified during the QR.***

7.1.3 Surface Water and Sediment: Five biased surface water and sediment sample pairs were collected within the MRS. Two ambient surface water and sediment sample pairs were collected outside the MRS, but within Doctors Lake. These samples were analyzed for explosive compounds and metals indicative of munitions used at the site (aluminum, antimony, copper, iron, lead, and zinc). The metals concentrations in the ambient surface water were used for background concentrations for comparison to the concentrations in the biased surface water sample. The USGS derived background concentrations for Clay County and the ambient sediment sample results were used for comparison to the biased sediment sample results. No explosives were detected in either the surface water or sediment samples. MC metals (aluminum, antimony, copper, iron, lead, and zinc) were detected above the background concentrations in the surface water. MC metals (aluminum, copper, iron, and zinc) were detected above the background concentrations in the sediment samples. The surface water and sediment pathways are complete at this MRS.

7.2 CONCLUSIONS REGARDING POTENTIAL MUNITIONS AND EXPLOSIVES OF CONCERN EXPOSURE PATHWAYS

An MEC Screening Level Risk Assessment was conducted based on the QR conducted in the field and historical data regarding previous field visits (Chapter 6). Based on this qualitative MEC risk evaluation, potentially hazardous munitions may remain at the Bombing Range MRS; therefore, an explosive safety risk is considered to be present at this MRS. The MEC exposure pathway at Mill Cove Bombing Site is potentially complete. This is based on the use of munitions with spotting charges

(signals) at this MRS, as reported in the 1994 INPR, 2002 ASR, 2004 ASR Supplement, and 2008 site visit.

7.3 CONCLUSIONS REGARDING POTENTIAL MUNITIONS CONSTITUENTS EXPOSURE PATHWAYS

7.3.1 An exposure pathway is not considered to be completed 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 The maximum detected concentrations of aluminum, copper, and iron in the surface water exceeded the risk-based human health screening values for surface water. Therefore, based on the analytical results presented in this report, ***there is a potential unacceptable human health risk from metals due to exposure to the surface water at the Bombing Range MRS.*** The maximum detected concentrations of aluminum, copper, iron, and zinc in the sediment did not exceed the risk-based human health screening values. Therefore, based on the analytical results presented in this report, ***an unacceptable human health risk from metals is not expected due to exposure to the sediment at the Bombing Range MRS.***

7.3.3 Although there is a ***potential unacceptable risk to ecological receptors*** due to exposure to ***aluminum, iron, and lead in surface water*** and ***aluminum in sediment*** at the site, the maximum concentration of aluminum in sediment (7,700 mg/kg) is only slightly higher than the Clay County USGS background concentration (7,280 mg/kg), and further, aluminum is not a CERCLA-hazardous substance and, therefore, the FUDS program is limited in its authority to respond to aluminum contamination. *The maximum detected concentrations of iron and lead in* ***surface water*** *at the Bombing Range MRS did exceed the ESV*, and the resulting HQ values for both iron and lead are greater than one. However, ***due to the slight exceedance of the screening values, the possibility of an unacceptable ecological risk is slight.***

7.4 OVERALL CONCLUSIONS

7.4.1 During various site visits, including the SI conducted in April 2008, neither MEC nor MD indicative of MEC have been discovered at Mill Cover Bombing Site. Interviews of persons familiar with historic activities at Mill Cove report finding and removal of some MD from the bottom of Mill Cove during the 1970s. The potential for future discoveries of MEC is considered possible.

7.4.2 The surface water and sediment pathways are considered complete for MCs. An unacceptable risk from surface water to both human health and ecological receptors exists at Mill Cove Bombing Site. A slight risk to ecological receptors from sediments exists at Mill Cove Bombing Site.

CHAPTER 8
RECOMMENDATIONS

Based on historical documentation, the April 2008 SI field effort, the analysis results, and the QR conducted, the Bombing Range MRS of the Mill Cove Bombing Site is recommended to proceed to RI/FS. The supporting evidence for this recommendation is as follows:

- Confirmed finding of MD indicative of MEC have been observed or reported during recreational activities at this site. During the 1992 INPR site visit, an interviewee that worked at Jacksonville NAS during World War 2 reported the use of "explosive bombs" at the site. The 2002 ASR mentioned the same interviewee stating the use of "practice bombs" and 0.50-caliber ammunition occurred at the site.
- Recreational divers reported taking practice bombs made of lead from Mill Cove during the 1970s.
- The target remnant is observable near the center of Mill Cove, confirming use as a military training site.
- Access to the site is unrestricted from the water side of the cove. Access from the land sides of Mill Cove is limited by private ownership of the shore. However, access by those owners is unrestricted.
- There is a potential unacceptable human health risk from metals due to exposure to the surface water at the Bombing Range MRS.
- There is a potential risk to ecological receptors from metals due to exposure to surface water and sediment at the Bombing Range MRS.
- At the RI/FS phase of the project, contamination from other sources needs to be examined in greater detail to differentiate DoD contamination from other contamination.

Table 8.1
Recommendations
Former Mill Cove Bombing Site, Clay County, Florida

MRS		Justification
Bombing Range MRS	RI/FS	Mill Cove is a confirmed former military used for bombing target practice. MD have been reported at the bottom of Mill Cove. MC metals in the surface water are a potential risk to human health. MC metals in the surface water and the sediment are a potential risk to ecological receptors at Mill Cove.

CHAPTER 9
REFERENCES

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