
Munitions Response Work Plan

Remedial Investigation/Feasibility Study

Culebra Island Site, Puerto Rico

Volume I of II

Contract No. W912DY-04-D-0006

Task Order No. 0022

Prepared For

U.S. Army Engineering & Support Center, Huntsville



Geographical District:

U.S. Army Corps of Engineers, Jacksonville

Prepared By

USA Environmental, Inc.

720 Brooker Creek Boulevard, Suite 204

Oldsmar, Florida 34677

Reviewed By

A handwritten signature in blue ink, appearing to read "Robert D. Crowover".

Robert Crowover
Corporate Quality Manager

Final

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ACRONYMS AND ABBREVIATIONS

APP	Accident Prevention Plan
ARAR	Applicable or Relevant and Appropriate Requirement
BATF	Bureau of Alcohol, Tobacco, Firearms and Explosives
BIP	Blow in place
BMP	Best Management Practices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulation
CIP	Community Involvement Plan
CSM	Conceptual Site Model
DDESB	Department of Defense Explosives Safety Board
DERP-FUDS	Defense Environmental Restoration Program for Formerly Used Defense Sites
DGM	Digital Geophysical Mapping
DGPS	Differential GPS
DMM	Discarded Military Munitions
DOD	Department of Defense
DOT	Department of Transportation
DQO	Data Quality Objective
EA	Environmental Assessment
EE/CA	Engineering Evaluation/Cost Analysis
EOD	Explosive Ordnance Disposal
EQB	Environmental Quality Board
ESQD	Explosives Safety Quantity Distance
ESS	Explosives Safety Submission
EZ	Exclusion Zone
°F	Degrees Fahrenheit
FLEX	Fleet Exercises
GIS	Geographical Information System
GPS	Global Positioning System
HA	Hazard Assessment
HE	High Explosive
HEAT	High Explosive Anti-Tank
HERO	Hazards of Electromagnetic Radiation to Ordnance
HFD	Hazardous Fragmentation Distance
in/ft	Inches per foot
MC	Munitions Constituents
MEC	Munitions and Explosives of Concern
MFD	Maximum Fragment Distance
MGFD	Munition with the Greatest Fragmentation Distance
MPPEH	Material Potentially Presenting an Explosive Hazard
MRS	Munitions Response Site
MSDS	Material Safety Data Sheet

NEW	Net Explosive Weight
NOFA	No Further Action
NOSSA	Naval Ordnance Safety and Security Activity
OD	Open Detonation
OSHA	Occupational Safety and Health Administration
PAL	Project Action Limit
PPE	Personal Protective Equipment
PR	Puerto Rico
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCP	Quality Control Plan
RAB	Restoration Advisory Board
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
SI	Site Inspection
SOP	Standard Operating Procedure
SUXOS	Senior Unexploded Ordnance Supervisor
TP	Technical Paper
UFP	Uniform Federal Policy
USACE	U.S. Army Corps of Engineers
USAE	USA Environmental, Incorporated
USEPA	U.S. Environmental Protection Agency
USMC	U.S. Marine Corps
UXO	Unexploded Ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer
UXOTI	Unexploded Ordnance Technician I
UXOTII	Unexploded Ordnance Technician II
UXOTIII	Unexploded Ordnance Technician III
WP	Work Plan

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1.0 INTRODUCTION

1.1 PROJECT AUTHORIZATION

USA Environmental (USA) has prepared this Work Plan (WP) for Culebra Island, Puerto Rico (Formerly Used Defense Site (FUDS) Project Number I02PR0068) under Contract No: W912DY-04-D-0006 Task Order No. 0022, from the U.S. Army Corps of Engineers, Engineering and Support Center, Huntsville (USAESCH).

1.2 PURPOSE AND SCOPE

The primary purpose and scope is to perform an in-depth study designed to gather the data necessary to determine the nature and extent of MEC and MC contamination on Culebra Island Munitions Response Sites (MRSs) 13, 10, 11, 06, 09, and, 08, to assess risk to human health and the environment; and establish remediation criteria for each MRS. This WP has been prepared to address the land portions of all six MRS sites. Specific project tasks are listed in Table 1-1. Detailed task descriptions can be reviewed in the Performance Work Statement (PWS) attached as Appendix A.

Table 1-1: Project Tasks

Task	Subtask	Task Description
1		Technical Project Planning (TPP)
	1a	Planning Site Visit
2	--	RI/FS Work Plan
	2a	Explosives Safety Submission Amendment
3	--	Geospatial Data
	3a	Landowner Database and Right of Entry (ROE)
4	--	RI/FS Field Activities
	4a	MRS 13 Cayo Luis Pena Impact Areas
	4b	MRS 10 Defensive Firing Area No. 1
	4c	MRS 11 Defensive Firing Area No. 2
	4d	MRS 06 Artillery Firing Area
	4e	MRS 09 Soldado Point Mortar and Bombing Area
	4f	MRS 08 Cayo Norte Impact Area
5	--	RI Report
6	--	FS Report
7	--	Proposed Plan (PP)
8	--	Decision Document (DD)
9	--	Community Relations Support
10	--	Public Involvement Plan
11	--	Administrative Record
12	--	Environmental Sampling and Analysis
13	--	Beach Monitoring

All activities involving work in areas potentially containing MEC hazards will be conducted in full compliance with U.S. Army Engineering and Support Center, Huntsville (USAESCH), USACE, Department of the Army (DA), and Department of Defense (DoD) requirements regarding personnel, equipment, and procedures, and with Occupational Safety and Health Administration (OSHA) Standard 29 Code of Federal Regulation (CFR) Part 1910.

1.3 WORK PLAN ORGANIZATION

1.3.1 GUIDANCE DOCUMENTS

This Work Plan (WP) follows the directions of DID MR-001, Type I Work Plan. DIDs followed in the preparation of the WP and sub plans are listed in Table 1-2.

Table 1-2: Data Item Descriptions

DID	DID Title
MR-001	Type I Work Plan
MR-005-02	Technical Management Plan
MR-005-03	Explosives Management Plan
MR-005-04	Explosives Siting Plan
MR-005-05.01	Geophysics
MR-005-06	Accident Prevention Plan
MR-005-07.01	Geospatial Information and Electronic Submittals
MR-005-10.01	Munitions Constituents Chemical data Quality Deliverables
MR-005-11	Quality Control Plan
MR-005-12	Environmental Protection Plan
MR-045	Report/Minutes, Record of Meeting
MR-055	Telephone Conversations/Correspondence Records
MR-085	Project Status Report

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1.3.2 WP ORGANIZATION

This RI/FS Work Plan has been divided into Chapters 1 through 11 with associated documents provided either as appendices herein or as standalone documents. Together, the WP and associated documents present the project history, work elements, and requirements in an organized manner. Table 1-3 describes the general structure and organization of this WP. References are frequently made between various sections in the WP and the associated documents.

Table 1-3: RI/FS Work Plan Structure

Chapter Number	Descriptor	Information
1	Introduction	A statement of the project objectives, project authorization, purpose and scope; summary of work plan organization, project location, site descriptions and history, land use, and initial summary of MEC risks.
2	Technical Management Plan	Summary of project objectives, project organization, communication and reporting, project deliverables, project schedule, public relations support, subcontractor management, and management of field operations.
3	Field Investigation Plan	Describes the approach and procedures that will be followed in performing the field investigation and reporting activities, and includes discussion of site characterization goals, data quality objectives, MEC exposure analysis, geophysical planning, intrusive investigation, and MC sampling.
4	Quality Control Plan	Describes the standard processes that will be used to monitor, inspect, and control daily field activities to ensure quality performance, processes to correct quality issues, quality control of contract deliverables, and QC reporting requirements.
5	Explosives Management Plan	Describes procedures that will be followed to manage explosives onsite and includes license/permitting requirements, acquisition and receipt of explosives, storage magazine, transportation, inventory, reporting lost or stolen explosives, and disposal of remaining explosives
6	Explosives Siting Plan	Describes the safety criteria used for planning and siting explosives operations and includes minimum separation distances, footprint areas (Blow-in-place, collection points, consolidated shots, type of storage magazines, listing of planned explosives, and site map.
7	Environmental Protection Plan	Describes the approach, methods and operational procedures that will be employed during onsite activities to protect the natural environment.
8	Property Management Plan	This chapter is not used. The Property Management Plan is not required for this Task Order.
9	Interim Holding Facility Siting Plan for Recovered Chemical Warfare Materiel	This chapter is not used. The Interim Holding Facility Siting Plan for Recovered Chemical Warfare Materiel is not required for this Task Order.
10	Physical Security Plan for Recovered Chemical Warfare Sites	This chapter is not used. The Physical Security Plan for Recovered Chemical Warfare Sites is not required for this Task Order.
11	References	Citation of documents referenced within this Work Plan

The following appendices are included in this WP:

APPENDIX A	Task Order Performance Work Statement
APPENDIX B	Site Maps
APPENDIX C	Local Points of Contact
APPENDIX D	Accident Prevention Plan
APPENDIX E	Munitions Constituents Sampling and Analysis Plan
APPENDIX F	USA Forms
APPENDIX G	MSD Calculation Sheets
APPENDIX H	Resumes
APPENDIX I	Technical Project Planning Minutes
APPENDIX J	Project Schedule
APPENDIX K	Standard Operating Procedures
APPENDIX L	Licenses and Permits
APPENDIX M	Standard Operating Procedures for Endangered Species Conservation
APPENDIX N	Reserved
APPENDIX O	Geophysical Data Quality Objectives
APPENDIX P	Explosives Site Plan
APPENDIX Q	Conceptual Site Models

1.4 PROJECT LOCATION

Project location is Culebra Island (MRS 06, 09, 10, and 11), approximately 17 miles east of the main island of Puerto Rico and also includes surrounding islands Cayo Luis Pena (MRS 13), located approximately three-quarter mile off the western coast of Culebra Island and Cayo Norte (MRS 08), located approximately one-half mile off the northeast coast of Culebra Island. Culebra Island and the surrounding cays are part of the Commonwealth of Puerto Rico.

1.5 SITE DESCRIPTION

1.5.1 LOCATION

Site location is described in section 1.4 and shown in Figure 1-1.

1.5.2 TOPOGRAPHY

Culebra Island and the surrounding cays are comprised of sandy beaches, irregular rugged coastlines, lagoons, coastal wetlands, steep mountains, and narrow valleys. Ninety percent of the island is mountainous. The highest point on Culebra is Mount Resaca at approximately 630 feet above sea level.

Culebra Island is underlain by both intrusive and extrusive volcanic rock of Upper Cretaceous age. The volcanic rock exhibits little or no porosity because of compaction and filling of the pores with quartz and calcite.

Cayo Luis Pena (MRS 13) is comprised of sandy beaches, irregular rugged coastlines and steep mountains. A peak of 476 feet above sea level is located in the center of the Cayo and a smaller peak of 171 feet above sea level exists on the northern peninsular of the Cayo.

Cayo Norte (MRS 08) is a generally flat island with several hills on the western side. The elevation ranges from 80 feet above sea level to 300 feet above sea level. The shoreline on the north side of the island consists of cliffs dropping off to the water. The southern side slopes down to the water and contains beaches. The island consists of light to moderate vegetation with large open areas. There is one body of water on the south side of the island that is connected to the beach- it is most likely a large brackish tidal pool.

1.5.3 CLIMATE

The weather on Culebra Island is generally warm year round due to its tropical marine climate. Yearly average rainfall is approximately 36 inches. The months of August through November are considered the wet season, and the driest months are January through April. Yearly average daily temperatures average 80°F year round with an average maximum of 86°F and an average low of 74°F. Winds are generally from the east-northeast during November through January and from the east during February through October. Yearly average wind speed is 8 knots. Hurricane season is from June through November, and severe hurricanes hit Culebra every 10 to 20 years. The yearly average rainfall for Culebra is provided in Table 1-4.

Table 1-4: Average Rainfall, Culebra Island

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mm	48.6	34.6	37.7	51.7	91.2	80.9	78.5	98.2	119.1	122.6	104.2	62.8	931.1
inches	1.9	1.4	1.5	2.0	3.6	3.2	3.1	3.9	4.7	4.8	4.1	2.5	36

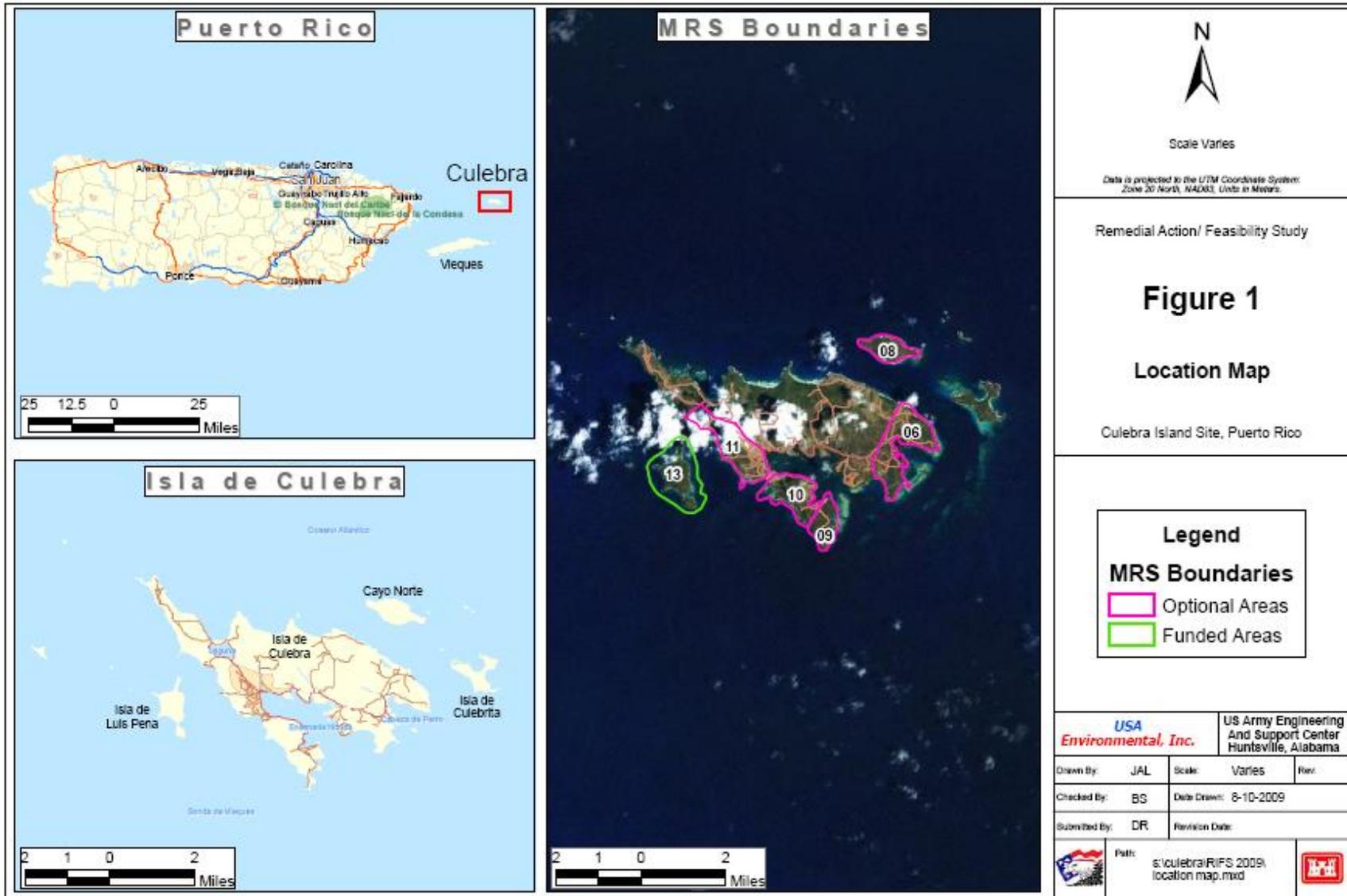


Figure 1-1: Location Map of Culebra, PR and MRS Boundaries

1.5.4 VEGETATION

Vegetation is moderately to extremely dense on undeveloped portions of Culebra, Luis Pena, Northeast Cay, and Culebrita; however, vegetation is sparse or absent on many of the smaller cays as most are rocky with very little soil. Hazardous vegetation include the Mesquite acacia or thorny brush, which may be present on Culebra and all of the surrounding cays, and the poisonous Manchineel tree (also called Manzanillo Tree on Culebra), which is known to be present on Northwest peninsula and near Flamenco Lagoon. Endangered vegetation includes the spineless Culebra Island cactus (*Leptocereus grantianus*).

1.5.5 GEOLOGY

Culebra Island and the surrounding cays are part of the Culebra Archipelago. The rocks are predominantly intrusive or extrusive volcanic rocks consisting of andesite lava and tuff. The rocks in the north-central portion of Culebra and on the east side of Cayo Luis Pena contain diorite porphyry inclusions and have little to no porosity due to compaction and quartz and calcite growth in the pore space.

1.5.6 SOILS

Soils are generally shallow and rocky and consist mostly of silts and clays. Loamy organic-rich soils are found in areas of dense vegetation and grasses, while sandy soils are found on tidal flats or areas near the beach. Many of the beaches on Culebra and the surrounding cays have clean white to tan sand, while other beaches are rocky with a mix of cobbles and pieces of dead coral reef.

1.5.7 HYDROLOGY

There are no permanently flowing surface water streams on Culebra; potable water is obtained from a desalinization plant. Three large ephemeral streams drain the hills north of Great Harbor to the south, and one large ephemeral stream has developed along an old, washed-out jeep road on the north side of the island toward Brava Beach. These ephemeral streams generally only carry water after heavy precipitation. There are many small ephemeral gullies and ditches throughout the island, and several lagoons are present on Culebra as well as Culebrita, Cayo Norte (MRS 08), and Cayo Luis Pena (MRS 13).

1.5.8 HYDROGEOLOGY

Ground water in Culebra occurs in alluvial deposits and in the volcanic and plutonic rocks. Alluvial deposits are located along major stream valleys that reach the coast. The alluvium is mostly composed of silt and clay with limited quantities of sand and gravel. Fractures and joints within the volcanic and plutonic rock formations store water in small quantities. Most of these fractures and joints diminish in number and size with depth and pinch out at about 300 feet below land surface. Water-table conditions prevail in the bedrock aquifer.

1.5.9 SENSITIVE ENVIRONMENTS

The main island of Puerto Rico and its associated islands support 75 federally listed threatened and endangered species consisting of 26 animals and 49 plants. Among this diverse group of fauna and flora are multiple species that are known to exist, potentially exist, or temporarily use areas within the Culebra Island, such as migratory birds. Of the 75 federally listed species, nine are known or are suspected to occupy Culebra Island and/or the associated cays. In addition to the federally listed species, 13 state-listed species are known to occupy Culebra Island and/or the associated cays. The federally and state-listed species includes both terrestrial and marine life. The federally listed species of most concern for the wildlife refuge are the Culebra Island giant anole, Virgin Islands tree boa, roseate tern, brown pelican, green sea turtle, hawksbill sea turtle, leatherback sea turtle, loggerhead sea turtle, *Leptocereus grantianus* (cactus), and Wheeler's peperomia. Due to declining populations, the elkhorn and staghorn corals in the surrounding waters are proposed to be federally listed threatened and endangered species.

According to the National Wildlife Refuge System (NWRS), portions of Culebra Island and 22 of the associated cays are considered National Wildlife Refuge area. The three largest cayos are Culebrita, Cayo Norte, and Luis Pena. These resemble Culebra in that they all have sandy beaches, rugged

coastline, and gentle to steep hills. Vegetation ranges from moderate to extremely dense. The smaller cays are primarily solid rock with sparse or no vegetation. A few of the smaller cays have small beaches; however, most are rugged rock all around.

According to the DNER, the conservation priority areas for Culebra and associated cays are as follows:

- All of the lagoons on Culebra
- Monte Resaca
- All beaches around Culebra
- The designated critical habitat area for the Virgin Islands Boa
- Flemenco Peninsula
- Puerto del Manglar
- Los Canos
- Punta Soldado
- Bahía (also called “Ensenada”) Cementerio
- All cayos and cays around Culebra
- The Culebra National Wildlife Refuge
- The Canal Luis Pena Natural Reserve

1.6 SITE HISTORY

Spain ceded all of Puerto Rico to the United States in 1898 following the Spanish American War. The public lands in the Culebra Island Archipelago were placed under the control of the U.S. Department of Navy in 1901. The Culebra Island Archipelago was used for training purposes by the U.S. Navy and U.S. Marines, and was later used by the North Atlantic Treaty Organization (NATO). The U.S. Marines used portions of Culebra Island as a training facility from 1902 through 1941. Culebra Island was used as a bombing and gunnery range from 1935 through 1975. To support the increased training needs during Viet Nam operations, the Navy acquired additional training areas on cays east and west of Culebra Island for use as air-to-ground ranges. Live ordnance operations reached their peak in 1969 as the fleet was training pilots for Viet Nam. Aircraft bombing and strafing of the Flamenco Peninsula ended around 1970, while the use of live rounds for naval gunfire support training ended in 1971. Subsequent naval support training was conducted using quieter practice rounds until ordnance use was terminated on September 30, 1975. Between 1975 and 1982, the facilities were turned over to the General Services Administration (GSA).

During military use of the land, the island was inhabited by many residents centralized around the town of Dewey on the west central portion of the island. Currently, the site includes municipal, residential, and recreational areas. Most of the main island of Culebra, as well as Cayo Norte, are privately owned, while the surrounding cays are managed by the U.S. Fish and Wildlife Service (USFWS). The Puerto Rico Department of Natural and Environmental Resources (DNER) also manages land on Culebra. Access is unrestricted on most of the island, although natural barriers such as dense vegetation and rocky cliffs make access to many areas difficult. Portions of the island are also used for cattle grazing.

1.7 CURRENT AND PROJECTED LAND USE

1.7.1 MRS 13 CAYO LUIS PENA IMPACT AREAS

MRS 13 covers all of Cayo Luis Pena. The Cayo is managed by the USFWS and DNER as part of the Culebra National Wildlife Refuge. Residential areas do not exist on Cayo Luis Pena but have been developed on the main island immediately across the channel. The site has no barriers to access. Site conditions could change in the future with potential impact on land use. Examples might include excessive soil erosion on beaches or streams, or the increase in land development that could reduce distances from the site to inhabited areas or otherwise increase accessibility.

1.7.2 MRS 10 DEFENSIVE FIRING AREA NO. 1

MRS 10 is almost entirely privately owned except for municipal lands such as the police and fire stations. Residential areas have been developed on the hills overlooking the mortar impact areas. Additional homes could be developed in the area of the firing points, but development is not expected in the impact zone. Site conditions could change in the future with potential impact on land use. Examples might include excessive soil erosion on beaches or streams, or the increase in land development that could reduce distances from the site to inhabited areas or otherwise increase accessibility. Seasonal surf action could cause changes in the bottoms of the surrounding waters. The water area adjacent to this shore is generally not used for recreational activities.

1.7.3 MRS 11 DEFENSIVE FIRING AREA NO. 2

Most of the southern portion of MRS 11 has been extensively developed for residential use. The areas along the beach and the west side of this site are less developed. The land is privately owned with some municipal properties such as the school, hospital, and government buildings. Residential areas have been developed on the hills overlooking the mortar impact areas. Development could occur throughout the site. Site conditions could change in the future with potential impact on land use. Examples might include excessive soil erosion on beaches or streams, or the increase in land development that could reduce distances from the site to inhabited areas or otherwise increase accessibility. The immediate offshore waters are part of the Luis Pena Water Refuge.

1.7.4 MRS 06 ARTILLERY FIRING AREA

MRS 06 is almost entirely privately owned except for the water line, which is owned by the DNER and USFWS. This tract contains several residential areas. Portions of this tract are currently being developed with others listed for sale for potential development. Site conditions could change in the future with potential impact on land use. Examples might include excessive soil erosion on beaches or streams, or the increase in land development that could reduce distances from the site to inhabited areas or otherwise increase accessibility.

1.7.5 MRS 09 SOLDADO POINT MORTAR AND BOMBING AREA

MRS 09 is managed by the DNER and residential development is not supposed to be allowed on the site. Public area structures could be developed at some point in the future. There are no restrictions for using the beach areas or entering the surrounding waters for recreation activities. Site conditions could change in the future with potential impact on land use. Examples might include excessive soil erosion on beaches or streams, or the increase in land development that could reduce distances from the site to inhabited areas or otherwise increase accessibility. Seasonal surf action could cause changes in the bottoms of the surrounding waters.

1.7.6 MRS 08 CAYO NORTE IMPACT AREA

MRS 08 covers all of Cayo Norte, a privately owned island with no barriers to access. Plans exist for residential development. Site conditions could change in the future with potential impact on land use. Examples might include excessive soil erosion on beaches or streams, or the increase in land development that could reduce distances from the site to inhabited areas or otherwise increase accessibility.

1.8 PREVIOUS SITE INVESTIGATIONS

1.8.1 1991-INVENTORY PROJECT REPORT (INPR), CULEBRA, PUERTO RICO, PROPERTY NO. I02PR0068, ORIGINAL MAY 1991.

The original INPR qualified 2660 acres of Culebra as eligible for consideration under the Environmental Restoration Program (DERP) for Formerly Used Defense Sites (FUDS). The INPR, signed on 24 December 1991, established the Culebra Island site as a FUDS, defined a site boundary, and assigned FUDS Project No. I02PR006800. The Findings and Determination of Eligibility (FDE) concluded that "the site, except for 87.5 acres still under control of the Navy, has been determined to be formerly used by the Department of Defense. It is therefore eligible for the Defense Environmental Restoration Program (DERP)."

1.8.2 1995-ARCHIVES SEARCH REPORT, FINDINGS, ORDNANCE AND EXPLOSIVE WASTE, CULEBRA ISLAND NATIONAL WILDLIFE REFUGE, CULEBRA, PUERTO RICO, FEBRUARY 1995.

The Archives Search Report (ASR) presented the findings of an historical records search and site inspection for MEC presence in the Culebra Island National Wildlife Refuge. As part of the ASR, a site visit was conducted in October 1994, during which the team identified munitions debris (MD) on Cayo Botella, Cayos Geniqui, and Cayo del Agua. In addition, MD was identified on Flamenco Beach, Flamenco Peninsula, and the hillside near Cerro Balcon. The ASR listed several ordnance items verified on site by either explosive ordnance disposal (EOD) personnel or the ASR field team. The ASR covered the entire land area of Culebra Island and the nearby keys, about 7300 acres of land, and also included 85,200 acres of surrounding water. The report included site history, site descriptions, real estate ownership information, and confirmed the presence of ordnance based on available records, interviews, and site inspections.

1.8.3 1995-INTERIM REMEDIAL ACTION

An Interim Remedial Action on 3.66 acres of Flamenco Bay Campground (MRS 02) near Flamenco Beach was completed in 1995 by MTA, Inc. The action was to remove and dispose of UXO within 2 feet of the ground surface. Work was conducted on the site between 12 May and 26 May 1995. MTA found 11 items of MEC and munitions debris.

1.8.4 1996-FINAL ENGINEERING EVALUATION/COST ANALYSIS, CULEBRA, PUERTO RICO, 1996.

Environmental Science and Engineering (ESE) completed an Engineering Evaluation/Cost Analysis (EE/CA) in 1996. ESE characterized the type of ordnance found and assessed the exposure potential at each of the sites based on the statistical sampling of randomly placed grids at each of 11 sites. Several remedial action alternatives were evaluated based on CERCLA evaluation criteria. The selected remedial alternatives included clearance for use at Flamenco Beach and the Northwest Peninsula, and surface clearance of MEC and munitions constituents at Cerro Balcon, Isla Culebrita, and the adjacent cays, including Cayo Botella, Cayo Tiburon, Los Gemelos, Cayo del Agua, Cayos Genequi, Cayo Lobo, and Cayo Alcarraza. An EE/CA Action Memorandum (ESE 1997) was filed which identified cleanup options and was approved by Department of Defense.

1.8.5 2004-SITE-SPECIFIC FINAL REPORT, UXO CONSTRUCTION SUPPORT, CULEBRA ISLAND WILDLIFE REFUGE, CULEBRA ISLAND, PUERTO RICO

The Site-Specific Final Report (for) UXO Construction Support was submitted In June 2004, by Ellis Environmental Group, LC (Ellis). The report documented clearance efforts conducted by Ellis on the Northwest Peninsula. Ellis performed four phases of clearance from January 2001 to February 2004. Phase I consisted of construction support by clearing roadways, a wind generator foundation, a desalination plant foundation, and regrading the site. Phase II of the construction support was not exercised. Phase III included surface clearance of 70 acres of bird nesting area and 4-foot-depth subsurface clearance of roadways, firebreaks, and an observation post. Phase IV consisted of demilitarization of scrap, construction of a fence and information kiosk, and development of public awareness information. The public awareness information included a video, UXO safety poster, and UXO safety brochure. During the UXO Construction Support project, Ellis recovered 15,479 pounds of scrap metal and 249 UXO items.

1.8.6 2004-ARCHIVES SEARCH REPORT SUPPLEMENT

In 2004, an ASR supplement was completed by the USACE Rock Island District as an addition to the 1995 ASR. The report provides details of aerial training conducted by the Navy between 1935 and 1975 and identifies the following range areas:

- Mortar Range: This area is also called Cerro Balcon and is part of MRS 02. The following munitions may have been used in this area: Mk1 3-inch HE mortar and M329A1 4.2-inch HE mortar.
- Airfield Rifle Range: This small arms range in MRS 14 is seen on historic maps in the vicinity of the airport. Suspect munitions include general small arms.

- Aerial Mining Range: Practice mines were dropped in the water-covered portion of this area and then cleared by divers or minesweepers.
- Water Mine Field: The water area is suspected to have been used for mine training.
- Water West: Part of this area is included in MRS 12. A local diver reported underwater ordnance in this area. Suspect munitions include Mk II 6-inch HE projectiles.
- Water Center: This area is included in MRS 12. A local diver reported underwater ordnance in this area. Suspect munitions include Mk II 6-inch HE projectiles.
- Water South: This water area includes the small bay north of Soldado Point (part of MRS 09). A local diver reported underwater ordnance in this area. Suspect ordnance includes Mk II 6-inch HE; however, other ordnance types are suspected due to use as 1936 aerial target and 1938 mortar boat firing exercises.
- Shark Rock: Part of MRS 02, also known as Cayo Tiburon, this area was used as a target for aerial gunnery with bombs and rockets. Suspected ordnance includes Mk82 general purpose 500-pound HE bombs and 5-inch Zuni rockets.
- Palada Cay: Part of MRS 02, also known as Cayos Geniqui, this area was used as a target for aerial gunnery with bombs and rockets. Suspected ordnance includes Mk82 general purpose 500-pound HE bombs and 5-inch Zuni rockets.
- Ladrone Cay: Part of MRS 02, also known as Cayo Botella, this area was used as a target for aerial gunnery with bombs and rockets. Suspected ordnance includes Mk82 general purpose 500-pound HE bombs and 5-inch Zuni rockets.
- Culebrita Strafing Range: This strafing range target was on the north side of Culebrita and is part of MRS 07. Suspected munitions include general small arms, .50-caliber small arms, and MKI 20mm HEI.
- Culebrita Torpedo Range: Firing at this range from the water north of Culebrita targeted the sheer cliffs of Cayos Geniqui, part of MRS 02. Suspected munitions include the Navy's general torpedo.
- Naval Gunfire Target Area: This range was a naval gunfire and air-to-ground range with its target located on Northwest Peninsula, MRS 02. Munitions included general small arms, .50-caliber small arms, Mk80s series general purpose bombs, M1 105mm HE, Mk21 8-inch armor piercing (AP), Mk5 16-inch AP, 2.75-inch rockets, and the 11.75-inch Tiny Tim rocket.
- Twin Rocks: This area, also known as Los Gemelos, is part of MRS 02. These cays were used as targets for aerial bombs and rockets. Munitions included Mk80s series general purpose bombs, 5-inch Zuni rockets, and Mk8 5-inch practice rockets.
- Fungy Bowl: This area, also known as Alcarazza, is part of MRS 02. This large rock was used as a target for aerial bombs and rockets. Suspected munitions include Mk80s series general purpose bombs and 5-inch Zuni rockets.
- Cross Cay: This area, also known as Cayo Lobo, is part of MRS 02 and was used as a strafing and bombing target. Munitions included general small arms, .50-caliber small arms, Mk80s series general purpose bombs, and Mk I 20mm HEI.
- Agua Cay: This area, also known as Water Key, is part of MRS 02 and was used as a target for bombing and rocket fire. Munitions include Mk80s series general purpose bombs and 2.75-inch rockets.
- Air-to-Ground North: This target, at the northern tip of Northwest Peninsula, is part of MRS 02. Munitions used include general small arms, .50-caliber small arms, Mk82 500-pound general purpose bombs, 2.75-inch rockets, and 11.75-inch Tiny Tim rockets.
- Air-to-Ground South: This target was located at the northern tip of Northwest Peninsula and is part of MRS 02. Munitions used include general small arms, .50-caliber small arms, Mk82 500-pound general purpose bombs, 2.75-inch rockets, and 11.75-inch Tiny Tim rockets.
- Rifle Range South: This small arms range is believed to be located on undeveloped land near the southern tip of the island in MRS 09. This range has not been confirmed; however, munitions used at this range would have included only general small arms.

1.8.7 2005-INVENTORY PROJECT REPORT (INPR), ORIGINAL MAY 1991, REVISED JULY 2005 (FINAL)

The original INPR was revised in 2005, clarifying the military use of the Island of Culebra and divided the original site, Property No I02PR0068, into 14 separate MRSs. One hazardous and toxic waste (HTW) project was identified and assigned the number 00, and 13 MMRP project areas were identified and assigned Risk Assessment Code (RAC) scores. MRS 01 was not defined.

The following MMRP projects and RAC scores were listed:

- MRS 02 – Culebra and Cays, RAC 1
- MRS 03 – Flamenco Bay Water Area, RAC 1
- MRS 04 – Flamenco Lagoon Maneuver Area, RAC 1
- MRS 05 – Mortar and Combat Range Area, RAC 1
- MRS 06 – Artillery Firing Area, RAC 3
- MRS 07 – Culebrita Artillery Impact Area, RAC 1
- MRS 08 – Cayo Norte Impact Area, RAC 3
- MRS 09 – Soldado Point Mortar and Bombing Area, RAC 2
- MRS 10 – Defensive Firing Area No. 1, RAC 2
- MRS 11 – Defensive Firing Area No. 2, RAC 1
- MRS 12 – Luis Pena Channel Water Areas, RAC 1
- MRS 13 – Cayo Luis Pena Impact Area, RAC 1
- MRS 14 – Airfield and Camp Area, RAC 3

1.8.8 2005-SUPPLEMENTAL ARCHIVES SEARCH REPORT, CULEBRA, PUERTO RICO, SEPTEMBER 2005.

USACE St. Louis District prepared the Supplemental ASR in 2005 as an addition to the 1995 ASR. The Supplemental ASR is the source of most of the historical information pertaining to site operations and identified the key areas of focus for the subsequent Site Inspection (SI). This document provided a detailed summary of military activities conducted on Culebra Island and the surrounding cays. The document summarized planned and/or executed maneuvers and training conducted at the site, including specific time periods, locations, and munitions used.

1.8.9 2007-SITE INSPECTION REPORT, CULEBRA ISLAND SITE, PUERTO RICO, FUDS PROJECT No. I02PR006802 THROUGH 14, 2007

Parsons Infrastructure and Technology Group (Parsons) completed a site inspection of the Island and published a Final SI Report in September 2007. Parsons concluded that the potential for MEC to pose a human health risk existed within 12 of the 13 MRSs, but that there was no evidence to indicate that MRS 14 had potential MEC contamination. Parsons further concluded that although there was potential for MEC to pose a risk at the Culebra Island sites, since the field team did not identify an imminent threat to the public, a TCRA was not necessary. However, due to the presence of munitions debris and MEC at several areas within the site, Parsons recommended these sites proceed to the remedial investigation/feasibility study (RI/FS) status.

1.8.10 2009-NON-TIME CRITICAL REMOVAL ACTION, CULEBRITA AND CULEBRA BEACHES, FEBRUARY 2009.

In 2008-2009, USA completed a NTCRA on Flamenco Beach located on Culebra Island and five beaches along Culebrita isle located east of Culebra Island. USA performed digital geophysical mapping of 12.3 acres and reacquired target anomalies. Findings included 6 munitions debris (MD) items and 2 UXO items (5" projectiles) on Flamenco Beach, and 12 MD (20mm, 75mm), 6 UXO (20mm) and 6 items classified as material potentially presenting an explosive hazard (MPPEH) (20mm) on one of the five beaches on Culebrita.

1.9 INITIAL SUMMARY OF RISK FROM MEC

1.9.1 MRS 13 CAYO LUIS PENA IMPACT AREAS

Cayo de Luis Pena, with 484 acres of land and 864 total MRS acres, is about one quarter mile off the western coast of Culebra. The northern tip of this island was used as a firing target during Marine exercises conducted between 1924 and 1941. Records show that 75mm projectiles were fired at the Cayo in 1924 and that 155mm, 37mm, 8-inch, and 6-inch rounds may have also been used. In the 1960s, an observation point was erected on the hill top on Luis Pena, including a run-in line, helipad, and living quarters. Cayo de Luis Pena is managed by the USFWS as part of the Culebra National Wildlife Refuge.

1.9.2 MRS 10 DEFENSIVE FIRING AREA No. 1

This area consists of 547 acres on the southwest peninsula of Culebra, south of the town of Dewey and north of MRS 09. Marines conducted amphibious landing and ground maneuver training using 81mm mortars on the beaches and hills in this area from the 1920s through the 1940s. Specifically, the hill on the north end of the MRS has been listed as a 1935 area of direct fire from 3" Common projectiles, and Snug Bay was shown as a 1935 water area for direct fire. Additionally a 1924 outpost and ammunition storage area is located on the north end of the MRS near Snug Bay. MRS 10 has many residents and businesses. Most of the development is near the town of Dewey on the north end of the site; however, houses are scattered throughout the southeastern side of this MRS. This MRS is almost entirely privately owned except for municipality lands such as the police and fire stations.

1.9.3 MRS 11 DEFENSIVE FIRING AREA No. 2

MRS 11 is located on the west side of Culebra between Northwest Peninsula and the town of Dewey. The property was part of the land leased from Mr. Jesus Nieves on 7 November 1923. The area is approximately 719 acres, and most of the southern portion of this MRS has been extensively developed for residential use. The areas along the beach and the west side of this site are less developed. The land is privately owned with some municipality properties such as the school, hospital, and government buildings. Several training exercises were conducted in this area, including 75mm and 155mm firing from Firewood Bay at Mono Cay and portions of Cayo de Luis Pena in 1924; FLEX No. 4 with firing of small arms and 81mm mortars in 1936; and FLEX No. 7 in 1941 with boat-to-beach firing of 5-inch and 6-inch projectiles.

1.9.4 MRS 06 ARTILLERY FIRING AREA

MRS 06 is on the eastern end of Culebra extending from a point at the most northern tip of Mosquito Bay, northeast to a point just west of Duck Point, and east to the end of the island. This area consists of 826 acres and was used by the Marines for artillery firing points for exercises conducted between 1922 and the 1940s. Exercises involving small arms, Stokes mortars, 75mm pack howitzers, 3-inch mortars, and 37mm HE rounds were conducted in Mosquito Bay in 1936. Beginning in 1936, the Marines fired 75mm projectiles from a firing point inland of Mangrove Bay at Weather Channel near Culebrita. Additionally, 1937 U.S. FLEX No. 4 involved use of the lagoon area at the back of Mosquito Bay. In 1939, the Marines fired from 1,000 yards northeast of Mosquito Bay toward the cays to the east. From Mosquito Bay, 37mm rounds were fired west to water targets between Point Vaca and Snapper Shoal.

The property of MRS 06 was leased from the Vieques Sugar Company and Mr. A Lugo in 1924. Mr. Lugo's lease was terminated in 1939; however, there is no record of the termination on the property owned by the Vieques Sugar Company. Currently, this MRS is almost entirely privately owned except for the water line, which is owned by the DNER and USFWS.

1.9.5 MRS 09 SOLDADO POINT MORTAR AND BOMBING AREA

This area consists of 328 acres on the very southern tip of the southwestern peninsula of Culebra. In 1914, a 5-inch battery was established on Soldado Point. Several training exercises including mortar firing, aerial bombing, and strafing were conducted on Soldado Point and the bay northwest of Soldado point during the 1930s and 40s. The Supplemental Archives Search Report (ASR) mentions that 30- and 1,000-pound bombs were dropped in this area (USACE 2005c). Munitions used in the bay included 30-pound fragmentation bombs, 100-pound demolition bombs, 81mm mortars, and small arms.

This piece of property was accepted in a quitclaim deed from the Secretary of the Interior by the Governor of Puerto Rico in 1982. This property is managed by the DNER; however, several shacks have been built along the water at Sueno cove.

1.9.6 MRS 08 CAYO NORTE IMPACT AREA

MRS 08 includes only Cayo Norte and covers approximately 306 acres of land. Cayo Norte was leased by the Marines for training; however, it cannot be determined from records whether the site was ever used for training. The property was leased from Mrs. Alma Hasselroth in 1924 for erecting artillery targets for 75 mm artillery practice. This lease was ended as part of the agreement between the Navy and Mayor of Culebra in 1971. Notes on FLEX No. 5 indicate that impact of Cayo Norte was planned but that difficulties clearing people and cows from the island kept it from being used for an impact area. The surrounding waters to the east of the Cayo Norte may contain suspected 5" HVAR from adjacent MRSs. No UXO has been identified on Cayo Norte. Cayo Norte is privately owned with plans for residential development.

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2.0 TECHNICAL MANAGEMENT PLAN

2.1 PROJECT OBJECTIVES

The objective of this Remedial Investigation/Feasibility Study (RI/FS) is to obtain acceptance of Decision Documents for each Munitions Response Site (MRS) that meet the requirements of Engineer Regulation 200-3-1 and Interim Guidance Document (IGD) 06-04, Engineer Pamphlet 1110-1-18 Military Munitions Response Process.

The overall objective of the RI/FS process is to identify and recommend a feasible and cost effective response alternative for MEC and MC related problems affecting human use of the site; determine and recommend areas that should receive response actions using the risk reduction option selected by the Government; perform risk evaluation of the site based on the potential response action options; and provide a convenient record of the process for use in final decision making that is protective of human health with respect to the intended future land use at the site.

2.2 PROJECT ORGANIZATION

For the RI/FS process to be successful, close coordination and cooperation between the stakeholders, community, regulators, and technical support personnel must occur. Figure 2-1 depicts the organizational structure of the USA project team with respect to the USACE. Other team members include the Culebra site stakeholders. The roles of these team members are described below.

2.2.1 U.S. ARMY CORPS OF ENGINEERS (USACE), JACKSONVILLE DISTRICT

USACE Jacksonville District is the project management and funding agency for this project. USACE Jacksonville District responsibilities include review of project plans and documents, obtaining rights-of-entry for properties in the investigation areas, coordinating with the news media and the public, and coordinating with national, state and local regulatory agencies on issues pertaining to protection of ecological and cultural resources

2.2.2 U.S. ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE (USAESCH)

USAESCH is the lead technical agency for this project. USAESCH responsibilities include procurement of contract services, review and coordination of project plans and documents, and supporting USACE Jacksonville District in working with the news media, the public, and the regulators. USAESCH provides technical expertise for MEC and MC activities. As the technical Project Manager, USAESCH is responsible for controlling the budget and schedule. As the contracting agency, USAESCH is responsible for directing the RI/FS contractor.

2.2.3 USA ENVIRONMENTAL, INC.

USA is the prime contractor to USAESCH for this project. USA will provide staff to perform all aspects of sample collection and provide oversight of field sampling activities. USA will assign project personnel based on management and technical experience and abilities. USA will contract TestAmerica for chemical analytical, APPL for QA analysis, and LDC for data validation. USA will prepare and submit data reports in accordance with (IAW) relevant USACE guidance. The USA Project Manager (PM) is Mr. Brian Skubin. The USA Quality Manager is Mr. Robert Crownover.

2.2.4 RTI LABORATORIES, DETROIT, MICHIGAN

RTI Laboratories (RTI) is the analytical laboratory subcontractor for this project. The RTI Customer Services Manager will coordinate with the USA QC Manager and PM on all issues concerning laboratory sample handling, analysis, analytical results, work scheduling, and laboratory QA/QC such that all environmental samples are analyzed according to appropriate methods and within specified holding times. The RTI QA Manager is responsible for oversight of data processing, data processing QC, and performance and system audits.

2.2.5 LABORATORY DATA CONSULTANTS

LDC is the chemical data validation subcontractor for this project. LDC will validate the analytical data submitted by Test America, Denver IAW USACE EM 200-1-1. The LDC Data Validator is Stella Cuenco.

2.2.6 TESTAMERICA DENVER

TestAmerica is the independent laboratory subcontractor to analyze the QA samples for this project. The results of the QA sample analysis are sent directly to USAESCH IAW the PWS. The TestAmerica QC Officer is responsible for oversight of data processing, data processing QC, and performance and system audits.

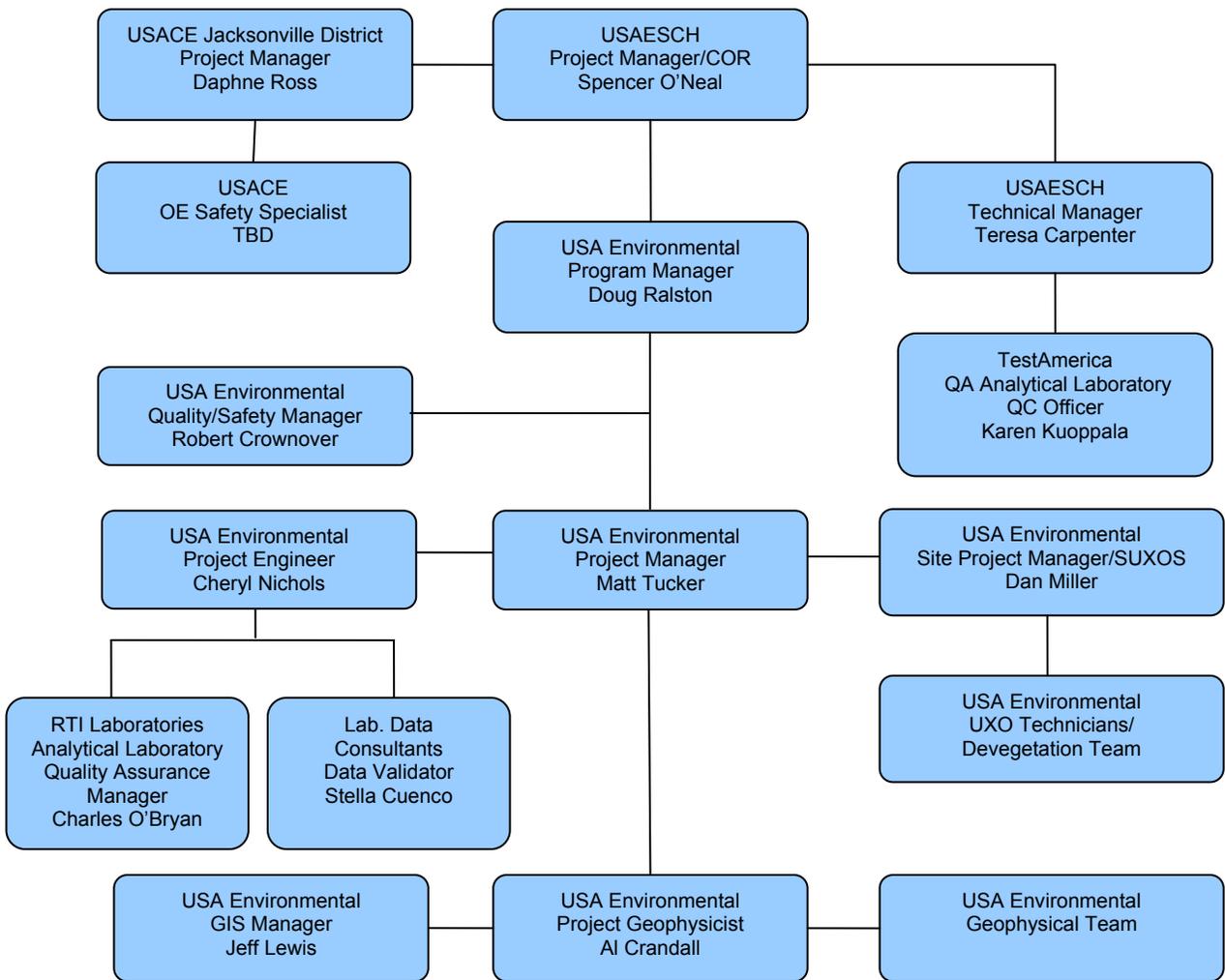


Figure 2-1: Project Management Organization

2.2.7 CULEBRA AREA STAKEHOLDERS

The stakeholders are the individuals and organizations directly impacted by the RI/FS activities and the final MMRP response actions selected for the site. Stakeholders include (but are not limited to):

- Puerto Rico Department of Natural and Environmental Resources (PR DNER)
- Puerto Rico Environmental Quality Board (PR EQB)
- United States Environmental Protection Agency (EPA)
- Culebra National Wildlife Refuge
- US Fish and Wildlife Service
- National Oceanic and Atmospheric Administration (NOAA)
- Restoration Advisory Board (RAB)
- Individual Leaseholders.

2.2.8 USA ENVIRONMENTAL, INCORPORATED (USA)

USA is the prime contractor to USAESCH. USA provides comprehensive engineering, project management, and quality control (QC) support services for the RI/FS. USA is responsible for managing the schedule and budget to ensure timely completion of the tasks detailed in the Performance Work Statement (PWS). USA properly trained and qualified unexploded ordnance (UXO) personnel and geophysical professionals will conduct escort and visual MEC removal of access routes and areas designated for geophysical investigation, perform the necessary vegetation removal/ geophysical survey activities, and perform necessary intrusive investigation of detected anomalies to characterize the MEC risk at the project site. USA will also collect MC composite soil samples at suspect MEC locations for analysis at TestAmerica Laboratories, Inc. The USA GIS Manager will incorporate collected real estate and geophysical investigation data into the existing GIS database. USA will provide the Senior UXO Supervisor (SUXOS), the UXO Quality Control Specialist (UXOQCS), and the UXO Safety Officer (UXOSO) for the field activities. USA will also conduct a MEC risk impact analysis and a baseline risk assessment for MC as part of the RI/FS work. The USAESCH Contracting Officer will direct all work performed by USA and its subcontractors. Key USA positions are described below and Resumes of key USA management and field personnel are presented in Appendix H.

2.3 PROJECT PERSONNEL

2.3.1 USA PROJECT MANAGER

The Project Manager is responsible for monitoring overall progress of the Task Order, reviewing monthly progress reports, and ensuring that resources are available. The Project Manager maintains close communication with USAESCH to assess client satisfaction with USA performance on this Task Order.

2.3.2 USA QUALITY MANAGER

The Quality Manager is responsible for reviewing and updating the Quality Control Plan and verifying compliance with the plan. The Quality Manager verifies compliance with the Quality Control Plan by auditing project activities and instituting corrective actions.

2.3.3 USA SAFETY MANAGER

The Safety Manager develops and coordinates the Accident Prevention Plan (APP). The Safety Manager is the contact for regulatory agencies on matters of health and safety. For this project, the Quality Manager also serves as the Safety Manager.

2.3.4 USA ENVIRONMENTAL ENGINEER

The Environmental Engineer provides technical, analytical, and report writing support to ensure the technical quality of deliverables to USAESCH.

2.3.5 USA GEOGRAPHICAL INFORMATION SYSTEMS (GIS) MANAGER

The GIS Manager is responsible for management and control of the project GIS. The GIS Manager will direct GIS operations occurring locally and remotely, and is responsible for control of data included in and used as part of the project GIS.

2.3.6 USA PROJECT GEOPHYSICIST

The Project Geophysicist provides oversight and direction for all geophysical activities. The Project Geophysicist is responsible for selection of the detection equipment to be used and for the quality and interpretation of the geophysical data collected.

2.3.7 USA SITE PROJECT MANAGER/SUXOS

The USA SITE PROJECT MANAGER/SUXOS is responsible for onsite administration, coordination, and site operations. He will manage all field operations, including site preparation, environmental surveys, and support for GPO and DGM to ensure the mapping is completed in a timely manner to allow the anomaly resolution phase to commence. The SUXOS will be the primary facilitator on site to coordinate with USFWS, the Refuge Manager, and local Culebra agencies for site control, environmental surveys, and demolition operations.

2.3.8 UXO QUALITY CONTROL SPECIALIST (UXOQCS)

The UXOQCS is responsible for monitoring and ensuring that all site MEC activities are conducted in accordance with this Work Plan. The UXOQCS will conduct Quality Control (QC) inspections of all MEC and explosives operations for compliance with established procedures and direct and approve all corrective actions to ensure all MEC-related work complies with contractual requirements.

2.3.9 UXO SAFETY OFFICER (UXOSO)

The UXOSO will implement the Site Safety and Health Plan (SSHP) and APP and verify compliance with applicable health and safety (H&S) requirements. The UXOSO will also implement the explosives safety program in compliance with all DoD, federal, state, and local statutes and codes; analyze MEC and explosives operational risks, hazards, and safety requirements; establish and ensure compliance with all site-specific safety requirements for MEC and explosives operations; and enforce personnel limits and safety exclusion zones (EZs) for MEC clearance operations and explosives transportation, storage, and destruction.

2.3.10 UXO/VEGETATION REMOVAL TEAMS

Each UXO team shall consist of one UXO Technician III and six or less team members. UXO teams shall have a minimum of two UXO qualified personnel, one of which shall be the UXO Technician III. The term *UXO_Qualified Personnel* applies only to personnel meeting the requirements for the positions of UXO Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist, and Senior UXO Supervisor.

The UXO Technician I assists fully qualified personnel (UXO Technician II and above) in the conducting reconnaissance and classification of MEC; identifying all munitions and associated components; locating subsurface MEC; performing excavation procedures on subsurface MEC; locating surface MEC by visual means; transporting MEC and demolition materials; preparing firing systems, both electric and non-electric, for destruction operations; operating Personnel Decontamination Stations (PDS); inspecting salvaged MEC-related material and erection of MEC-related protective works; and donning and doffing personnel protective equipment. The UXO Technician I shall not determine if OE items are moveable.

USA SUXOS shall supervise all UXO related tasks and UXO teams. This individual may supervise other than UXO teams such as vegetation removal teams. When non-UXO teams are under the direct supervision of someone other than a UXO Technician III, the teams shall be accompanied by a UXO Technician II who will provide UXO avoidance support.

Vegetation removal teams will conduct vegetation removal activities in coordination with the sub-contracted botanist.

The USA SUXOS will maintain personnel files on each employee. These records will include copies of licenses, training records and certificates of qualifications that support the employee's placement and position. Prior to the employee's initial assignment or any change in duties/assignment, the USA SUXOS will physically review the employee's licenses, training records and certificates to ensure that the employee is qualified.

2.3.11 REMOTELY OPERATED VEHICLE (ROV) OPERATOR

The ROV Operator will be qualified to operate the ROV and will undergo site-specific training prior to underwater anomaly investigation activities.

2.3.12 BOAT SUPPORT PERSONNEL

Personnel assigned to support operations consist of the following positions:

- Boat captain and crew

The boat captain and crew personnel will be provided by a local subcontractor identified to provide water transportation services.

2.3.13 SUBCONTRACTORS

2.3.13.1 Sea Ventures

USA will subcontract with Sea Ventures to provide water transportation support. Sea Ventures operates out of Marina Puerto Del Rey, Fajardo, Puerto Rico and operates boats that are inspected and licensed by the United States Coast Guard and the Puerto Rico Public Service Commission. USA will rely on Sea Ventures to provide water transport of explosives when the only access route is by sea and rubber dinghies for access into shallow water areas.

2.3.13.2 Biologist

As an optional task, USA will subcontract the services of a local qualified Project Biologist for daily beach monitoring prior to MEC intrusive investigation activities as described in the *Standard Operating Procedures for Endangered Species Conservation and their Habitat on DERP-FUDS Project No. I02PR006802.Culebra, Puerto Rico* (Appendix O). The Project Biologist's background includes 2 to 4 years of experience in related work, working independently under general supervision. The Project Biologist qualification is equivalent to industry Biologist II.

2.3.13.3 Botanist (optional)

If authorized, USA will contract with a local botanist for approval of any trimming of vegetation. The botanist or their designated botany technician would be on site and approve any vegetation that was required to be trimmed by the vegetation removal teams to allow DGM survey in close proximity to beach areas.

2.3.13.4 Laboratory Data Consultants

Laboratory Data Consultants, Inc. (LDC) is the chemical data validation subcontractor for this project. LDC validates the analytical data submitted by TestAmerica IAW USACE EM 200-1-1.

2.3.13.5 RTI Laboratories

RTI Laboratories will provide analysis of environmental samples. The RTI Project Manager coordinates with the USA QC Manager and USA Project Manager on all issues concerning laboratory sample handling, analysis, analytical results, work scheduling, and laboratory QA/QC such that all environmental samples are analyzed according to appropriate methods and within specified holding times. The RTI QC

Officer is responsible for oversight of data processing, data processing QC, and performance and system audits.

2.3.13.6 TestAmerica

TestAmerica is the independent laboratory subcontractor to analyze the QA samples for this project. The results of the QA sample analysis are sent directly to USAESCH IAW the PWS. The TestAmerica Project Manager coordinates with the USA QC Manager and Project Manager on all issues concerning laboratory sample handling, analysis, analytical results, work scheduling, and laboratory QA/QC such that all environmental samples are analyzed according to appropriate methods and within specified holding times. The TestAmerica QC Officer is responsible for oversight of data processing, data processing QC, and performance and system audits.

2.4 PROJECT COMMUNICATION AND REPORTING

Communications for this project will generally flow along the lines established by the organization depicted previously in Figure 2-1. All communications between USA and the USAESCH will primarily be directed through the respective USAESCH Project Manager or Contracting Officer. Communication directly between USA and other government entities associated with this project will only occur with USAESCH concurrence.

2.4.1 PROJECT INTERNET WEB PAGE

USA will utilize a dedicated Internet Web page to disseminate information to the project team and the public. This Web page will be updated periodically with new information about the project and will be used to post copies of monthly reports, documents, and other correspondence as desired by USAESCH. Some of the access will be password protected as determined necessary by USAESCH. The USA project Website address is <http://www.usaprojecthost.com>.

2.5 PROJECT DELIVERABLES

This section provides a brief description of the required deliverables for this RI/FS. A detailed description of project deliverables is provided in the PWS (Appendix A). Deliverable data will be submitted to USAESCH and USACE Jacksonville District (CESAJ) no later than the close of the business day indicated in the project schedule. Electronic data will be submitted in formats consistent with USAESCH software and systems, as defined in the PWS.

2.5.1 RI/FS WORK PLAN

A Draft, Draft Final, and Final RI/FS Work Plan will be prepared using DID MR-001 as guidance. USA team members will perform a peer review of each section of the WP followed by an overall review by the USA QC Manager prior to submittal to confirm the overall quality and completeness of each document. Review comments received on the Draft and Draft Final versions will be incorporated and formal, annotated responses will be provided for each comment. USA will submit the Draft Final and Final versions no later than 14 days following receipt of comments. USA will include a CD with each hard copy document submitted.

2.5.2 TECHNICAL PROJECT PLANNING (TPP) MEMORANDUM

A Draft and Final TPP Memorandum will be prepared and submitted. The memorandum will contain Data Quality Objectives (DQOs) and other results of the TPP meetings, including a conceptual site model (CSM).

2.5.3 PUBLIC INVOLVEMENT PLAN (PIP)

USA will update the existing PIP and submit draft and final versions prepared in accordance with EP 1110-3-8. The draft submission will be prepared after the first TPP meeting, following an assessment of stakeholder and public preferences. Review comments will be incorporated and formal, annotated responses will be provided for each comment. The Final PIP will be submitted no later than 14 days following receipt of comments. USA will include a CD with each hard copy document submitted.

2.5.4 REMEDIAL INVESTIGATION (RI) REPORT

A Draft, Draft Final, and Final RI Report will be prepared following the guidance in EM CX Interim Guidance 06-04. The report will document data collected during the RI field activities, the results of a baseline risk assessment, and conclusions that contribute to evaluation and selection of the most appropriate remedy for each MRS. The RI report includes an updated Conceptual Site Model (CSM); Baseline Human Health and Ecological Risk Assessment IAW EPA Risk Assessment Guidance for Superfund (RAGS) and USACE EM 200-1-4; and a determination of the MRS priority for each MRS using the Munitions Response Site Prioritization Protocol (MRSPP) worksheets.

The Draft RI Report will be submitted within 60 days completion of all fieldwork. USA will attend a teleconference on-board review after receiving comments on the Draft RI Report and will submit a Draft Final no more than 14 days later. USA will coordinate the third Technical Project Planning (TPP) meeting with the Project Delivery Team (PDT) to verify that all identified data gaps have been filled. Following receipt of all comments, the Final RI Report will be submitted within 14 days.

2.5.5 FEASIBILITY STUDY (FS) REPORT

A Draft, Draft Final, and Final FS Report will be prepared following the guidance in EM CX Interim Guidance 06-04. The report will document the screening of treatment technologies, the development of remedial options, the identification of Preliminary Remediation Goals (PRGs), RAOs and ARARs, and the evaluation of appropriate remedial alternatives. Following submittal of the Draft report and receipt of comments USA will attend an onboard meeting (via teleconference) to discuss the comments. A Draft Final FS Report will be submitted no more than 14 days later. The Final FS Report will be submitted within 14 days following receipt of comments on the Draft Final FS Report.

2.5.6 PROPOSED PLAN

A Draft and Final Proposed Plan will be submitted. The Draft Proposed Plan will be prepared following approval of the Final FS Report. The plan will be developed to summarize the remedial alternatives proposed for the project and to specify the preferred cleanup method. The Plan will be written in non-technical language and be understandable by the general community. The Proposed Plan explains why the preferred remedial alternative is most appropriate for the site. Upon USAESCH approval of the Proposed Plan, it will be posted on the project website (<http://www.usaprojecthost.com>) and in the Administrative Record for public review. USA will issue a public notice with local media to announce the availability of the Proposed Plan, and coordinate and facilitate a public meeting to familiarize the public with the site and initiate the public comment period. The public will have 30 days to provide verbal or written comments on the Proposed Plan. The comments generated during the public comment period will be addressed in the Responsiveness Summary in the Decision Document.

2.5.7 DECISION DOCUMENT

Within 14 days following approval of the Final Proposed Plan, a Draft Decision Document will be developed to document the remedial alternative chosen and the public comments and community concerns. The Decision Document will be prepared for each MRS to gain acceptance IAW ER 200-3-1 FUDS Program Policy, MM CX Interim Guidance 06-04, and Appendix B. Appendix B provides new formatting requirements for the Decision Document and supersedes the MM CX Interim Guidance 06-04 for formatting of the Decision Document. A Draft Final will be submitted within 7 days receipt of comments on the draft and a Final version will be submitted within 7 days following receipt of comments on the Draft Final.

2.5.8 ADMINISTRATIVE RECORD

An Administrative Record will be established and maintained for each MRS. USA will closely coordinate with the USAESCH and CESAJ to establish and maintain an Administrative Record IAW the guidance given in EP 1110-3-8, Chapter 4 (Establishing and Maintaining Administrative Records) and Standard Operating Procedure for Formerly Used Defense Sites (FUDS) Records Management, Revision 5, dated January 2008. A separate Administrative Record will be maintained for each MRS. USA will secure a place to establish and house the Administrative Record in the local community of the project site (e.g., local public library). All required documents to the Administrative Record will be secured and incorporated into the Administrative Record. All final documents will be provided on CD/DVD to USAESCH and CESAJ for archival and placement onto the Project Information Retrieval System (PIRS). Two copies will be submitted to each of USAESCH and CESAJ.

2.6 PROJECT SCHEDULE

The project schedule presents the logical sequence of tasks, deliverable due dates, and anticipated number of days to complete each task. The schedule will be updated monthly and included in the Monthly Progress Status reports prepared and submitted IAW DID MR-085. The schedule is included in Appendix J.

2.7 PERIODIC REPORTING

Project Status Reports will be prepared IAW DID MR-085. This report will be submitted monthly when fieldwork is not being performed, and weekly when fieldwork is underway.

2.8 COSTING AND BILLING

The budget for the project was negotiated with the USAESCH pursuant to contract number W912DY-04-D-0006 Task Order No. 0022. USA will submit a monthly invoice to the USAESCH. The USA Project Manager is responsible for submitting monthly reports to the USAESCH Project Manager along with the invoice that documents the work performed during the corresponding billing period. Requests for payment will be based on completion of performance milestones as defined in the monthly Project Status Report.

2.9 PROJECT PUBLIC RELATIONS SUPPORT

Public relations support will include participation in up to three public meetings to be held on the Isla Culebra. These meetings are in addition to the TPP meetings. USA will prepare and deliver briefings, graphics, maps, posters, presentations, and support of question and answer sessions. When required, USA will prepare invitation letters, fact sheets, and meeting notices. USA will obtain the meeting sites, perform public notification and prepare any correspondence necessary to meeting the objectives of this task. USA will also maintain a project website for viewing by the public and PDT members. To ensure the quality of public meetings, USA will coordinate with the USACE public relations officer or other appropriate USACE representative on all matters of public relations.

2.10 SUBCONTRACT MANAGEMENT

Before subcontract work is performed at the site, USA will negotiate and prepare subcontracts that will detail all necessary and appropriate terms and conditions, including the statement of work (SOW). Once the subcontract is executed, USA will perform periodic reviews to ensure that contractual requirements and milestones are met. These reviews will cover contractual progress, technical progress, and cost and schedule status. USA technical staff will review data generated by the subcontractor as part of subcontract deliverables.

USA will maintain overall supervisory responsibility for all operations. Subcontractors will work under the direction and oversight of USA's Site Project Manager/SUXOS and will be monitored by USA's UXOQCS. The SUXOS will schedule all operational activities and a strict accounting will be made of actions performed and activities completed. Throughout their operations, subcontractors will coordinate their operational schedules with USA's SUXOS, and strictly adhere to this Work Plan and associated APP.

2.11 MANAGEMENT OF FIELD OPERATIONS

During reconnaissance and MEC sampling efforts, the USA Site Project Manager/SUXOS will manage field operations from outside the exclusion zone at a command post established in the vicinity of the project site. Unauthorized personnel will not be allowed to access work areas.

The USA Safety Manager and Quality Manager will remain off site but will be available by telephone for consultation on issues of safety or quality. The USA UXOSO will be dual-hatted as the UXO Quality Control Specialist, and will be on site during field activities to ensure all activities comply with the APP and to conduct QC inspections of field activities.

The USA GIS Manager, who is responsible for control of data included in and used as part of the project GIS, will also be available by telephone for consultation.

3.0 FIELD INVESTIGATION PLAN

3.1 OVERALL APPROACH TO MUNITIONS RESPONSE ACTIVITIES

3.1.1 SITE CHARACTERIZATION GOALS

Identifying characterization goals is critical within the Technical Project Planning (TPP) process to ensure appropriate planning activities. Goals are defined by current and future land use, regulatory compliance, and budget and schedule requirements and limitations.

Preliminary project goals have been developed in accordance with USACE Interim Guidance for TPP. The project team will continue to develop and refine project goals to guide the site characterization efforts. The preliminary project goals are presented in the TPP Memorandum for Record (MFR) Worksheet (Appendix I). The sole preliminary project goal is to determine if the land and surrounding coastal waters within each MRS site is safe for continued use by property owners and the public. Based on this preliminary project goal, site characterization goals may include:

- Document available information pertaining to the nature and extent of MEC within each MRS;
- Identify areas where further investigation is warranted;
- Conduct a field investigation of each MRS to characterize the nature and extent of MEC and MC within the MRS; and
- Perform qualitative assessment of MEC and MC risk at each MRS.

3.1.2 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQO) are qualitative and quantitative statements derived from the TPP process that clarify study objectives, define the appropriate type of data, and specify the tolerable levels of potential decision errors that are used as the basis for establishing the quality and quantity of data needed to support decisions. These project specific statements describe the intended data use; the data need requirements; and the means to achieve acceptable data quality for the intended use. DQOs produced through the TPP process meet the U.S. Environmental Protection Agency (EPA) *QA/G-4HW Guidance's* definition of a DQO. The following subsections describe project DQOs that have been developed for this RI/FS.

3.1.2.1 Project Data Quality Objectives

Project DQOs have been developed IAW the US Army RI/FS Study Guidance (November 2009) and EM 1110-1-4009 to ensure that collected data allows for the adequate characterization of MEC at the Culebra MRSs as established during the TPP process. These DQOs exhibit the overall data requirements to accomplish the characterization goals for each MRS based on future land use, potential receptors, and accessibility. The data collected IAW the DQOs will be used to update the conceptual site models (CSM) for each MRS, as required. Table 3-1 shows the Project DQOs for MEC and MC characterization at the identified Culebra MRSs.

Table 3-1: Project Data Quality Objectives for MEC and MC

DQO STEPS	MRS LOCATIONS
MRS 13 Cayo Luis Pena Impact Areas	
1. State Problem(s)	<ul style="list-style-type: none"> • Define the nature and extent of MEC contamination relative to future land use, potential receptors, and accessibility within MRS 13, Cayo Luis Pena. • Define the nature and extent of MC contamination relative to future land use, potential receptors, and accessibility within MRS 13, Cayo Luis Pena.
2. Identify the Decision	<ul style="list-style-type: none"> • Determine where <i>surface</i> MEC contamination along <i>accessible trails</i> poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary, • Determine where <i>surface</i> and <i>subsurface</i> MEC contamination on <i>accessible beach areas</i> poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary, • Determine where suspected underwater MEC contamination in <i>accessible water areas</i> poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary, • Determine where surface soil, subsurface soil, surface water, and sediment MC contamination poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary. <p><i>* For the purposes of this DQO: "accessible" means that access has not been hindered by slopes in excess of 33 degrees, dense vegetation, fences/natural barriers, or any combination of the above.</i></p>
3. Identify the Inputs	<ul style="list-style-type: none"> • Future Land Use, Potential Receptors, and Access* (CSM), • Historical Records (SI & ASR), • Presence of MEC items on the <i>surface</i> along accessible* trails, • Presence of MEC items on the <i>surface</i> and <i>subsurface</i> within the accessible* beach areas, • Presence of suspected MEC items on the seafloor within <i>accessible water areas</i>, no further than 100 yards seaward from the mean high tide mark, • Presence of MC related metals detected with handheld metals analyzer, • Concentration value of MC taken from discrete surface soil, subsurface soil, surface water, and sediment samples, including step-out areas if applicable. One (1) discrete sample per applicable media, per location.
4. Define the Study Boundary	<p>The MRS boundary defines the population to be sampled and the decision unit to which the data will be applied. The populations MEC to be sampled is on the surface and subsurface (accessible beach areas) within the MRS. The populations to be sampled for MC are surface and subsurface soil, surface water, and sediment.</p> <p><u>MEC:</u></p> <ul style="list-style-type: none"> • Locations on the surface and subsurface (accessible beach areas) within the MRS, • Locations on the seafloor within the <i>accessible water areas</i>, no further than 100 yards seaward from the mean high tide mark,

DQO STEPS	MRS LOCATIONS
	<p><u>MC:</u></p> <ul style="list-style-type: none"> • Surface and subsurface soil sampling locations will be established based on locations of MEC/MD discovered during the geophysical investigation. Surface water samples will be collected in areas near streams and shorelines down gradient from areas containing MEC/MD discovered during the geophysical investigation, • Surface water and Sediment samples will be collected from down gradient streams and depositional areas downgradient from areas containing MEC/MD discovered during the geophysical investigation.
<p>5. Develop a Decision Rule</p>	<p>The following decision rules will be applied to the MEC population and decision unit:</p> <ul style="list-style-type: none"> • If MEC is discovered on the surface, subsurface (accessible beach areas), or the seafloor (within the underwater investigation boundary) of the MRS then a baseline MEC Hazard Analysis (MEC HA) based on future land use, potential receptors, and access will be performed and presented to the project team for further evaluation. • The MEC investigation will be halted if and when project objectives are met, (e.g. nature and extent of MEC has been determined for an MRS or a portion of an MRS*.) If the project objectives for MEC have not been met, grid or transecting step out processes will be implemented to collect additional data required to further bound the nature and extent of MEC contamination. <p>* Criteria taken from EM-110-1-4009, Chapter 7, Site Characterization.</p> <p>The following decision rules will be applied to the MC population and decision unit:</p> <p><u>Surface and Subsurface Soil:</u></p> <p>If MC concentrations for each sample site are less than the screening values identified in Worksheet #15 of the UFP QAPP, then no further action for that area will be considered as it is delineated. If MC concentrations for each sample site are greater than the screening values identified in Worksheet #15, Step-out sampling will be conducted IAW the Step-out procedure Flow Chart included in the Sampling and Analysis Plan (SAP) in Appendix E. Step-out sampling will continue until MC concentration is at or below screening criteria, in which the contamination shall be delineated.</p> <p><u>Surface water and sediment:</u></p> <p>If MC concentrations for all sample sites are less than the screening values identified in Worksheet #15, then surface water at that site will not be considered to impact surface water or sediments within the MRSs. If a concentration exceeds the screening values for a given location, additional downstream samples will be collected until MC concentration is at or below screening criteria, in which the contamination shall be delineated.</p>
<p>6. Specify Limits on Decision Errors.</p>	<p>Measurable decision errors are limited to the field and analytical QC processes. The analytical requirements for MC are defined on Worksheet #12 of the UFP QAPP.</p>
<p>7. Optimize the Design for Obtaining Data</p>	<p>Data collection procedures and associated QC for MEC are included in the RI/FS Work Plan.</p> <p>MC sample design and rationale is listed on Worksheet #17 of the UFP QAPP.</p>

DQO STEPS	MRS LOCATIONS
MRS 10 Defensive Firing Area No. 1	
1. State Problem(s)	<ul style="list-style-type: none"> Define the nature and extent of MEC contamination relative to future land use, potential receptors, and accessibility within MRS 10, Defensive Firing Area No. 1. Define the nature and extent of MC contamination relative to future land use, potential receptors, and accessibility within MRS 10, Defensive Firing Area No. 1.
2. Identify the Decision	<ul style="list-style-type: none"> Determine where <i>surface and subsurface</i> MEC contamination poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary, Determine where suspected underwater MEC contamination in <i>accessible water areas</i> poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary, Determine where surface soil, subsurface soil, surface water, and sediment MC contamination poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary. <p><i>* For the purposes of this DQO: "accessible" means that access has not been hindered by slopes in excess of 33 degrees, dense vegetation, fences/natural barriers, or any combination of the above.</i></p>
3. Identify the Inputs	<ul style="list-style-type: none"> Future Land Use, Potential Receptors, and Access (CSM), Historical Records (SI & ASR), Presence of MEC items on the surface or subsurface in prescribed transects and grids, Presence of suspected MEC items on the seafloor within <i>accessible water areas</i>, no further than 100 yards seaward from the mean high tide mark, Presence of MC related metals detected with handheld metals analyzer, Concentration value of MC taken from discrete surface soil, subsurface soil, surface water, and sediment samples, including step-out areas if applicable. One (1) discrete sample per applicable media, per location.
4. Define the Study Boundary	<p>The MRS boundary defines the population to be sampled and the decision unit to which the data will be applied. The populations MEC to be sampled is on the surface and subsurface within the MRS. The population to be sampled for MC are surface and subsurface soil, surface water, and sediment.</p> <p><u>MEC:</u></p> <ul style="list-style-type: none"> Locations on the <i>surface and subsurface</i> within the MRS, Locations on the seafloor within the <i>accessible water areas</i>, no further than 100 yards seaward from the mean high tide mark, <p><u>MC:</u></p> <ul style="list-style-type: none"> Surface and subsurface soil sampling locations will be established based on locations of MEC/MD discovered during the geophysical investigation. Surface water samples will be collected in areas near streams and shorelines downgradient from areas containing MEC/MD discovered during the geophysical investigation, Surface water and Sediment samples will be collected from down gradient streams and depositional areas downgradient from areas containing MEC/MD discovered during the geophysical investigation.

DQO STEPS	MRS LOCATIONS
<p>5. Develop a Decision Rule</p>	<p>The following decision rules will be applied to the MEC population and decision unit:</p> <ul style="list-style-type: none"> If MEC is discovered on the surface, subsurface, or the seafloor (within the underwater investigation boundary) of the MRS then a baseline MEC Hazard Analysis (MEC HA) based on future land use, potential receptors, and access will be performed and presented to the project team for further evaluation. <p>The MEC investigation will be halted if and when project objectives are met, (e.g. nature and extent of MEC has been determined for an MRS or a portion of an MRS*). If the project objectives for MEC has not been met, grid or transecting step out processes will be implemented to collect additional data required to further bound the nature and extent of MEC contamination.</p> <p>* Criteria taken from EM-110-1-4009, Chapter 7, Site Characterization.</p> <p>The following decision rules will be applied to the MC population and decision unit:</p> <p><u>Surface and Subsurface Soil:</u></p> <p>If MC concentrations for each sample site are less than the screening values identified in Worksheet #15 of the UFP QAPP, then no further action for that area will be considered as it is delineated. If MC concentrations for each sample site are greater than the screening values identified in Worksheet #15, Step-out sampling will be conducted IAW the Step-out procedure Flow Chart included in the Sampling and Analysis Plan (SAP) in Appendix E. Step-out sampling will continue until MC concentration is at or below screening criteria, in which the contamination shall be delineated.</p> <p><u>Surface water and sediment:</u></p> <p>If MC concentrations for all sample sites are less than the screening values identified in Worksheet #15, then surface water at that site will not be considered to impact surface water or sediments within the MRSs. If a concentration exceeds the screening values for a given location, additional downstream samples will be collected until MC concentration is at or below screening criteria, in which the contamination shall be delineated.</p>
<p>6. Specify Limits on Decision Errors.</p>	<p>Measurable decision errors are limited to the field and analytical QC processes. The analytical requirements for MC are defined on Worksheet #12 of the UFP QAPP.</p>
<p>7. Optimize the Design for Obtaining Data</p>	<p>Data collection procedures and associated QC for MEC are included in the RI/FS Work Plan.</p> <p>MC sample design and rationale is listed on Worksheet #17 of the UFP QAPP.</p>
<p>MRS 11 Defensive Firing Area No. 2</p>	
<p>1. State Problem(s)</p>	<ul style="list-style-type: none"> Define the nature and extent of MEC contamination relative to future land use, potential receptors, and accessibility within MRS 11, Defensive Firing Area No. 2. Define the nature and extent of MC contamination relative to future land use, potential receptors, and accessibility within MRS 11, Defensive Firing Area No. 2.
<p>2. Identify the Decision</p>	<ul style="list-style-type: none"> Determine where <i>surface and subsurface</i> MEC contamination poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary, Determine where suspected underwater MEC contamination in <i>accessible water areas</i> poses an unacceptable risk to human health and the environment and

DQO STEPS	MRS LOCATIONS
	<p>requires further consideration or a response action, or recommended that no further investigation is necessary,</p> <ul style="list-style-type: none"> Determine where surface soil, subsurface soil, surface water, and sediment MC contamination poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary. <p><i>* For the purposes of this DQO: "accessible" means that access has not been hindered by slopes in excess of 33 degrees, dense vegetation, fences/natural barriers, or any combination of the above.</i></p>
<p>3. Identify the Inputs</p>	<ul style="list-style-type: none"> Future Land Use, Potential Receptors, and Access (CSM), Historical Records (SI & ASR), Presence of MEC items on the surface or subsurface in prescribed transects and grids, Presence of suspected MEC items on the seafloor within <i>accessible water areas</i>, no further than 100 yards seaward from the mean high tide mark, Presence of MC related metals detected with handheld metals analyzer, Concentration value of MC taken from discrete surface soil, subsurface soil, surface water, and sediment samples, including step-out areas if applicable. One (1) discrete sample per applicable media, per location.
<p>4. Define the Study Boundary</p>	<p>The MRS boundary defines the population to be sampled and the decision unit to which the data will be applied. The populations MEC to be sampled is on the surface and subsurface within the MRS. The population to be sampled for MC are surface and subsurface soil, surface water, and sediment.</p> <p><u>MEC:</u></p> <ul style="list-style-type: none"> Locations on the <i>surface</i> and <i>subsurface</i> within the MRS, Locations on the seafloor within the <i>accessible water areas</i>, no further than 100 yards seaward from the mean high tide mark, <p><u>MC:</u></p> <ul style="list-style-type: none"> Surface and subsurface soil sampling locations will be established based on locations of MEC/MD discovered during the geophysical investigation. Surface water samples will be collected in areas near streams and shorelines downgradient from areas containing MEC/MD discovered during the geophysical investigation, Surface water and Sediment samples will be collected from down gradient streams and depositional areas downgradient from areas containing MEC/MD discovered during the geophysical investigation.
<p>5. Develop a Decision Rule</p>	<p>The following decision rules will be applied to the MEC population and decision unit:</p> <ul style="list-style-type: none"> If MEC is discovered on the surface, subsurface, or the seafloor (within the underwater investigation boundary) of the MRS then a baseline MEC Hazard Analysis (MEC HA) based on future land use, potential receptors, and access will be performed and presented to the project team for further evaluation. The MEC investigation will be halted if and when project objectives are met, (e.g. nature and extent of MEC has been determined for an MRS or a portion of an MRS*). If the project objectives for MEC has not been met, grid or transecting step out processes will be implemented to collect additional data required to further bound the nature and extent of MEC contamination. <p><i>* Criteria taken from EM-110-1-4009, Chapter 7, Site Characterization.</i></p>

DQO STEPS	MRS LOCATIONS
	<p>The following decision rules will be applied to the MC population and decision unit:</p> <p><u>Surface and Subsurface Soil:</u></p> <p>If MC concentrations for each sample site are less than the screening values identified in Worksheet #15 of the UFP QAPP, then no further action for that area will be considered as it is delineated. If MC concentrations for each sample site are greater than the screening values identified in Worksheet #15, Step-out sampling will be conducted IAW the Step-out procedure Flow Chart included in the Sampling and Analysis Plan (SAP) in Appendix E. Step-out sampling will continue until MC concentration is at or below screening criteria, in which the contamination shall be delineated.</p> <p><u>Surface water and sediment:</u></p> <p>If MC concentrations for all sample sites are less than the screening values identified in Worksheet #15, then surface water at that site will not be considered to impact surface water or sediments within the MRSs. If a concentration exceeds the screening values for a given location, additional downstream samples will be collected until MC concentration is at or below screening criteria, in which the contamination shall be delineated.</p>
6. Specify Limits on Decision Errors.	Measurable decision errors are limited to the field and analytical QC processes. The analytical requirements for MC are defined on Worksheet #12 of the UFP QAPP.
7. Optimize the Design for Obtaining Data	<p>Data collection procedures and associated QC for MEC are included in the RI/FS Work Plan.</p> <p>MC sample design and rationale is listed on Worksheet #17 of the UFP QAPP.</p>
MRS 06 Artillery Firing Area	
1. State Problem(s)	<ul style="list-style-type: none"> • Define the nature and extent of MEC contamination relative to future land use, potential receptors, and accessibility within MRS 06, Artillery Firing Area. MEC contamination • Define the nature and extent of MC contamination relative to future land use, potential receptors, and accessibility within MRS 06, Artillery Firing Area. MEC contamination
2. Identify the Decision	<ul style="list-style-type: none"> • Determine where <i>surface and subsurface</i> MEC contamination poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary, • Determine where suspected underwater MEC contamination in <i>accessible water areas</i> poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary, • Determine where surface soil, subsurface soil, surface water, and sediment MC contamination poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary. <p><i>* For the purposes of this DQO: "accessible" means that access has not been hindered by slopes in excess of 33 degrees, dense vegetation, fences/natural barriers, or any combination of the above.</i></p>

DQO STEPS	MRS LOCATIONS
3. Identify the Inputs	<ul style="list-style-type: none"> • Future Land Use, Potential Receptors, and Access (CSM), • Historical Records (SI & ASR), • Presence of MEC items on the surface or subsurface in prescribed transects and grids. • Presence of suspected MEC items on the seafloor within <i>accessible water areas</i>, no further than 100 yards seaward from the mean high tide mark, • Presence of MC related metals detected with handheld metals analyzer, • Concentration value of MC taken from discrete surface soil, subsurface soil, surface water, and sediment samples, including step-out areas if applicable. One (1) discrete sample per applicable media, per location.
4. Define the Study Boundary	<p>The MRS boundary defines the population to be sampled and the decision unit to which the data will be applied. The populations MEC to be sampled is on the surface and subsurface within the MRS. The population to be sampled for MC are surface and subsurface soil, surface water, and sediment.</p> <p><u>MEC:</u></p> <ul style="list-style-type: none"> • Locations on the <i>surface</i> and <i>subsurface</i> within the MRS, • Locations on the seafloor within the <i>accessible water areas</i>, no further than 100 yards seaward from the mean high tide mark, <p><u>MC:</u></p> <ul style="list-style-type: none"> • Surface and subsurface soil sampling locations will be established based on locations of MEC/MD discovered during the geophysical investigation. Surface water samples will be collected in areas near streams and shorelines downgradient from areas containing MEC/MD discovered during the geophysical investigation, • Surface water and Sediment samples will be collected from down gradient streams and depositional areas downgradient from areas containing MEC/MD discovered during the geophysical investigation.
5. Develop a Decision Rule	<p>The following decision rules will be applied to the MEC population and decision unit:</p> <ul style="list-style-type: none"> • If MEC is discovered on the surface, subsurface, or the seafloor (within the underwater investigation boundary) of the MRS then a baseline MEC Hazard Analysis (MEC HA) based on future land use, potential receptors, and access will be performed and presented to the project team for further evaluation. • The MEC investigation will be halted if and when project objectives are met, (e.g. nature and extent of MEC has been determined for an MRS or a portion of an MRS*). If the project objectives for MEC has not been met, grid or transecting step out processes will be implemented to collect additional data required to further bound the nature and extent of MEC contamination. <p>* Criteria taken from EM-110-1-4009, Chapter 7, Site Characterization.</p> <p>The following decision rules will be applied to the MC population and decision unit:</p> <p><u>Surface and Subsurface Soil:</u></p> <p>If MC concentrations for each sample site are less than the screening values identified in Worksheet #15 of the UFP QAPP, then no further action for that area will be considered as it is delineated. If MC concentrations for each sample site are greater than the screening values identified in Worksheet #15, Step-out sampling will be conducted IAW the Step-out procedure Flow Chart included in the Sampling and Analysis Plan (SAP) in Appendix E. Step-out sampling will continue until MC concentration is at or below screening criteria, in which the contamination shall be delineated.</p>

DQO STEPS	MRS LOCATIONS
	<p><u>Surface water and sediment:</u></p> <p>If MC concentrations for all sample sites are less than the screening values identified in Worksheet #15, then surface water at that site will not be considered to impact surface water or sediments within the MRSs. If a concentration exceeds the screening values for a given location, additional downstream samples will be collected until MC concentration is at or below screening criteria, in which the contamination shall be delineated.</p>
6. Specify Limits on Decision Errors.	Measurable decision errors are limited to the field and analytical QC processes. The analytical requirements for MC are defined on Worksheet #12 of the UFP QAPP.
7. Optimize the Design for Obtaining Data	<p>Data collection procedures and associated QC for MEC are included in the RI/FS Work Plan.</p> <p>MC sample design and rationale is listed on Worksheet #17 of the UFP QAPP.</p>
MRS 09 Soldado Point Mortar and Bombing Area	
1. State Problem(s)	<ul style="list-style-type: none"> • Define the nature and extent of MEC contamination relative to future land use, potential receptors, and accessibility within MRS 09, Soldado Point Mortar and Bombing Area. • Define the nature and extent of MC contamination relative to future land use, potential receptors, and accessibility within MRS 09, Soldado Point Mortar and Bombing Area.
2. Identify the Decision	<ul style="list-style-type: none"> • Determine where <i>surface and subsurface</i> MEC contamination poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary, • Determine where suspected underwater MEC contamination in <i>accessible water areas</i> poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary, • Determine where surface soil, subsurface soil, surface water, and sediment MC contamination poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary. <p><i>* For the purposes of this DQO: "accessible" means that access has not been hindered by slopes in excess of 33 degrees, dense vegetation, fences/natural barriers, or any combination of the above.</i></p>
3. Identify the Inputs	<ul style="list-style-type: none"> • Future Land Use, Potential Receptors, and Access (CSM), • Historical Records (SI & ASR), • Presence of MEC items on the surface or subsurface in prescribed transects and grids. • Presence of suspected MEC items on the seafloor within <i>accessible water areas</i>, no further than 100 yards seaward from the mean high tide mark, • Presence of MC related metals detected with handheld metals analyzer, • Concentration value of MC taken from discrete surface soil, subsurface soil, surface water, and sediment samples, including step-out areas if applicable. One (1) discrete sample per applicable media, per location.

DQO STEPS	MRS LOCATIONS
<p>4. Define the Study Boundary</p>	<p>The MRS boundary defines the population to be sampled and the decision unit to which the data will be applied. The populations MEC to be sampled is on the surface and subsurface within the MRS. The population to be sampled for MC are surface and subsurface soil, surface water, and sediment.</p> <p><u>MEC:</u></p> <ul style="list-style-type: none"> • Locations on the <i>surface</i> and <i>subsurface</i> within the MRS, • Locations on the seafloor within the <i>accessible water areas</i>, no further than 100 yards seaward from the mean high tide mark, <p><u>MC:</u></p> <ul style="list-style-type: none"> • Surface and subsurface soil sampling locations will be established based on locations of MEC/MD discovered during the geophysical investigation. Surface water samples will be collected in areas near streams and shorelines downgradient from areas containing MEC/MD discovered during the geophysical investigation, • Surface water and Sediment samples will be collected from down gradient streams and depositional areas downgradient from areas containing MEC/MD discovered during the geophysical investigation.
<p>5. Develop a Decision Rule</p>	<p>The following decision rules will be applied to the MEC population and decision unit:</p> <ul style="list-style-type: none"> • If MEC is discovered on the surface, subsurface, or the seafloor (within the underwater investigation boundary) of the MRS then a baseline MEC Hazard Analysis (MEC HA) based on future land use, potential receptors, and access will be performed and presented to the project team for further evaluation. • The MEC investigation will be halted if and when project objectives are met, (e.g. nature and extent of MEC has been determined for an MRS or a portion of an MRS*.) If the project objectives for MEC has not been met, grid or transecting step out processes will be implemented to collect additional data required to further bound the nature and extent of MEC contamination. <p>* Criteria taken from EM-110-1-4009, Chapter 7, Site Characterization.</p> <p>The following decision rules will be applied to the MC population and decision unit:</p> <p><u>Surface and Subsurface Soil:</u></p> <p>If MC concentrations for each sample site are less than the screening values identified in Worksheet #15 of the UFP QAPP, then no further action for that area will be considered as it is delineated. If MC concentrations for each sample site are greater than the screening values identified in Worksheet #15, Step-out sampling will be conducted IAW the Step-out procedure Flow Chart included in the Sampling and Analysis Plan (SAP) in Appendix E. Step-out sampling will continue MC concentration is at or below screening criteria, in which the contamination shall be delineated.</p> <p><u>Surface water and sediment:</u></p> <p>If MC concentrations for all sample sites are less than the screening values identified in Worksheet #15, then surface water at that site will not be considered to impact surface water or sediments within the MRSs. If a concentration exceeds the screening values for a given location, additional downstream samples will be collected until MC concentration is at or below screening criteria, in which the contamination shall be delineated.</p>
<p>6. Specify Limits on Decision Errors.</p>	<p>Measurable decision errors are limited to the field and analytical QC processes. The analytical requirements for MC are defined on Worksheet #12 of the UFP QAPP.</p>

DQO STEPS	MRS LOCATIONS
7. Optimize the Design for Obtaining Data	<p>Data collection procedures and associated QC for MEC are included in the RI/FS Work Plan.</p> <p>MC sample design and rationale is listed on Worksheet #17 of the UFP QAPP.</p>
MRS 08 Cayo Norte Impact Area	
State Problem(s)	<ul style="list-style-type: none"> • Define the nature and extent of MEC contamination relative to future land use, potential receptors, and accessibility within MRS 08, Defensive Cayo Norte Impact Area. • Define the nature and extent of MC contamination relative to future land use, potential receptors, and accessibility within MRS 08, Defensive Cayo Norte Impact Area.
2. Identify the Decision	<ul style="list-style-type: none"> • Determine where <i>surface and subsurface</i> MEC contamination poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary, • Determine where suspected underwater MEC contamination in <i>accessible water areas</i> poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary, • Determine where surface soil, subsurface soil, surface water, and sediment MC contamination poses an unacceptable risk to human health and the environment and requires further consideration or a response action, or recommended that no further investigation is necessary. <p><i>* For the purposes of this DQO: "accessible" means that access has not been hindered by slopes in excess of 33 degrees, dense vegetation, fences/natural barriers, or any combination of the above.</i></p>
3. Identify the Inputs	<ul style="list-style-type: none"> • Future Land Use, Potential Receptors, and Access (CSM), • Historical Records (SI & ASR), • Presence of MEC items on the surface or subsurface in prescribed transects and grids, • Presence of suspected MEC items on the seafloor within <i>accessible water areas</i>, no further than 100 yards seaward from the mean high tide mark, • Presence of MC related metals detected with handheld metals analyzer, • Concentration value of MC taken from discrete surface soil, subsurface soil, surface water, and sediment samples, including step-out areas if applicable. One (1) discrete sample per applicable media, per location.
4. Define the Study Boundary	<p>The MRS boundary defines the population to be sampled and the decision unit to which the data will be applied. The populations MEC to be sampled is on the surface and subsurface within the MRS. The population to be sampled for MC are surface and subsurface soil, surface water, and sediment.</p> <p><u>MEC:</u></p> <ul style="list-style-type: none"> • Locations on the <i>surface</i> and <i>subsurface</i> within the MRS, • Locations on the seafloor within the <i>accessible water areas</i>, no further than 100 yards seaward from the mean high tide mark,

DQO STEPS	MRS LOCATIONS
	<p><u>MC:</u></p> <ul style="list-style-type: none"> • Surface and subsurface soil sampling locations will be established based on locations of MEC/MD discovered during the geophysical investigation. Surface water samples will be collected in areas near streams and shorelines downgradient from areas containing MEC/MD discovered during the geophysical investigation, • Surface water and Sediment samples will be collected from down gradient streams and depositional areas downgradient from areas containing MEC/MD discovered during the geophysical investigation.
5. Develop a Decision Rule	<p>The following decision rules will be applied to the MEC population and decision unit:</p> <ul style="list-style-type: none"> • If MEC is discovered on the surface, subsurface, or the seafloor (within the underwater investigation boundary) of the MRS then a baseline MEC Hazard Analysis (MEC HA) based on future land use, potential receptors, and access will be performed and presented to the project team for further evaluation. • The MEC investigation will be halted if and when project objectives are met, (e.g. nature and extent of MEC has been determined for an MRS or a portion of an MRS*.) If the project objectives for MEC has not been met, grid or transecting step out processes will be implemented to collect additional data required to further bound the nature and extent of MEC contamination. <p style="text-align: center;">* Criteria taken from EM-110-1-4009, Chapter 7, Site Characterization.</p> <p>The following decision rules will be applied to the MC population and decision unit:</p> <p><u>Surface and Subsurface Soil:</u></p> <p>If MC concentrations for each sample site are less than the screening values identified in Worksheet #15 of the UFP QAPP, then no further action for that area will be considered as it is delineated. If MC concentrations for each sample site are greater than the screening values identified in Worksheet #15, Step-out sampling will be conducted IAW the Step-out procedure Flow Chart included in the Sampling and Analysis Plan (SAP) in Appendix E. Step-out sampling will continue until MC concentration is at or below screening criteria, in which the contamination shall be delineated.</p> <p><u>Surface water and sediment:</u></p> <p>If MC concentrations for all sample sites are less than the screening values identified in Worksheet #15, then surface water at that site will not be considered to impact surface water or sediments within the MRSs. If a concentration exceeds the screening values for a given location, additional downstream samples will be collected until MC concentration is at or below screening criteria, in which the contamination shall be delineated.</p>
6. Specify Limits on Decision Errors.	<p>Measurable decision errors are limited to the field and analytical QC processes. The analytical requirements for MC are defined on Worksheet #12 of the UFP QAPP.</p>
7. Optimize the Design for Obtaining Data	<p>Data collection procedures and associated QC for MEC are included in the RI/FS Work Plan.</p> <p>MC sample design and rationale is listed on Worksheet #17 of the UFP QAPP.</p>

3.1.3 DATA INCORPORATION INTO THE RI REPORT

Field data and GIS data will be incorporated into the RI Report in accordance with DID MR 005-07.01. Maps will be submitted which show the locations of the areas searched, the search pattern, and the significant findings, as well as significant surface features within and adjacent to each MRS. Personal Digital Assistant (PDA) GPS/Data Collection equipment will be used to record location, terrain and vegetation data. A waypoint, brief description, and digital photograph will be electronically recorded for any MEC related items and significant metal detector responses. Locations and descriptions of ground scars, craters, vegetation, and terrain will also be recorded, and a tabulated list of MEC items located in the field will be provided.

3.1.4 EXPOSURE ANALYSIS

Once the nature and extent of MEC and MC hazards are characterized, the potential risk due to exposures to MEC and MC hazards will be assessed. Potential MEC risk for each MRS will be determined by evaluating the ordnance, site characteristics, and human exposure pathways. The ordnance category includes the type of MEC identified, the level of sensitivity (i.e., the potential adverse health effects associated with exposure to the specified MEC), the density of MEC in a specified area, and the depth of the MEC.

Initial Conceptual Site Models (CSMs) were prepared for each of the Culebra MRSs as part of the 2007 Final Site Inspection Report (Parsons). Three dimensional and wire-frame CSMs for the Culebra MRSs covered under this work plan have been updated IAW guidance document *EM-1110-1-100 Engineering and Design – Conceptual Site Models for Ordnance and Explosives (OE) and Hazardous, Toxic, and Radioactive Wastes (HTRW) Projects (2003)* and are included in Appendix Q. The CSMs may be updated as part of the RI/FS activities and final CSMs will be included in the RI/FS Report. A Potential MC Risk Assessment will follow EPA Risk Assessment Guidance for Superfund (RAGS) and USACE guidance in EM 200-1-4.

3.1.5 TIME CRITICAL REMOVAL ACTIONS

The procedures outlined in this Work Plan apply to a RI/FS. Should circumstances justify the need for a Time Critical Removal Action (TCRA), USA will develop procedures in accordance with USACE guidance.

3.1.6 FOLLOW-ON ACTIVITIES

The project will be closed upon USAESCH acceptance of the Decision Document and subsequent acceptance of the final invoice. At the time of the development of this Work Plan, the schedule projects the completion of the RI/FS with the Decision Document in June 2011.

3.2 IDENTIFICATION OF AREAS OF CONCERN

Each MRS is considered an area of concern (AOC). Within each MRS subareas indicative of the different types of ordnance training operations and ordnance types have been identified. Table 3-2 lists each AOC and subareas. The AOCs are described in the following sections.

Table 3-2: Areas of Concern and Subareas

AOC	Subarea	MEC Concerns
MRS 13- Cayo Luis Pena Impact Areas	See Figure B-3	
	Northern Island Impact Area	75mm MKI HE
	Underwater Area	5" HVAR MK 1
	Southern Island	5" MK 41
MRS 10- Defensive Firing Area No. 1	See Figure B-4	
	Beach Defensive Area	81mm M43 HE
	Direct Fire Area	3" Common MK 3 Mod 7

AOC	Subarea	MEC Concerns
	Underwater Area	81mm M43 HE
MRS 11- Defensive Firing Area No. 2	See Figure B-5	
	Mortar Boat Firing Area	4.2" M3A1 HE
	Beach Defensive Area	81mm M43 HE
	Direct Fire Area	3" Common MK 3 Mod 7
	Underwater Area	81mm M43 HE
MRS 06- Artillery Firing Area	See Figure B-6	
	Land Impact Area	37mm MK II
	Beach Defensive Area #1 & #2	81mm M43 HE
	Water Impact Area	37mm MK II
MRS 09- Soldado Point Mortar and Bombing Area	See Figure B-7	
	Mortar Boat Firing Area	4.2" M3A1 HE
	Aircraft Bombing Target	100lb AN-M30A1 HE
	Direct Fire Area	3" Common MK 3 Mod 7
	Water Target	37mm MK II
MRS 08- Cayo Norte Impact Area	See Figure B-8	
	Land Impact Area	75mm MKI HE
	Water Impact Area	5" HVAR MK 1

3.2.1 MRS 13 CAYO LUIS PENA IMPACT AREAS

MRS 13 has been subdivided into Northern Island Impact Area, Underwater, and Southern Island based on information provided in the Supplemental ASR (Supplemental Archives Search Report, Culebra, Puerto Rico, September 2005) regarding ordnance training histories. The northern tip of this island (Northern Impact Area) was used as a firing target during Marine exercises conducted between 1924 and 1941. Records show that 75mm projectiles were fired at the Cay in 1924 and that 155mm, 37mm, 8-inch, and 6-inch rounds may have also been used. In the 1960s, an observation point was erected on the hill top on Luis Pena, including a run-in line, helipad, and living quarters. Cayo de Luis Pena is managed by the USFWS as part of the Culebra National Wildlife Refuge.

3.2.2 MRS 10 DEFENSIVE FIRING AREA NO. 1

MRS 10 is located on the southwest peninsula of Culebra, south of the town of Dewey and north of MRS 09. It covers 547 acres and extends seaward 100 yards from mean high tide. The MRS has been subdivided into Direct Fire Area, Beach Defensive Area, and Underwater based on information provided in the Supplemental ASR (Supplemental Archives Search Report, Culebra, Puerto Rico, September 2005) regarding ordnance training histories. Marines conducted amphibious landing and ground maneuver training on the beaches and hills in this area from the 1920s through the 1940s. Specifically, the hill on the north end of the MRS has been listed as a 1935 area of direct fire from infantry and tanks, and Snug Bay was shown as a 1935 water area for direct fire. A 1924 outpost and ammunition storage area is located on the north end of the MRS near Snug Bay. MRS 10 has many residents and businesses. Most of the development is near the town of Dewey on the north end of the site; however, houses are scattered throughout the southeastern side of this MRS. This MRS is almost entirely privately owned except for municipality lands such as the police and fire stations MRS 06 Artillery Firing Area.

3.2.3 MRS 11 DEFENSIVE FIRING AREA NO. 2

MRS 11 is located on the west side of Culebra between Northwest Peninsula and the town of Dewey, and has been subdivided into Mortar Boat Firing Area, Beach Defensive Area, Direct Fire Area, and Underwater Area based on information provided in the Supplemental ASR regarding ordnance training histories (Supplemental Archives Search Report, Culebra, Puerto Rico, September 2005). The area is approximately 719 acres and extends seaward 100 yards from mean high tide. Most of the southern portion of this MRS has been extensively developed for residential use. The areas along the beach and

the west side of this site are less developed. The land is privately owned with some municipality properties such as the school, hospital, and government buildings. Several training exercises were conducted in this area, including 75mm and 155mm firing from Firewood Bay at Mono Cayo and portions of Cayo de Luis Pena in 1924; FLEX No. 4 with firing of small arms and 81mm mortars in 1936; and FLEX No. 7 in 1941 with boat-to-beach firing of 5-inch and 6-inch projectiles.

3.2.4 MRS 06 ARTILLERY FIRING AREA

MRS 06 is on the eastern end of Culebra extending from a point at the most northern tip of Mosquito Bay, northeast to a point just west of Duck Point, and east to the end of the island. The MRS has been subdivided into Beach Defensive Area 1 and 2, Land Impact Area, and Water Impact Area based on information provided in the Supplemental ASR regarding ordnance training histories (Supplemental Archives Search Report, Culebra, Puerto Rico, September 2005). It covers 826 acres of land and extends seaward 100 yards from mean high tide. MRS 06 was used by the Marines for artillery firing points for exercises conducted between 1922 and the 1940s. Exercises involving small arms, Stokes mortars, 75mm pack howitzers, 3-inch mortars, and 37mm HE rounds were conducted in Mosquito Bay in 1936. Beginning in 1936, the Marines fired 75mm projectiles from a firing point inland of Mangrove Bay at Weather Channel near Culebrita. Additionally, 1937 U.S. FLEX No. 4 involved use of the lagoon area at the back of Mosquito Bay. In 1939, the Marines fired from 1,000 yards northeast of Mosquito Bay toward the cays to the east. From Mosquito Bay, 37mm rounds were fired west to water targets between Point Vaca and Snapper Shoal.

3.2.5 MRS 09 SOLDADO POINT MORTAR AND BOMBING AREA

MRS 09 is located on the very southern tip of the southwestern peninsula of Culebra and has been subdivided into Mortar Boat Firing Area, Aircraft Bombing Target, Direct Fire Area, and Water Target based on information provided in the Supplemental ASR regarding ordnance training histories (Supplemental Archives Search Report, Culebra, Puerto Rico, September 2005). It covers 328 acres and extends seaward 100 yards from mean high tide. In 1914, a 5-inch battery was established on Soldado Point. Several training exercises including mortar firing, aerial bombing, and strafing were conducted on Soldado Point and the bay northwest of Soldado point during the 1930s and 40s. The Supplemental ASR mentions that 30- and 1,000-pound bombs were dropped on targets near the Point Soldado, however supporting documentation did not indicate whether the bombs were live or practice. Munitions used in the bay included 30-pound fragmentation bombs, 100-pound demolition bombs, 81mm mortars, and small arms. This property is managed by the DNER; however, several shacks have been built along the water at Sueno cove.

3.2.6 MRS 08 CAYO NORTE IMPACT AREA

MRS 08 is located off the northeast coast of Culebra Island and has been subdivided into Land Impact Area and Water Impact Area based on information provided in the Supplemental ASR regarding ordnance training histories (Supplemental Archives Search Report, Culebra, Puerto Rico, September 2005). It includes Cayo Norte, which covers approximately 306 acres of land and extends seaward 100 yards from mean high tide. Cayo Norte was leased by the Marines for training; however, it cannot be determined from records whether the site was ever used for training. The property was leased in 1924 for erecting artillery targets for practice. The lease was ended in 1971. Notes on FLEX No. 5 indicate that impact of Cayo Norte was planned but that difficulties clearing people and cows from the island kept it from being used for an impact area. No UXO has been identified on Cayo Norte. Cayo Norte is privately owned with plans for residential development.

3.3 GEOPHYSICAL PROVE-OUT (GPO) PLAN AND REPORT

Based on previous agreement obtained during the project kickoff meeting, a GPO will not be required and has been replaced with a Geophysical System Test Strip Plan and Report.

3.3.1 GEOPHYSICAL SYSTEM TEST STRIP PLAN AND REPORT

In lieu of a GPO, daily analog and digital instrument response tests will be performed each morning. A combination of small Industry standard Objects (ISOs), intended to simulate 37mm projectiles, and large ISOs, intended to simulate 105mm projectiles or 4.2 inch mortars, will be used in each test strip. The

response curves for these ISOs are well documented for both the best case orientation (vertical) and the worst case orientation (horizontal). Four of each ISO will be used; two horizontal at depths 3 and 7 times ISO diameter, and two vertical at the same 3 and 7 times diameter depth. EM61-MK2 responses for each seed item will be compared to published response curves to ensure the equipment is performing as designed. There is no need to bury test objects at their deepest detectable depths. A dynamic background line will be acquired in each MRS to establish Root Mean Square (RMS) noise levels for each time gate. An initial anomaly selection threshold, 5 to 6 times the RMS noise level will define the depth detection limits for each MRS. An example plot of the EM61-MK2 time gate 2 small ISO detection response curves is provided below. An ideal background RMS noise level of 1 mV and an Anomaly Selection Threshold of 5 mV are shown. Note for this example, the small ISO is detectable to 8.66 inches in its worst case orientation and to 25.59 inches in its best case orientation. Actual distances between test strip seed items may vary, based on background anomalies. Final seed item depths may be limited by bedrock or water intrusion or analog detection limits over the smallest expected MEC within the MRS (i.e., 75mm projectile for Cayo de Luis Pena) buried horizontal at its typical maximum detection depth (11 times diameter or the maximum consistent analog detection depth) or the maximum depth obtainable, if limited by bedrock or water infiltration. A medium Industry Standard Object (ISO) will also be included in the daily instrument test strip. Although the medium ISO (2" x 8" pipe nipple) is smaller than a 75mm projectile, its detection response curves for these ISOs are well documented and will be used to assess daily EM61-MK2 performance. The location of the response test strip will be varied from MRS to MRS and may even vary within an MRS to ensure that local geological, vegetation, and terrain variations are considered. The response test strip will be used in the daily morning and afternoon DGM latency tests or the morning analog system tests near the start and end of each day's survey.

Table 3-3: Example Test Strip Design

Culebra RI/FS Test Strip Design				
Seed Item	X (ft)	Y (ft)	Depth to object center	Orientation
Start	0.00	0.0	0"	Vertical
Small ISO	10.00	0.0	3"	Horizontal
Small ISO	20.00	0.0	3"	Vertical
Small ISO	30.00	0.0	7"	Horizontal
Small ISO	40.00	0.0	7"	Vertical
Large ISO	50.00	0.0	12"	Horizontal
Large ISO	60.00	0.0	12"	Vertical
Large ISO	70.00	0.0	28"	Horizontal
Large ISO	80.00	0.0	28"	Vertical
End	90.00	0.0	0"	Vertical

This space is intentionally left blank.

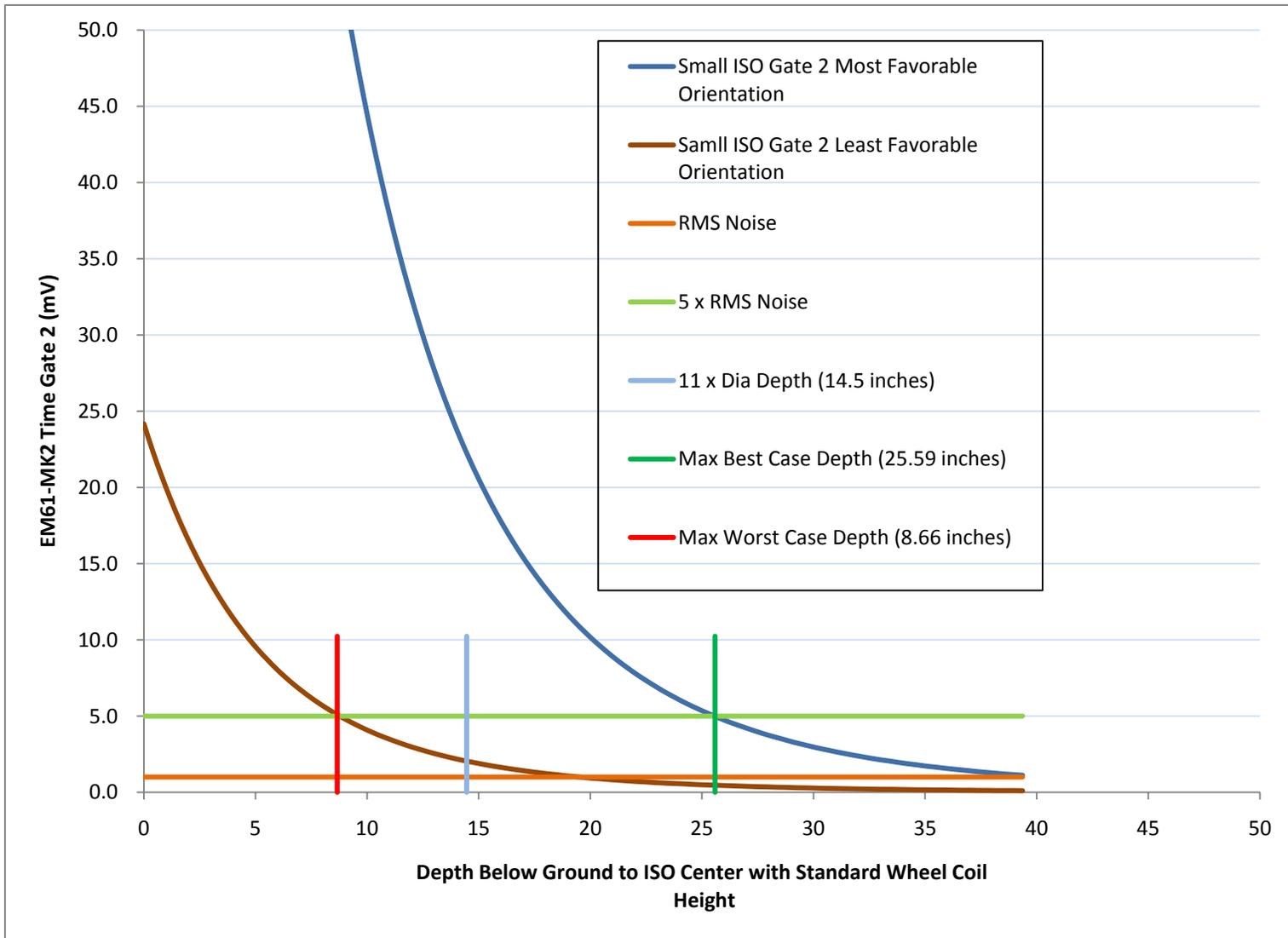


Figure 3-1: Example Small ISO EM61-MK2 Time Gate 2 Response Curves

Naval Research Laboratory Report NRL/MR/6100—09-9183 EM61-MK2 Response of Three Munitions Surrogates dated March 12, 2009

USA believes this approach will provide better transect anomaly selection metrics (peak amplitude and anomaly width [e.g., full width of peak at half maximum]), as the deepest anomalies will be along beaches or other deep soil areas, and the shallowest anomalies will be along rocky portions of the each MRS such as upland mountains and rocky portions of beaches.

In order to evaluate DGM grid survey line spacing (e.g. every 2.5 ft), the initial test strip will include a set of DGM transects, parallel to the test strip centerline. This simulated grid data will also provide a database to evaluate grid anomaly selection criteria (e.g. Sensor time gate, anomaly selection threshold, Signal to Noise Ratio (SNR), Signal Strength, and anomaly size. Combinations of these anomaly characteristics may be used to classify grid anomalies as MEC-like or Not MEC like.

In addition to the simulated grid, the initial test strip survey will include multiple passes over the test strip centerline, and several half-line spacing offsets to document the range of dynamic detection seed item responses. All of these will be documented in the IVS/geophysical report.

USA uses Standard Operating Procedures (SOPs), included in Appendix K, for geophysical use, processing and analysis, and anomaly reacquisition. USA demonstrates DGM anomaly reacquisition at the initial instrument response test strip with the Trimble's Pathfinder Pro XRT, or equivalent hand held DGPS with external antenna, and the EM61-MK2 operating in real time monitor mode. This will include stakeout of test strip centerline transect anomalies, as will be performed on MRS 13, Cayo de Luis Pena, as well as the simulated grid anomalies, as will be performed on all other MRSs. Note that the daily analog checks over the geophysical test strip are used to verify the detection performance of the White all metals detector, model Surf PI Dual Field or DXF 300 All Metals Detector, with enhanced hot rock rejection capabilities, or other analog instrument shown to provide reliable results at the test strip being used for analog transects. Geophysical task-specific data quality objectives (DQOs) are provided in Appendix O.

The test strip results and anomaly selection criteria will be provided to USACE's geophysicist prior to starting field work. Any recommended changes to the anomaly selection criteria will be discussed with USACE's geophysicist prior to implementing.

Initial test strip results will be used to establish the range of dynamic ISO responses. These will be compared to the published static ISO responses as a general performance check. If the initial test strip results fail to approximate published responses, a root cause analysis will be performed and a recommended corrective action proposed that may include equipment repair/replacement, more operator training/replacement, and the test strip repeated. Daily test strip results will be compared to the initial test strip response values. If the daily tests strip results fail to match the initial test strip results, then the same root cause analysis will be performed and a recommended response action proposed/implemented. The failing daily test strip will be repeated, and any data collected with a failed system will be recollected.

Blind seed items (BSIs), placed by USA's UXOQCS, will be used in all DGM grids, following standard anomaly avoidance procedures. BSIs are not included along transects, as no intrusive operations are planned along them. Transect data are used to develop anomaly density maps which will help place DGM grids to determine the nature and extent of potential MEC contamination in each high density area. The small ISO (37mm projectile simulant) will be used as BSIs and will be buried at depths between 3.9" (3 x dia.) and 9.2" (7 x dia.) measured from ground surface to item center and a variety of orientations. The range of small ISO responses at the test strip will be used to establish the expected range of BSI responses in production DGM grids.

USA will document the results of the initial instrument response test strip in a Geophysical System Test Strip letter report that will document test strip setup, analog and digital geophysical detection results, grid line spacing test results, initial grid anomaly selection criteria, and DGM anomaly reacquisition results and recommended final performance metrics. The initial test strip will be established in a typical challenging

wooded portion of the MRS to verify acceptable geophysical system performance. Assuming the geophysical systems are performing as designed, USA expects same-day review of the initial test strip results, finalization of project geophysical metrics, and concurrence to proceed immediately to production DGM.

Although the high resolution underwater video camera and the VideoRay remote operated vehicle (ROV) and smart tether are not strictly a geophysical system, they will be used to collect visual data for underwater MEC, critical habitat and endangered species investigations around all MRSs. The underwater video camera and ROV are checked each morning at its initial transect marking buoy clump. The underwater transect is marked with a peanut buoy and weight (clump) that is positioned with the Trimble GeoXH, or equivalent, with an external antenna. Once the transect point is marked, the buoy line is plumbed and an actual DGPS location is recorded. The underwater video camera and ROV use the clump to verify visual detection and to measure the clump's location. The measured clump location is compared to the surface DGPS location for accuracy within 2m.

3.4 GEOPHYSICAL INVESTIGATION PLAN

Upon acceptance of the geophysical system verification, USA proceeds to collect land transect data to satisfy the project DQOs of the RI. Transects acres were converted to miles, using the PWS provided, 2.75 miles per transect acre as the conversion factor. All required grid acres were assigned to land portions of each MRS. The PWS coverage for each MRS has been divided equally between land and water resulting in 8.25 miles of land transects and 8.25 miles of underwater transects, Underwater data collection is to be included in future efforts. The left portion of Table 3-4 below summarizes the PWS coverage requirements and the Land/Underwater split.

Land transects include upland transects that will be characterized using DGM techniques and beach transects that will be characterized using analog and dig techniques. Transects were planned for each MRS, focusing on historical munitions use areas, yet covering the entire MRS, including all beach areas. MRS terrain maps were used during the transect planning to follow MRS elevation contours as much as possible and to avoid slopes greater than 30 degrees. All DGM transect data will be analyzed for potential MEC anomalies. These potential MEC anomalies will be imported into the project GIS to create anomaly density maps, using ESRI's Spatial Analyst, for each MRS. High anomaly density areas that exceed background density by a factor of 5 or more will be considered potential MEC firing points or target areas.

The assigned number of grids was put onto each MRS map simply as place holders. The final grid locations will be decided, based on DGM transect anomaly density maps to refine the nature and extent of each high density area. At least one grid will be placed at the maximum density portion of each high density area to provide better RI follow on removal action cost data. Additional grids will be spaced around each high density area to better define the nature and extent of MEC contamination. The right portion of Table 3-4 below summarizes the investigation design (acres of DGM transects, acres of analog transects, plus acres of DGM grids. The geophysical investigation total is compared to the MRS acreage to assess the percentage of MRS investigation coverage. The mean transect spacing is included for each MRS as a reference. The total MRS coverage is also compared to the PWS coverage requirement to ensure the investigation design meets or exceeds PWS requirements, See North, Land, Beach, and Underwater Transect Maps (Appendix B) for the idealized transect design. Appendix B contains the investigation design maps for each MRS. A summary coverage table is included on each map.

USA follows DID MR-005-05.01 Geophysics to collect, assess, process, analyze, and deliver geophysical data.

Table 3-4: MRS Design Coverage

MRS	Land Acres	Water Acres	DGM Transect Acres	DGM Grid Acres	Analog Transect Acres	Water Video Transect Acres	Geophysical Acres	MRS Coverage
13	484.00	380.00	0.00	0.00	2.00	9.24	11.24	1.30%
10	522.00	25.00	4.18	0.98	0.29	3.34	8.78	1.61%
11	694.00	25.00	4.55	0.98	1.06	3.98	10.56	1.47%
6	826.00	0.00	3.02	1.00	1.05	4.07	9.14	1.11%
9	203.00	125.00	1.08	0.98	0.15	3.10	5.31	1.62%
8	306.00	0.00	1.44	0.50	0.35	2.02	4.31	1.22%

3.4.1 UPLAND DGM TRANSECTS AND GRIDS

Upland transects will require devegetation prior to DGM. The devegetation crew will use the Trimble Pro XRT DGPS, or equivalent, to follow each transect, following a path of least resistance to help minimize devegetation and avoiding all properties where a Right of Entry (ROE) has not been signed. A certified botanist/biologist will accompany the devegetation crew to ensure critical habitat or endangered species are avoided (see Section 7.2). Along upland transects where vegetation clearance is to be minimized, transects will be cleared with a machete, or equivalent, to a width of 1.5m (about 5 ft) to allow passage of the 1m wide EM61-MK2 coil, to a height of 6 ft. One member of the devegetation crew will mark each transect with surveyor tape, approximately every 100 feet. On upland locations, the digital sensor will be an EM61-MK2 in either the standard wheel mode or in stretcher mode. Along upland transects, the EM61-MK2 will be deployed with the wide (1m) edge forward and positioned with a Trimble Pro XRT, or equivalent, with an external antenna (see Figures 3-1 and 3-2). During upland DGM transects, a UXO technician will guide the DGM operator along each planned transect using a second GeoXH for guidance, following the path cleared and marked by the devegetation crew. The third member of the land DGM team will maintain the field log book, and help lift the EM61-MK2 over any obstacles or help carry the EM61 in stretcher mode. Selected DGM transect anomalies will be loaded into the project GIS database and used to create anomaly density maps for each MRS. Initial upland transects were selected based on topography and an attempt to cover most of the each MRS. These locations have been revised based on subsequent input from the TPP and a post-award site visit. DGM performance metrics will follow those listed in the PWS Table 7-1 Performance Requirements for RI/FS using DGM Methods (Appendix A For purposes of data quality acceptance, the morning and afternoon transect data collections are considered two (2) lots of DGM data.

On MRS 13, instrument assisted reconnaissance will be performed along all known trails and roads to identify surface MEC.

On all other MRSs, 50-ft x 50-ft grids, or equivalent rectangular areas, will be established in each high anomaly density area to provide the necessary data to establish the nature and extent of MEC contamination. Grid locations will be selected with one grid at the center or peak of the high density areas to provide better removal action cost estimates. Other grids overlapping the edges of the high density area will be used to better document MEC extent at each high density area. DGM grid locations will be staked out using the Pro XRT with the external antenna mounted to a telescoping range pole, capable of extending 25-ft. Each grid area will be surveyed by the project botanist/biologist to avoid all critical habitat and endangered species. Once a grid is established and accepted by the biologist/botanist, it will be devegetated the same as the transects were, with the edges of each grid extended approximately 5-ft to allow the DGM sensor/operator to safely turn around. The cleared grid will then be seeded with a dynamic repeatability item (small ISO buried 3 to 7 times its diameter), and surveyed with the EM61-MK2, positioned with the Pro XRT, or traditional line, station, fiducials, if DGPS proves to be inadequate. Grid survey line spacing, necessary to reliably detect objects as small as a 37mm projectile are planned to be every 2.5 ft. Expected grid coverage is 95% or greater at the 2.5 ft line spacing. All unavoidable obstacles in any grid will be located with the Pro XRT and documented in the DGM maps. Grid anomalies will be selected, as approved at the initial test strip. Dig lists and target maps for each DGM grid will be provided to the project PDT for review and approval. USA will recommend a set of anomalies to intrusively investigate in each MRS, up to the allotted amount of digs in the PWS. Grid DGM anomalies will be reacquired using the same positioning system used to survey the grid (e.g. Pro XRT DGPS or tape measures). The EM61-MK2 will be used to refine each anomaly, as well as providing post-intrusive assurance that the anomaly source has been successfully identified and removed. For purposes of data quality acceptance, each DGM grid is considered a lot of DGM data.

Survey speeds are designed to be 3.4 miles per hour or less. DGM transect repeatability is documented at the geophysical test strip each morning and afternoon. DGM anomaly selections are based on daily test strip results. Geodetic positioning is provided by the Trimble's Pathfinder Pro XRT GeoXH, or equivalent, with an external antenna. The average position accuracy provided by the Trimble GeoXH Pro XRT is expected to be within 1m in open areas and within 2m in heavily wooded areas. Dynamic DGM detection metric for grids is: Test item characteristics (peak response and size) repeatable with allowable variation of +/-25%. Dynamic DGM detection metric for transects is: Test item in test strip anomaly characteristics (peak response and size) repeatable with allowable variation +/-25%. Dynamic DGM positioning metric for grids is: Position offset of test item target $\leq 35\text{cm} + \frac{1}{2}$ line spacing (e.g. ≤ 2.4 ft for 2.5 ft line spacing) or $\leq 50\text{cm} + \frac{1}{2}$ line spacing (e.g. ≤ 2.9 ft for 2.5 ft line spacing) for fiducially positioned data. Dynamic DGM positioning metric for transects is: Test item position offset $\leq 2\text{m}$. Dynamic Analog detection repeatability metric is: Repeat a segment transect and show extra flags not greater than the greater of 20% or 8 flags, or within range of adjacent segment. The transect guidance Trimble Geo XH, with internal antenna, is expected to provide accuracies within 2.5m in heavily wooded areas, however, upland transects will be clearly marked and devegetated.

In the event DGPS proves to be unreliable in positioning the EM61-MK2, the EM61-MK2 may be used in the EM and flag mode. The operator monitors the EM61-MK2 output in real time, flags all anomalies that exceed selection threshold, and uses the DGPS telescoping range pole to document the location of each flagged anomaly.

3.4.2 ANALOG BEACHES

On the accessible beaches in each MRS, USA will use an analog sensor (e.g. White's Surf PI Dual Field or DXF300 All Metals Detector, or other analog instrument shown to provide reliable results at the test strip) in the traditional Analog and Flag mode, marking each anomaly with a large metal washer tagged with surveyor tape. During beach and beach buffer area transects, a UXO technician will guide the Analog operator along each transect using a Geo XH Pro XRT DGPS, or equivalent, for guidance. The field team leader will follow the instrument operator to help ensure transect coverage, and to record the location of each flagged anomaly using a second Pro XRT. Initial beach and beach buffer area transects are selected from aerial photographs and an assessment of beach access. Beach transect locations may

be revised based on subsequent TPP input or the post-award site visit. Any beach that requires access from the water is clearly marked on each MRS map. All precautions necessary to avoid critical habitat or endangered species and safe boat operations will be followed.

3.4.3 ANOMALY SELECTIONS

DGM data is processed on-site by USA's Site Geophysicist, as demonstrated at the initial geophysical test strip. Based on the initial instrument response over the background portion of each test strip on each MRS, the dynamic background RMS noise levels will be determined. An initial anomaly selection threshold of 5 times the RMS noise level and spatial extent (e.g. full width at half maximum) needed to select all test strip seed items will be established over the smallest expected MEC item (e.g. a 75mm projectile) buried horizontal at its typical maximum detection depth (e.g. 11 times diameter = 32 inches), an anomaly selection threshold and spatial extent (e.g. full width at half maximum) is determined for DGM transect anomaly selection.

All transect anomalies are forwarded and imported into the project GIS database and an anomaly density map is created for each MRS.

Grid anomalies are selected using the same selection threshold as the transect anomalies in each MRS and classified as MEC like or Not MEC like using the classification criteria established at the initial test strip, and documented in the initial test strip report. The selections are reviewed by the Site Geophysicist and the Corps' representative. If the total number of grid anomalies is below the PWS number of digs, all grid anomalies will be investigated. If the number of grid anomalies exceeds the PWS number of digs and an on-site determination is made as to which of the selected anomalies will be intrusively investigated by the PDT.

See Table 3-5 below for the number of digs in each MRS. The split between DGM digs and analog digs is 90% DGM and 10% analog.

Table 3-5: PWS Digs in each MRS with Split Between DGM and Analog

MRS	PWS Digs	DGM Digs	Analog Digs
13	350	0	350
10	350	315	35
11	400	360	40
6	450	405	45
9	200	180	20
8	250	225	25

3.4.4 ANOMALY INVESTIGATION APPROACH

For the Culebra RI/FS, the total amount of anomalies to be investigated for each MRS is based on the funded amount stated the PWS. In most MRSs, anomalies selected for investigation will be selected from a combination of DGM grids and analog beach transect surveys. During the initial TPP, it was decided that there will be no underwater intrusive investigation until after a formal consultation with the USFWS is completed. Our approach for distributing intrusive investigations over the MRS is to distribute 90% to DGM Grid anomalies and 10% to analog transect anomalies. Any future underwater intrusive investigations will be addressed under a separate mobilization, unless otherwise directed.

If a selected anomaly proves to be inaccessible (e.g. below bedrock or under seeping water), it will be noted on the dig list and another anomaly in that MRS DGM grid or Analog transect is selected. If the selected anomaly proves to be a Blind Seed Item, an alternate anomaly will be selected.

If sufficient intrusive results have been acquired to characterize the nature and extent of MEC contamination in an area/grid/transect, USA will notified the PDT and request confirmation to halt further anomaly investigations in that area/grid/transect. If the PDT determines that a data gap still remains, then the anomaly investigation in that area/grid/transect will continue as designed.

If sufficient data for establishing the nature and extent of MEC contamination has not been achieved (e.g. impacted MEC is discovered within 15 feet of an MRS boundary or high density area), a step-out procedure will be implemented. This may include additional analog transects along MRS beaches or additional DGM transects or grids. Step-out transects or grids will be designed to document the extent of MEC contamination from the step-out trigger point. Step-outs will be limited to no more than 3 step-outs per event.

3.4.5 GEOPHYSICAL DATA DELIVERY

Digital and analog geophysical data and QC information will be submitted in accordance with DID MR-005-05.01 (e.g. Access Database).

3.5 UNDERWATER VISUAL INVESTIGATION

USA will conduct an underwater visual survey along transects within 100 yards seaward of mean high tide in order to collect data that satisfy the project DQOs. Investigation depth will not exceed recreational diving depths (120ft) Visual and positioning data related to suspected MEC items will be collected using a combination of a GPS-integrated underwater video system and VideoRay ROV system.

Where water depths and site conditions allow access by small boat, a pole/hull-mounted underwater video camera will be deployed and monitored as the vessel progresses down each transect. The boat will be accurately maneuvered through use of a GPS-integrated Personal Digital Assistant (PDA) displaying the transect line, while a UXO Technician monitors the video display. Digital video footage is recorded onto a lap top computer, noting the latitude and longitude of the camera position. The UXO technician will note suspected areas of interest along transects. In addition, a post survey review of the video footage will be conducted by a UXO Technician to identify suspected MEC items along the seafloor.

Items that reflect characteristics of MEC items will be required and investigated further with the ROV as required in order to capture video footage of the item and the surrounding underwater environment. Procedures for ROV operations are detailed in the ROV SOP located in Appendix K.

Where water depths and site conditions do not allow access by small boat, a visual survey will be completed using the VideoRay ROV deployed from shore, or support boat situated in deeper surrounding waters.

3.5.1 UNDERWATER STEP OUT PROCEDURE

In the event that a suspected MEC item is encountered along each transect, an expanded survey will be completed within an estimated 100-foot radius of the item (200 ft diameter; 31,415 sq ft; 0.72 acres). The expanded survey is intended to identify any additional MEC items located in close proximity, which may indicate the previous presence of a waterborne target or concentrated aiming point.

If an additional item/s is located, one additional 100-foot radius will be surveyed (from the position of the item most distant from the initial point) in order to characterize the boundary of the potential area of concentration. The step out process will continue out as far as the 100 yard seaward mean high tide mark.

3.6 GEOSPATIAL INFORMATION AND ELECTRONIC SUBMITTALS

This chapter details procedures that USA will use to perform mapping and GIS integration during the RI/FS. USA developed this plan in accordance with DID MR-005-07.01.

3.6.1 ACCURACY

USA will establish survey control on the site using Class I, Third Order control monuments. The horizontal control will be based on either the English or the metric system and referenced to the NAD83 and the UTM Grid System. Vertical control is not required for this project. Any control points established or recovered will be constructed of iron or steel pins, concrete monuments, or other permanent construction method meeting the standards found in EM 1110-1-1002. This construction will ensure recoverability for any current or future work at the site. USA will use a professional licensed surveyor (PLS) registered in Puerto Rico to complete all surveying requirements, which include: installing control points, internal grid corners, and site boundaries. The northing and easting (X and Y) coordinates for all control points, grid corners, and project boundaries will be presented in a certified letter or drawing at the completion of the MR. The PLS will provide all required data and include the project-specific coordinate system, datum, and units (e.g., UTM Coordinate System, Zone 17 North, NAD83, and units in meters).

3.6.2 GIS INCORPORATION

The GIS database will be maintained at the USA corporate office located in Oldsmar, Florida. The GIS Manager will manage the database, which is used to store preliminary and final or published versions of project GIS data. It is the official project repository of GIS data, including unprocessed feature and attribute data sources that may be used outside the GIS. The Oldsmar-based database is the main location for processing data sources into draft and final GIS products, as well as for production work.

USA will produce ArcGIS Projects in accordance with the PWS and DID MR-005-07.01, and will update the GIS as often as necessary to enable planning and coordination of daily, weekly, and monthly activities. Acreage clearance estimates will be prepared and revised based on the latest design drawings provided to USA. The ArcGIS project will be prepared in ArcGIS 9.x format and be compatible with ArcGIS 9.1.

MEC items that are found and either moved or BIP will have the original coordinates documented within the GIS. The layers will be completely independent, and produce a concise picture of all clearance activities completed during this contract. Supporting tabular data will be provided in Microsoft Excel and/or Microsoft Access format at the completion of the project.

Throughout the project, USA will build the GIS database upon existing data and integrate the field data into the system. To enhance accuracy of the field data, USA will collect the field data using a ruggedized handheld GPS and electronic data collection system. These data will be downloaded on site on a daily basis and digitally transferred to USA's Corporate Headquarters on at least a weekly basis. Upon receipt of the field data, the GIS Manager will perform an accuracy inspection of the data and import this data into the project GIS.

All GIS data will be in ESRI Shapefile or Geodatabase format. Raster data such as orthophotography will be in Tagged Image File Format (TIFF) or MrSID- compliant format. Associated databases will be in Microsoft Excel format.

3.6.3 PLOTTING

All control points recovered or established will be plotted at the appropriate scale for the parcel being described. Parcels less than 10 acres will be plotted at 1:200. Parcels 10-100 acres will be plotted at 1:600 (1" = 50'). Parcels larger than 100 acres will be plotted at 1:2400 (1" = 200'). A sheet index for the project will be prepared that includes enough of the planimetric data to indicate the sheet's geographical location in the project area. This index will be shown on each map with the current sheet crossed-hatched or heavily outlined. If required, a separate sheet file may be utilized for the index.

3.6.4 MAPPING

The location, identification, coordinates, and elevations of all control points recovered or established at the site will be plotted on a map. Each control point will be identified on the map by its name and number and the final adjusted coordinates and elevations. The coordinates for grid corners will be shown to the closest 1.0 ft. Locations of individual recovered MEC items will be located to a horizontal accuracy of plus or minus 1 ft within the grid and plotted on a map. Maps will have a revision block, title block, index sheet layout, legend, grid lines, scale bar, and a true north arrow. In general, the direction of north will run from the bottom of the file to the top, with no skew. A legend showing the standard symbols used for mapping will be on the map as well as a map index showing the site in relation to all other sites within the project boundary.

3.6.5 DIGITAL DESIGN DATA

All GIS Data will be delivered in ESRI Shapefile format. A READ ME file will be included with delivered data, which will contain basic information about each Shapefile.

3.6.6 COMPUTER FILES AND DIGITAL DATA SHEETS

All final document files will be delivered to USAESCH in IBM and MS Office compatible formats. The drawing and plot data will be provided in the UTM Coordinate System, NAD83, and units in meters. GIS data will be submitted in ESRI Arc Map-compatible format. Raster data, such as USGS Topographic Quadrangles or Orthophotography will be provided in either TIFF or MrSID format. All ArcGIS project files (.mxd) will be supplied with the appropriate final report. In addition to GIS data and project files, maps will be delivered in PDF format for viewing without modification.

All final GIS data generated from this project will conform to the Spatial Data Standards for Facilities, Infrastructure and Environment.

3.7 INTRUSIVE INVESTIGATION

3.7.1 GENERAL METHODOLOGY

Intrusive investigations are currently planned on the land and portions of each MRS. General and specific methods planned for use during intrusive investigations are discussed in the following sections. In addition, the methods for documenting MEC items are described as well as the required qualifications of personnel involved in the investigation and disposal of MEC. All intrusive activities, including recovery, management, storage and disposal of MEC items are performed in compliance with applicable DOD and Army requirements, including DOD 6055.9-M, *Ammunition and Explosive Safety Standards*, TM 60A 1-1-31, *Explosive Ordnance Disposal Procedures*, AR 385-64, *Ammunition and Explosives Safety Standards*, EM 385-1-1, *Safety and Health Requirements Manual*, DDESB TP-18, *Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel*.

3.7.2 ACCOUNTABILITY AND RECORDS MANAGEMENT FOR MEC

A detailed account of all MEC and non-MEC materials encountered during the investigation will be maintained. A log entry of all MEC related materials located in a transect or grid will be made in the database indicating amount, identification, condition, depth, and disposition. A log entry will be made for non-MEC materials, indicating the general types of materials encountered and pounds excavated. Digital and analog geophysical data and QC information will be submitted in accordance with DID MR-005-05.01 (e.g. Access Database)." will be included.

USA will not remove scrap small arms cartridge cases during any excavation. Munitions Debris and cultural debris may be stored in the same general area in separate, lockable (sealed) containers but not commingled. Certification by the UXOQCS and SUXOS that the Munitions Debris are inert and free of energetic material will be made on DD Form 1348-1A.

All land excavations will be filled in and tamped to the approximate consistency of the surrounding soil. The excavation site shall be returned as nearly as feasible to an undisturbed condition.

3.7.3 PERSONNEL QUALIFICATIONS

3.7.3.1 UXO Team Personnel

UXO teams will consist of qualified personnel approved by USACE. Non-UXO qualified personnel will not perform any excavation or handle MEC. As required by the specific task, all USA personnel on this project will complete the Occupational Safety and Health Administration (OSHA) 40-hour training course for hazardous waste site workers and an 8-hour refresher course as appropriate. Management and supervisory personnel will also complete supervisory training and refresher training as required by CFR 1910.120 e (4) & (8). Additional site-specific training, in accordance with 29 CFR 1910.120, EM 385-1-1 (USACE Safety and Health Requirements Manual), and ER 385-1-92 (Safety and Occupational Health Document Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities) will be provided to all personnel upon their initial mobilization. A Medical Surveillance Program is in place with the latest examination within the last 12 months.

All personnel must meet the requirements set forth in DDESB Technical Paper (TP) 18, Personnel/Work Standards. UXO personnel will be U.S. citizens and graduates of the U.S. Naval EOD School, Eglin AFB, Florida; the U.S. Army Bomb Disposal School, Aberdeen Proving Ground, Maryland; the U.S. Naval Explosive Ordnance Disposal (EOD) School, Indian Head, Maryland; the EOD Assistants Course, Redstone Arsenal, Alabama; the EOD Assistants Course, Eglin AFB, FL or a DOD-Certified equivalent course. Credit for the EOD experience while assigned to the National Guard or Reserve will be based on the actual documented time spent on active duty, not on the total time of service.

3.7.4 MEC SAMPLING LOCATIONS AND PROCEDURES

Each MRS includes land investigation sampling locations include transect anomalies in MRS 13. Sampling locations for all other MRSs will be on both transect and grids. Underwater visual surveys will be conducted in locations where suspect MEC items are discovered along transects.

3.7.4.1 Land Investigation

Based on historical data including the Ordnance and Explosives Waste Archives Search Report (Feb 1995), Inventory Project Report (INPR) (USACE, July 2005), Supplemental Archive Search Report (USACE, Sept 2005), and Final Site Inspection Report (USACE, Sept 2006), transects will be located across the each MRS in areas that will be accessible by foot following any necessary brush removal activities. To the extent practical transects will be spread evenly across the entire MRS. Geophysical investigation will proceed with transects. Following geophysical investigation of transects, to create anomaly density maps, and grids, to establish the nature and extent of potential MEC contamination in each high density area, the team will coordinate with the PDT to select upland anomalies for intrusive investigation. Selection of anomalies to investigate will give full consideration to potential impact on sensitive habitats within the MRS. Note that beach analog and dig anomalies will be selected and investigated the same day by the analog team leader. Upland DGM transect anomalies will be available for review the same week as the DGM survey, but this review needs to be done immediately so that intrusive operations can begin the next week, as only a single mobilization is planned.

All anomalies identified for sampling will be intrusively investigated, unless removal of surface metallic debris can be verified as accounting for the mapped geophysical anomaly. The MEC teams will provide a description of the item to include recovery depth and item orientation in a handheld personal data assistant (PDA). Intrusive investigation excavations will continue until the anomaly source has been positively identified. Excavation of anomaly locations will be performed in accordance with the procedures outlined in the following subsections. Delayed excavations will be reported to the Site Project Manager/SUXOS and scheduled for future excavation.

Anomalies within 3 feet of the surface will be excavated using hand tools. Anomalies close to the surface will be excavated by carefully removing the earth overburden using a hand shovel/trowel or other small digging implement. Throughout the excavation, the UXO Technicians will use a hand-held Whites Surf PI Dual Field Metal Detector to check and verify the proximity of the anomaly.

Anomalies deeper than 3 feet may require excavation using heavy equipment (e.g., backhoe); applies to areas where access is available. For these excavations, personnel will coordinate equipment operating requirements with the SUXOS. Prior to the arrival of the heavy equipment, the UXO Technician III will ensure that a cleared entrance and egress path is available for the heavy equipment. The UXO Technician III will designate one person to direct the heavy equipment operator. Heavy equipment (operated by a qualified UXO Technician) or manual digging tools will be used to excavate the earth overburden in 6-inch lifts. After each lift, the anomaly location will be redefined with appropriate instrumentation and the anomaly source investigated using hand tools. This process will continue until the source of the anomaly has been uncovered and identified.

Before entering an excavation, the UXO Technician must make eye contact with the backhoe operator. When a UXO Technician is checking backhoe excavations for suspected MEC-source proximity, the backhoe bucket will be placed on the ground and the operator will keep his/her hands clear of the operating controls. The backhoe operator will resume excavation operations only after visually verifying that all personnel are clear of the excavation and outside of the bucket swing area.

Equipment requirements for this activity includes: instrumentation used for the instrument-assisted ground reconnaissance, including hand-held Minelab Explorers II and Trimble GeoXH, or equivalent, DGPS/Data Collection tool and miscellaneous common hand tools (e.g., screwdrivers, digging implements). A backhoe and demolition equipment and explosives required for MEC disposal may be necessary.

3.7.4.1.1 MRS 13 Cayo Luis Pena Impact Areas

In MRS 13, MEC sampling will be limited to investigations along accessible trails and beach areas. In order to minimize vegetation removal within the National Wildlife Refuge, only transect sampling will be employed, as opposed to grid sampling, which typically requires more extensive vegetation removal than transects. To satisfy the MEC component of the DQO for MRS 13, only surface MEC sampling will occur along the accessible portions of the existing trails on Cayo Luis Pena. MEC sampling for accessible beach areas will consist of surface and subsurface analog investigations.

3.7.4.1.2 MRSs 10, 11, 6, 9, and 8

The investigation approach of these MRS sites is to collect analog and digital transect data, use this transect anomaly data to produce anomaly density maps. Reposition investigation grids in and around each high density area (greater than 5 times background density). Collect all grid data and analyze for MEC-like anomalies, based on simulated grid test strip data. Intrusively investigate grid anomalies to establish the nature and extent of MEC contamination.

3.7.5 MUNITION WITH GREATEST FRAGMENTATION DISTANCE (MGFD)

The MGFD for each MRS are shown in Table 3-6 below.

3.7.6 MINIMUM SEPARATION DISTANCES (MSD)

The MSD for each MRS are shown in Table 3-6 below.

Table 3-6: MGFs and MSDs

MRS	Subarea	MGFD	MSD
			(HFD ¹ / MFD ²)
MRS 13- Cayo Luis Pena Impact Areas	Northern Island Impact Area	75mm MKI HE	239 ft / 1,873 ft
	Underwater Area	5" HVAR MK 1	349 ft/ 2,328 ft
	Southern Island	5" MK 41	359 ft / 2,377ft
MRS 10- Defensive Firing Area No. 1	Beach Defensive Area	81mm Mortar	247 ft/ 1,579 ft
	Direct Fire Area	3" Common MK 3 Mod 7	126 ft / 1,700 ft
	Underwater Area	81mm Mortar	247 ft/ 1,579 ft
MRS 11- Defensive Firing Area No. 2	Mortar Boat Firing Area	4.2" M3A1 HE	316 ft / 1,670 ft
	Beach Defensive Area	81mm Mortar	247 ft/ 1,579 ft
	Direct Fire Area	3" Common MK 3 Mod 7	126 ft / 1,700 ft
	Underwater Area	81mm Mortar	247 ft/ 1,579 ft
MRS 06- Artillery Firing Area	Land Impact Area	37mm MK II	90 ft / 982 ft
	Beach Defensive Area #1 & #2	81mm Mortar	247 ft/ 1,579 ft
	Water Impact Area	37mm MK II	90 ft / 982 ft
MRS 09- Soldado Point Mortar and Bombing Area	Aircraft Bombing Target	100lb AN-M30A1 HE	413 ft/ 1,833
	Direct Fire Area	3" Common MK 3 Mod 7	126 ft / 1,700 ft
	Water Target	37mm MK II	90 ft / 982 ft
MRS 08- Cayo Norte Impact Area	Land Impact Area	75mm MKI HE	239 ft / 1,873 ft
	Water Impact Area	5" HVAR MK 1	349 ft/ 2,328 ft
1. HFD= Hazardous Fragmentation Distance 2. MFD= Maximum Hazardous Distance			

3.7.7 MEC IDENTIFICATION

Any suspected or known MEC encountered during excavation will be clearly marked and its position annotated on the Trimble GeoXH, or equivalent, and other appropriate site maps. The UXO Technician III will evaluate the item found and immediately report the condition of the item to the SUXOS. No UXO will be moved without positive identification as acceptable to move, an evaluation of its condition, and approval has been received from the SUXOS and UXOSO or the item has been identified as non-UXO.

3.7.8 MEC REMOVAL

3.7.8.1 Land

If an excavated item is considered MEC, it shall be uncovered sufficiently to obtain a positive identification of the item and to determine whether or not it is fused. It is preferred that unfused MEC be Blown-in-Place but can be removed and consolidated with other items previously located or if the item is located within a sensitive habitat area. A separate determination on disposal will be made by the SUXOS with concurrence of the USACE OE Safety Specialist.

Fused UXO will not be removed unless it has been determined to be acceptable to move by the SUXOS and UXOSO. The SUXOS will make a determination in each case on how best to dispose of the UXO. If the UXO cannot be safely disposed of under the existing conditions, the USACE OE Safety Specialist will be notified. In no case shall the SUXOS authorize or undertake destruction of UXO when there is sufficient reason to believe that the disposal action will result in personnel casualties or property damage.

3.7.8.2 Water

Suspected MEC located during the underwater visual survey will be left in place. Underwater demolition is not currently authorized as part of the RI.

3.7.9 MEC STORAGE

MEC will not be stored. MEC items will be left in place for later disposal by blow-in-place or, if acceptable to move, later removed, consolidated with other MEC items and disposed of in accordance with MEC Disposal operations. MEC items discovered on the main island of Culebra (MRS-06, 09, 10, 11) and left in place for later disposal, will have a guard posted to prevent public contact until the item is disposed. For MEC items left in place on Cayo Luis Pena (MRS 13) or Cayo Norte (MRS 08) USA will coordinate with the onsite USACE Safety Specialist to determine the need for a guard. Due to the low number of inhabitants and limited access, a guard should not be necessary.

3.7.10 MEC DISPOSAL

This WP includes procedures for disposal of MEC recovered during intrusive investigation activities. Disposal may be through destruction using one of the following methods:

- **In-Place Destruction.** USA will destroy in place all MEC that is identified as unacceptable to move; this method is commonly known as BIP. The USA SUXOS and UXOSO will follow the procedures in sections 3.6.9.3.6 Evacuation and Site Control; 3.6.9.3.7 Fragmentation Distance; 3.6.9.3.10 Blow-in-Place Procedures; and 3.6.9.3.11 Operations in Populated/Sensitive Areas when destroying MEC in place. When this technique is employed, engineering controls may be used to minimize the blast effects.
- **On-Site Destruction.** USA will use the on-site destruction method to move MEC items that are acceptable to move to a central location for destruction within the same area. Procedures in this WP for Evacuation and Site Control, Fragmentation Distances, and Operations in Populated/Sensitive Areas will be followed. When this technique is employed, engineering controls may be used to minimize the blast effects.

During In-Place or On-Site disposal of MEC and related material, safety is the primary concern. The most obvious requirements are to protect personnel, the public, and the environment from fire, blast, noise, fragmentation, and toxic releases. Planned detonation of explosives requires more stringent safety distance requirements than those for ordnance in storage, and such detonation shall be conducted in accordance with the requirements outlined in DOD 6055-9-M, EM385-1-97, p.1.2.C.3, EM1110-1-17 App D, and the latest approved version of the Explosives Siting Plan (USA, 2011).

USA intends to use electrical disposal procedures. Depending on local explosives availability, USA may use (with concurrence of the OE Safety Specialist) a Shock Tube Firing System (Non-EL) in accordance with USA Standard Operating Procedures (SOP) in Appendix L. All personnel directly or indirectly engaged in UXO operations are thoroughly trained and capable of recognizing hazardous explosive exposures. All personnel are required to read, become familiar with, and adhere to the requirements contained in this chapter to ensure that all general safety regulations and safe work practices are observed at all times.

All USA personnel engaged in UXO demolition activities will utilize these procedures. However, situations may warrant additional safety measures, such as fire trucks, medical personnel, and protective clothing. The SUXOS has the overall responsibility to comply with the minimum requirements listed below and has the authority to upgrade the requirements as the situation dictates.

All MEC and MPPEH related material containing explosives or hazardous material will be disposed of by detonation using standard demolition procedures as outlined in Technical Manual (TM) 60A-1-1-31 and USA's SOPs in Appendix L of this WP. USA will use electric or Non-EL firing procedures for positive control of demolition operations. If these methods of disposal are determined to be impractical, USA will notify the on-site USACE OE Safety Specialist, who will request local military EOD support. The following paragraphs describe the procedures USA will use to detonate MEC and MPPEH related items.

Throughout MEC disposal operations the Standard Operating Procedures for Endangered Species Conservation and their Habitat on DERP-FUDS Project No. I02PR006802.Culebra, Puerto Rico (Appendix M) will be followed to minimize the impact on the environment. USA will implement a daily survey for turtle nesting by a biologist 75 days prior to any underwater work commencing.

3.7.10.1 MEC/MPPEH Procedures

USA will dispose of MEC and MPPEH related materials after notification of the agencies listed in section 3.6.9.3.6 Evacuation and Site Control, which allows Notification to Airmen (NOTAM), Notice to Mariners (NOTM), and notification of the local police. USA will use off duty police officers or a local security service to provide security of the items located on land during the notification phase in conjunction with coordination with the USACE OE Safety Specialist. Demolition operations will begin at a work site when all nonessential personnel are out of the minimum separation distance (MSD) of the ordnance being detonated. The MSD will be in accordance with Table 7-1 Minimum Separation Distance of the Explosives Site Plan. UXO that is acceptable to move may be consolidated within an area to reduce the number of shots and lessen environmental damage. To the greatest extent possible, all items will be BIP to reduce the risk inherent in handling and movement. Demolition shots may require engineering controls to meet the MSD requirements stated in Table 7-1 of the Explosives Site Plan.

Demolition operations will not begin in a work site until all non-essential personnel are outside of the Exclusion Zone (EZ) established for the ordnance being detonated. MEC that is unacceptable to move (e.g., fuzed items) must be BIP.

3.7.10.1.1 Coordination and Supervision

The on-site disposal will be under the direct control of an experienced and trained UXO Team Leader charged with the responsibility for all demolition activities within the area. The Team Leader, assigned by the SUXOS, will be responsible for training all personnel regarding the nature of the materials handled, the hazards involved, and the precautions necessary, and will be present during all on-site disposal operations. The Team Leader will also maintain custody of the blasting machine or Non-EL initiator. The SUXOS and Team Leader will ensure that the appropriate local authorities are notified prior to daily on-site demolitions (see section 3.6.9.3.6 Evacuation and Site Control for list of local authorities to notify).

The SUXOS and UXOSO will be on site at all times during disposal operations. The operation is performed under the direction and supervision of the SUXOS, who is charged with the responsibility to ensure that procedures contained in this WP and referenced documents are followed. The UXOSO monitors compliance with the safety measures contained in the WP and associated documents, and in case of noncompliance, is vested with the authority to stop or suspend operations. Individuals will report the completion of tasks to the SUXOS. The following tasks are required.

- Secure all access roads to the area.
- Visually check demolition site for any unauthorized personnel.
- Check firing wire for continuity and shunt.
- Prepare designated shots.
- Check continuity of detonators.
- Secure the detonators in a safe location.
- Place charge in desired location.

3.7.10.1.2 Detonation Operations

Prior to conducting a disposal operation, the Team Leader will conduct a safety briefing to the members of the demolition team. This safety briefing will include, at a minimum the following topics:

- Phases of the operation

- Review of explosive handling and precautions
- Location of safe area
- Emergency notification procedures
- Site specific characteristics
- Type of UXO being destroyed
- Placement and quantity of counter charge
- Misfire procedures
- Post-detonation cleanup of the site
- Care and handling of explosive materials
- Personal hygiene
- Two person rule
- Potential trip/fall hazards
- Location of the vehicle
- Wind direction (toxic fumes) and
- Location of first aid kit and fire extinguisher.

The vehicle engine will be started prior to initiating priming procedures and will be kept running.

Telephone or radio communication will be established with emergency response personnel. No radio or cellular telephone transmissions will take place in the vicinity during the positioning or connecting of electrical initiating devices. Additional safety precautions for demolition operations include:

- Conduct operations in accordance with Army TM 60A 1-1-31 (Explosive Ordnance Disposal Procedures).
- During demolition operations, designate an emergency vehicle (in addition to the vehicle associated with the demolition team) that will remain in the area.
- Keep blasting caps in approved containers, located at least 50 ft downwind from other explosives, until they are needed for priming.
- Always point the explosive end of blasting caps, detonators, and explosive devices away from the body and other personnel during handling. This will minimize injury should the item explode.
- Do not bury blasting caps used for initiation of explosive charges.
- If explosive charges are to be covered or tamped with earth, fit the charges with detonating cord leads that protrude 1.8 meters (6 ft) from the earth.
- Do not use blasting caps less than the equivalent of a commercial No. 8 cap unless used with commercial explosives and approved by the explosives manufacturer.
- Transport to the disposal site only those explosives or initiators needed to meet the requirement of the operation.
- Do not surrender the blasting machine or activating device to the individual designated to fire the shot until the SUXOS is assured that the area is clear.
- Clear an appropriate distance (50 ft) around the demolition site of dry grass, leaves, and other extraneous combustible materials.
- Provide a minimum delay time of 30 seconds for electric operations between detonations.
- If MEC cannot be BIP and must be removed, it will be disposed of after proper notifications. Depending on the amount of UXO encountered, a daily schedule may be established for detonation of UXO on site to allow the site personnel to clear the area and to not alarm the public. The detonation time will be announced to the agencies concerned to enhance public relations.

3.7.10.1.3 General Detonation Safety Procedures

Disposal activities are inherently hazardous and require strict adherence to approved safety and operational procedures. During disposal operations, USA will ensure that the following safety measures:

- Personnel working with electric blasting caps or other electro-explosive devices will not wear static-producing clothing such as nylon or silk.
- Prior to making connection with the electric blasting cap, the firing circuit will be continuity tested.
- All parts of the firing circuit will be kept insulated from the ground or other conductors such as bare wires, rails, pipes, or other paths of stray current.
- Electric blasting caps will be connected to the firing circuit before connection to the main initiation charge.
- Electric blasting caps of different manufacturers or types will not be used in the same system.
- The shunt will not be removed from the wires until the individual performing the operation has been grounded.
- The electric blasting caps will be tested for continuity with a galvanometer at least 50 ft downwind from any explosives prior to connecting them to the firing circuit. After the testing is completed, the lead wires will be short-circuited by twisting the bare ends of the wires together. The wires will remain shunted until ready to connect to the firing circuit.
- The electrical lead wires of electric blasting caps, detonators, or other electro-explosive devices should not be pulled; detonation may occur.
- The legs of the blasting cap should be unrolled so that the cap is as far as possible from the operator and pointing away from him.
- The blasting cap will be placed in a hole or behind a barricade before removing the shunt and testing for continuity. The cap should not point toward other personnel or explosives.
- Only authorized and serviceable testing equipment will be used.
- The blasting machine will not be connected to the firing wires until all pre-firing tests have been completed, and all preparations have been made to fire the charge.
- The blasting cap will not be held directly in the hand when uncoiling the leads. The wires will be held approximately 6 inches from the cap. This will minimize injury should the cap explode. The lead wires should be straightened by hand and not thrown, waved, or snapped to loosen the coils.
- The shunt will not be removed from the lead wires of blasting caps except when testing for continuity or actual connection into the firing circuit. The individual removing the shunts should be grounded prior to performing this operation to prevent accumulated static electricity from firing the blasting cap.
- Keep both ends of the firing wires shorted or twisted together except for testing or firing. The blasting caps will not be connected to the firing circuit unless the power end of the firing circuit leads is shorted.

3.7.10.1.4 Electric Firing Procedures

Procedures for electrical firing are provided in OPS-03 Demolition/Disposal Operations (Appendix K).

3.7.10.1.5 Electrical Misfires

Procedures for electrical misfires are provided in OPS-03 Demolition/Disposal Operations (Appendix K).

3.7.10.1.6 Shock Tube (Non-EL) demolition Operations

Procedures for Non-EL are provided in OPS-03 Demolition/Disposal Operations (Appendix K).

3.7.10.1.7 Evacuation and Site Control

USA will notify the following agencies at least 36 hours in advance of performing any demolition operations:

- US Coast Guard A.M. Schmidt, LTJG, USCG or Mr. John Reyes Marine Information Specialist (787) 729-5381), Sector San Juan AtoN & WWM Officer 787-289-2086 fax 729-2377. This is for a Broadcast to Mariners of the scheduled demolition shot. Alison.M.Schmidt@uscg.mil.
- FAA Coordination Facility for a Notice to Airmen on flight restriction above the demolition area. (787) 253-8664 Mr. Gilberto Iglesias or Mr. Felipe Fraticelli, www.nes.notams.faa.gov.
- Municipal Police, (787) 742-0106 for any activity on Culebra. USA SUXOS or UXOSO will coordinate directly with the police department to overcome any language difficulties on demolition operations.
- Puerto Rican State Police (787) 742-3501 for any activities on Culebra. USA SUXOS or UXOSO will coordinate directly with the police department to overcome any language difficulties on demolition operations.

Control of the demolition site must be maintained during demolition operations. All personnel who are not essential to demolition operations must evacuate to a safe area. Access roads entering the blast area will be blocked during explosive disposal operations to ensure that unsuspecting individuals are not placed in jeopardy by the explosion. The Team Leader will ensure the area is clear of unauthorized personnel and equipment prior to permitting attachment of the initiation devices to the priming charge.

An observer will be stationed at a location where there is a good view of the air and surface approaches to the demolition site. It shall be the responsibility of the observer to notify the Team Leader to suspend firing if any aircraft, vehicle, or personnel are sighted approaching the general demolition site.

A minimum of two UXO qualified personnel, one of whom will be the Team Leader, will conduct demolition operations. An electrical firing system provides better control of the demolition activities. Control of initiation devices will remain with the Team Leader until attachment to the firing circuit.

Local fire departments may need to be alerted to standby during demolition operations (see Appendix D APP, for telephone numbers). In the event of a fire or unplanned explosion, site personnel will be responsible to extinguish the fire. If unable to do so, they will notify the local fire department and evacuate the area. **NOTE:** Do not attempt to fight explosive fires.

Prevailing weather condition information will be obtained from a reliable source; this data will be logged before each on-site detonation. Demolition charges will not be primed or connected for electrical firing during the approach or presence of a thunderstorm. Other weather conditions (high winds, dust storms, temperature inversions, low altitude clouds, or cloud coverage of more than 50%) may adversely impact planned demolition operations. The SUXOS will consider these conditions when determining whether or not to conduct demolition operations. If weather conditions preclude the disposal by BIP, USA personnel will secure and cover the UXO with sandbags and properly mark the area, until favorable conditions allow the demolition. Personnel will remain at the site as long as the possibility of fire exists as the result of a demolition operation.

Depending on the location of the anomaly, the MGF, and the MSD, it will be necessary to use engineering controls and/or evacuations to protect non-essential personnel during intrusive investigations.

USA will use engineering controls (in accordance with HNC-ED-CS-S-98-7) to reduce fragmentation distances of demolition shots. A copy of HNC-ED-CS-S-98-7 will be on site and available to site personnel. Additional engineering controls that may be used include the buried explosion module IAW Department of Defense Explosives Safety Board (DDESB) TP-16 and water mitigation IAW HNC-ED-CS-S-00-3. In areas where an acceptable fragmentation distance cannot be achieved, items acceptable to move may be moved to the approved demolition area, with the concurrence of the USACE OE Safety Specialist. If these methods of disposal are determined to be impractical, USA will notify the on-site USACE OE Safety Specialist.

USA will use a seismograph to record and document the seismic event and blast effect of on land detonations when housing is in close proximity to the detonation.

3.7.10.1.8 Fragmentation Distance

Fragmentation distances and overpressure distances are based upon the net explosive weight (NEW) of a single demolition item plus the donor charge as outlined in the Explosive Site Plan (see Appendix P), the MSD calculations in Appendix G or Chapter 9 of DOD 6055.9-M. The calculation of fragmentation and overpressure distances is important in order to ensure the safety of not only site personnel, but also the public; these distances will be calculated using DDESB Technical Paper 16. The fragmentation ranges are for open, un-barricaded shots.

Detonating multiple shots will be sequentially timed to ensure they are not simultaneous. USA ensures that all shots are within the appropriate fragmentation and K328 range. If this is not possible, use tamping or other engineering controls.

3.7.10.1.9 Comparison of Barricades

USA will compare the six barricades listed in HNC ED-CS-S-96-8 publication to determine the most appropriate barricade for the location and type of MEC items being blown-in-place. This will minimize the impacts to listed species and their habitat. Once the MEC item is known a map will be created to show the habitat that needs to be protected from fragments. USA will determine the 95% confidence level fragment range to show that a barricade is required.

3.7.10.1.10 Barricade Siting and Selection Procedure

The following is the process for determining the barricade to be used:

- Location of Ordnance and Protection Area
- Maximum Fragment Distance
- Selection of Fragment Mitigating Material
- Terrain Limitations
- Reduced Fragment Range with Barricade
- Horizontal Coverage

3.7.10.1.11 Blow-In-Place Procedures

The UXO team will evaluate the unexploded ordnance and either detonates it in place or relocate the ordnance to a designated area within the site. No fuzed ordnance will be moved unless it is deemed acceptable to move by the UXOSO or is directed to do so by the OE Safety Specialist. Detonations will occur only after all unnecessary personnel have left the area, road guards have been posted, and the required personnel have been notified. USA personnel not involved in the disposal operation will act as perimeter guards, as directed by the SUXOS. USA will use our subcontractor, Sea Ventures, to provide a boat to enforce the EZ on adjacent water areas. A UXO Technician, stationed on the craft at the appropriate distance will notify the UXOSO if any craft enter the area in turn enabling Marine Radio to be used to warn the unauthorized craft away from the area.

3.7.10.1.12 Operations in Populated/Sensitive Areas

Some areas may require evacuations because of the proximity of residences, and the use of engineering controls is not possible. USA will request assistance from the local authorities on Culebra to notify residents at least 36 hours prior to performing any operations at these sites. If for any reason the

resident(s) refuse or do not evacuate, USA will move to an alternate location and notify USACE. USA will coordinate with USACE for notification using the RAB and other regulatory agencies before a demolition event.

Evacuation of the public during the demolition of a UXO item is a last resort if all other engineering controls are not adequate. USA will conduct demolition operations only after all personnel protective measures have been completed and reported to the SUXOS. USA will take property protective measures such as, but not limited to: sandbagging, tamping with earth, and barricading. Personnel will be permitted to re-enter the area only after the demolition point has been inspected and the "all clear" has been given by the SUXOS.

3.7.10.2 Material Potentially Presenting an Explosive Hazard (MPPEH)

USA UXO technicians will inspect all tentative MPPEH items to determine if the items present an explosive hazard. USA UXO technicians will classify these items as MPPEH, Munitions Debris (MD), range related debris, or MEC. USA will classify items of undetermined explosive hazard as MPPEH and will dispose and/or vent the item with other demolition shots. All MEC and MPPEH containing explosives will be disposed of by detonation utilizing the standard demolition procedures outlined in Technical Manual (TM) 60A-1-1-31 and procedures described in section 3.6.9 MEC Disposal of this WP.

3.7.10.3 Munitions Debris

Within or adjacent to each operating section, the UXO Team will establish temporary MD collection points. During intrusive operations, debris will be inspected by a UXO Technician II and segregated into the following three categories:

1. Other Scrap (e.g., nails, wire, tin cans, etc.).
2. Munitions debris
3. Material Potentially Presenting an Explosive Hazard (MPPEH)-Scrap requiring venting to determine if it is free of explosive hazards.

Upon completion of daily operations, the team will collect the material in these temporary collection points for transport to the debris holding area. As the material is being loaded, the UXO Technician III will perform a second inspection of the material to ensure it is segregated correctly.

The debris holding area is within the fenced area of the explosive Type II magazine area and will be set up to maintain the segregation of metal scrap into separate locked containers. The keys to these containers will be maintained by the SUXOS. Other scrap will be placed in a locked dumpster for local disposal. Munitions debris will be placed in 55-gallon drums (open-top type) fitted with a lock. Each drum will be labeled with its contents and each container will be marked with a unique identification number. MPPEH requiring venting will be temporarily stored in a 55-gallon drum (open-top type) fitted with a lock. This container will also be marked with its contents.

Inspection and classification is a critical aspect of MEC operations and only personnel qualified as a UXO Technician II or above perform these inspections. The total weight of munitions debris will be documented during certification and verified upon receipt by the recycle facility. Each container is closed and sealed, after all materials are loaded into the container and it has passed the certification/verification process. Each container is closed in a manner that requires that the seal be broken to gain access to the interior of the container. The material will be shipped to a recycle facility at the end of the project or periodically, as required. Upon turn-in of the scrap, the SUXOS completes a DD Form 1348-1A and follows current guidance from USAESCH on handling and certification of MPPEH. USA ensures that the materials are inspected on the exterior and interior surface to be certain that these items do not present an explosive hazard. USA employs a four-level process for the inspection of MPPEH and range residue: 1) Inspection by the UXO team at the time of excavation; 2) Inspection by the UXOQCS during daily audits of the procedures used by UXO teams and individuals for processing MPPEH or range residue; 3) UXOQCS ensures the procedures and responsibilities for processing MPPEH and range residue for certification as

scrap metal are being followed and performs random checks of processed MPPEH and range residue; 4) SUXOS is responsible for ensuring WP and QC Plan detail the specifics of the procedures to be followed to process MPPEH and range residue; completes the DD Form 1348-1A and performs random checks that the munitions debris and range residue are free from explosive hazard; ensures all inspection, certification, and final disposition procedures meet the requirements of the WP.

Munitions debris will be packaged, sealed, and shipped to a recycling facility for final disposal. USA plans to use Timberline Environmental Services (TES) for final disposal. USA will maintain the chain of custody of the sealed package shipped to TES. As an element of cradle-to-grave documentation, TES will ensure the continued chain of custody, provide USA and the Government with signed copies of receipt documents and certificates of destruction verifying that the contents have been smelted, shredded, or flashed and are only identifiable by their basic content. This documentation will be included in the RI Report. Shipments to TES will be made at the end of the project or periodically if required.

3.7.10.3.1 Personnel Responsibilities

- UXO Technicians II: Check, classify and segregate all scrap as they recover it.
- UXO Technicians III: Re-inspect all scrap, as it is loaded for transport to the scrap holding area.
- The UXOQCS:
 - Conducts daily audits of the scrap metal handling process
 - Randomly inspects and documents a minimum of 10% of the scrap being processed to ensure the handling procedures are being followed.
- The UXOSO:
 - Ensures that specific procedures for scrap metal processing are being followed, performed safely, consistent with applicable regulations, and in accordance with the WP.
 - Performs random checks to ensure all scrap is being handled correctly.
- SUXOS:
 - Ensures that specific procedures for scrap metal processing are being followed, performed safely, consistent with applicable regulations, and in accordance the project WP
 - Performs random checks to ensure all scrap is being handled correctly
 - Certifies that all scrap metal is free from explosive hazards
 - Takes responsibility for ensuring all inspected materials are secured in locked containers while awaiting shipment off site
 - Ensures that prior to shipping material off site, inspected materials are in a closed, labeled, and sealed container and documented as follows:
 - Unique label including “USACE/ Culebra Site/USA Environmental, Inc./Container # (e.g., 0001)/Seal Number”

USA will include a documented description of each container that will be provided for the disposal facility with the following information: contents, weight, location where scrap was obtained, name of contractor, names of certifying and verifying individuals, container identification number, and seal identification.

3.7.10.3.2 Certification and Verification

The SUXOS will certify and the USACE Safety Specialist will verify that the scrap metal is free of explosives hazards. A DD Form 1348-1A will be used as the certification/verification documentation and will state the following information:

- Basic material content
- Estimated weight

- Unique identification/seal numbers for each container
- Location where scrap was obtained.

The following certification/verification will be entered on the DD 1348-1A and be signed by the SUXOS and USACE OE Safety Specialist:

This certifies and verifies that the material listed has been 100 percent inspected and to the best of our knowledge and belief, are inert and/or free of explosives and related materials."

3.7.11 DISPOSAL ALTERNATIVES

USA intends to perform all MEC disposal onsite. Offsite disposal will not be considered. However, when MEC disposal cannot be performed onsite, USA will request U.S. Navy assistance to render safe, the MEC item. Other alternatives (e.g., controlled detonation chamber or water jets) are considered impractical due to lack of suitable access and other logistical constraints.

3.8 MUNITIONS CONSTITUENTS (MC) SAMPLING

MC sampling includes collection and analysis of discrete surface and subsurface soil samples, discrete surface water and sediment samples, and pre and post detonation composite soil samples. The objective of MC sampling is to determine the presence of, and the nature and extent of MCs that are detected above the applicable regulatory criteria. The sampling and analysis results are then used to support an ecological and human health risk assessment IAW the EPA RAGS and USACE EM 200-1-4, Volumes I and II.

MC sampling will be performed in accordance with the Sampling and Analysis Plan (SAP), which includes a field sampling plan and a Quality Assurance Project Plan, prepared in accordance with DID MR-005-10.01 and UFP QAPP. The SAP plan describes the approach to sampling and addresses contaminants of interest and the sample media (soil, sediment, and surface water). The SAP is included as Appendix E to this WP. Any deviations from the SAP will be documented in the Daily Quality Control Reports (DQCRs).

3.9 INVESTIGATIVE DERIVED WASTE PLAN

Previous investigations and records detailing historical use of the MRS sites have not identified Recovered Chemical Warfare Materiel (RCWM) or any other hazardous material contamination at the project site. As a result, the project team does not anticipate recovery, handling, or disposal of Investigative Derived Waste (IDW) during the course of the RI/FS investigations.

3.10 RISK CHARACTERIZATION AND ANALYSIS

3.10.1 MEC RISK

For the MEC risk characterization and assessment element, the MEC Hazard Analysis (MEC HA) will be used. The MEC HA evaluates the level of risk to the public in terms of the likelihood of exposure and the severity of exposure to MEC. The MEC HA process entails definition of risk factors, MEC risk assessment, and assessment of response alternatives.

3.10.1.1 Definition of MEC Risk Factors

The potential risk posed by MEC at a site may be characterized by evaluating the likelihood of exposure to MEC, the severity of the exposure, and the likelihood of detonation. These three components can be evaluated using the following basic risk factor categories.

- **MEC Factors:** This category covers the physical characteristics (MEC Type, MEC Sensitivity) and location/extent (MEC Potential, MEC Depth Range) of MEC at a given site;
- **Site Characteristics Factors:** This category refers to the physical conditions of the site and natural events that may occur at the site (Site Accessibility, Site Stability); and

- **Human Factors:** This category refers to the types of activities (Site Activities) that exist on the site, the number of people (Site Population) that may have access and the frequency of the access to the site on a daily basis.

For example, the likelihood of exposure may be evaluated by considering the MEC potential (based on results of the RI field investigation), the number of people using the site, the type of activities conducted at the site, and the accessibility of the site. Similarly, the type of MEC and its sensitivity must be considered to evaluate the likelihood of detonation and severity of exposure. These risk factors are described in the following sections.

3.10.1.2 MEC Baseline Risk Assessment

The MEC Risk Assessment is the second step in the OERIA process. The project team will perform this baseline risk assessment by evaluating the basic risks factors for each OERIA evaluation area. This risk evaluation uses data collected from the remedial investigation, data from previous investigations, documented reports of discovered MEC, current and future land uses and the basic risk factors to assess the overall MEC hazard level for each of the response alternatives.

3.10.1.3 MEC Assessment of Response Alternatives

The third and final step of the OERIA process is the assessment of response alternatives. After completing the baseline risk assessment, the response action alternatives are assessed using the basic risk factors and baseline risk assessment data for each of the OERIA evaluations areas.

The response action alternatives are analyzed and ranked using each risk factor identified in the baseline risk assessment. Each response action alternative is assigned an impact evaluation score of 'No Impact' or an alphabetical rank from 'A' to 'D' representing the relative impact of the response action alternative – with 'A' being the highest impact and 'D' being the lowest. This comparison provides a qualitative indication of the change in the potential for harm and level of protectiveness at the site for each response action alternative that could be implemented.

The project team will assign an overall alphabetical rank to each response action alternative based upon the impact ranks for each factor. The response action alternative that provides the greatest impact on risk from MEC (i.e., achieves the most reduction of the risks posed by the site) is assigned an 'A'.

The OERIA results are further applied to the evaluation of removal alternatives for the project and serve as input to the evaluation of the Effectiveness Criteria for Alternatives Evaluation in the Feasibility Study.

3.10.2 MC RISK

MC sampling and analysis results will be used to characterize the human health and ecological risks presented by the presence of MC. MC sampling and analysis was previously performed as part of the Site Inspection (Parsons, 2007). Samples were collected at each MRS and analyzed for MC metals and explosives. The 2007 Site Inspection (Parsons, 2007) confirmed the presence of MC metals in soil and sediment samples within each of the MRS addressed in this WP. MC explosives were not detected during soil and sediment sampling. Based on a screening level risk assessment, the SI concluded that the soil and surface water / sediment migration pathways were complete, but that none of the metals detected resulted in unacceptable risk to human health. In contrast, a screening level ecological risk assessment concluded that unacceptable ecological risk could not be ruled out at MRSs 06, 09, 10, and 13 due to metals in soil. Surface water / sediment was not sampled at MRS 06, but there is historical evidence that direct fire may have contaminated the lagoon at Mosquito Bay within this MRS; therefore, risk to human health and ecological receptors at MRS 06 cannot be ruled out. Additionally, ecological risk is possible due to metals migration from soil at six MRS 06, 09, 10, and 13.

Using the analytical data, the project team will perform the human health and ecological risk assessment in accordance with EPA RAGS and USACE EM 200-1-4, to include the exposure assessment, toxicity assessment, risk characterization, and evaluation of uncertainties and limitations. For example, the

human health risk assessment will compare the estimated upper-bound excess lifetime cancer risks for each MRS to the EPA target risk range of 1×10^{-6} to 1×10^{-4} for health protectiveness at CERCLA response action sites. The estimated, non-carcinogenic hazard indices would be compared to 1. Hazard indices greater than 1 would indicate a potential for adverse health effects.

3.11 DISCUSSION ON THE ANALYSIS OF INSTITUTIONAL CONTROLS

USA will conduct an Institutional Analysis in accordance with EP 1110-1-24 as part of the RI/FS. As Institutional Controls rely on existing powers and authorities of various government agencies to protect the public from MEC risks, government agencies having jurisdiction over properties containing MEC will be identified and their appropriateness, capability, and willingness to assert controls will be assessed.

For each institution selected for review, USA will collect the following information:

- Name of Agency
- Origin of Institution
- Basis of Authority
- Sunset Provisions
- Geographic Jurisdiction
- Public Safety Function
- Land Use Control Function
- Financial Capability
- Desire to participate in the Institutional Control Program
- Constraints to Institutional Effectiveness.

An Institutional Analysis Report will be prepared to document feasible local initiatives that will be used to support development of alternative plans of action. The report will identify and analyze the institutional framework that supports the development of institutional controls for the site. The report will address local initiative strategies available to control or limit access to different areas within the project site or strategies to implement public safety awareness actions regarding the site. The Institutional Analysis will include discussions with state and local agencies, and with private parties having interests in the sites.

Following the Institutional Analysis and preparation of the Institutional Analysis Report, a draft Institutional Control Plan will be included in the draft RI Report, detailing the Institutional Control Alternatives recommended based on their apparent ability to satisfy project objectives.

3.12 DISCUSSION ON THE PREPARATION OF THE RECURRING REVIEW PLAN

Recurring reviews are required for OE response actions to determine if a response action continues to minimize explosives safety risks and continues to be protective of human health, safety, and the environment. The reviews also provide an opportunity to assess the applicability of new technology for addressing previous technical impracticability determinations. Recurring reviews are conducted under the Long Term Management phase once a Formerly Used Defense Site (FUDS) achieves Response Complete and satisfies the CERCLA requirement for reviews no less than every five years.

The scope of the reviews is site specific and depends on the response objectives and the specific responses implemented. The review evaluates site specific factors that may have impact on the continued effectiveness of the response. Example factors include changes in physical conditions, public accessibility and land use. The proposed frequency and duration of recurring reviews is documented in the Feasibility Study report in a draft Recurring Review Plan.

USA will prepare the draft Recurring Review Plan following the guidance of EP 75-1-4. The draft plan will be included as an appendix to the FS report. The plan will reflect the recommended response action alternatives contained in the FS report. The plan will be developed with full involvement of the project delivery team (PDT) and in coordination with the regulators and stakeholders. The plan will include MRS site descriptions; details regarding frequency of reviews; documents to be reviewed; methodologies to be

used during the recurring review site visits; and a discussion on terminating recurring reviews at the MRS sites.

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4.0 QUALITY CONTROL PLAN

4.1 INTRODUCTION

The USA QC process provides a permanent and workable system that allows each employee to understand the job performance expected within the assigned task. The USA QC and improvement process ensures that the training, actions, procedures, and tools support every employee according to the requirements and in such a manner that we protect the environment and minimize the impact of the project activities. Checklists have been developed to ensure that critical elements are addressed and that QC checks are documented for compliance with the WP, SOPs, policies and procedures. By promoting teamwork and by focusing attention on the solutions, the quality of work can be increased and assured throughout the project.

This Quality Control Plan (QCP) provides the procedures and methods to be used for the MEC RI activities and DGM tasks within the selected work areas. This plan addresses organization and responsibilities, DQOs, QC test methods audit procedures and pass/fail criteria, digital geophysical operations, anomaly acquisition and reacquisition, field operations, equipment testing maintenance and calibration, QC inspections, and of generated records reporting procedures. The QCP outlines procedures to ensure all personnel meet the qualification requirements and receive the site-specific training to perform the duties of the job for which they were hired and site-specific training requirements for visitors. The QCP also describes how lessons learned are captured, documented and submitted to the Government.

Due to the various aspects of the DGM operations to be performed at different levels on this project, this QCP contains specific DGM requirements starting in Section 4.11 and 4.12.

USA will use the data collected during the overall MEC response investigation for inclusion in the Final RI Report at the completion of the project.

4.2 QUALITY MANAGEMENT STRUCTURE

The following paragraphs describe the organizational structure of the USA Quality Management Team during operations at the project site. Names and qualifications of site personnel will be provided prior to mobilization.

4.2.1 CORPORATE QUALITY CONTROL MANAGER (QCM)

The USA Corporate QCM has is responsible for USA's QC program. The Corporate QCM reports directly to the President of USA Environmental, Inc., on matters of effectiveness, adequacy and status of QC methods and procedures. He maintains an alternate line of communication to the President of USA Environmental, Inc. The Corporate QCM has the following responsibilities:

- Preparation of USA QC policies and procedures
- Ensuring timely submission of contract deliverables
- Providing training and assistance to the site project UXOQCS
- Reviewing employee qualification records to ensure accuracy
- Conducting periodic field audits of sites, programs, and projects project activities to ensure QC compliance.

4.2.2 PROJECT GEOPHYSICIST

The USA Project Geophysicist is responsible for the overall performance of the DGM services and data review and anomaly selection during this project. The USA Project Geophysicist will develop the DGM requirements and checks necessary for this project. The USA Project Geophysicist has the following responsibilities:

- Monitoring project DGM performance
- Preparation of DGM QC policies and procedures
- Analyzing any failures and implementing corrective actions

- Establishing additional guidelines to assist in the development of site and task specific policies and procedures
- Ensuring timely submission of contract deliverables.

4.2.3 SENIOR UXO SUPERVISOR

The SUXOS is responsible for the day-to-day field operations at the project site. The SUXOS reports directly to the USA Project Manager (PM) and has the following responsibilities:

- Implementation of work plan and QC policies and procedures
- Reporting to the PM on effectiveness, adequacy, and status of the project
- Ensuring the timely submission of contract deliverables
- Coordinating with project personnel for site tasking and schedules
- Reviewing any failures and implementing corrective actions
- Implementing additional guidelines used to assist in the development of site and task specific policies and procedures.

4.2.4 SITE GEOPHYSICIST

The USA Site Geophysicist is responsible for the overall performance of the DGM services and data review and anomaly selection at the project level. The Site Geophysicist will assist the Project Geophysicist in the development and implementation the DGM requirements and checks necessary for this project. The Site Geophysicist has the following responsibilities:

- Planning and monitoring project level DGM performance
- Preparation of DGM checklist and reports
- Acquiring, transferring, processing, analyzing, and managing all field DGM data
- Analyzing any failures and implementing identified corrective actions
- Implementing additional guidelines for the development of site and task specific policies and procedures
- Ensuring timely submission of contract deliverables
- Reporting directly to the Project Geophysicist.

4.2.5 USA QUALITY CONTROL SPECIALIST (UXOQCS)

The UXOQCS is responsible for the enforcement of the site QCP. The UXOQCS coordinates with the SM / SUXOS and Site Geophysicist for daily operations and reports directly to the Corporate QCM. The UXOQCS is responsible for the QCS and DGMQCS functions for both land and water-borne operations. The UXOQCS has the following responsibilities:

- Conducting a formal, systematic audit throughout the project. The audit will be prepared IAW the PWS, the DQOs in Section 4.3 and Appendix O, the Definable Features of Work (DFW) in Table 4-1, and the Work Plan, and will be developed in conjunction with the Corporate QC Manager, Project Manager, and Geophysicists.
- Reviewing, implementing, and enforcing the QCP for land and water-borne operations, including:
 - Proper DGM equipment setup and operation
 - Proper DGM QC testing
 - Implementation and monitoring of the Blind blind/test seed item program.
- Coordinating with project personnel to ensure QC procedures are demonstrating validity sufficient to meet QC objectives
- Conducting an inspection/audit of work being performed throughout the project. The inspection/audit procedures listed in Table 4-1, were prepared for each definable feature of work

(DFW), providing the audit procedures, the QC phases (preparatory, initial, and follow-up), the frequency of the audits, the pass/fail criteria and the actions required in the event a failure occurs. The UXOQCS will use the QC Surveillance Forms (located in Appendix F) to conduct the audits and document whether the subtasks pass or fail the QC inspection QC inspections of the DFW listed in Table 4-1 (audits of documents, work in progress, work performed, and monitoring work practices); recording and reporting the results to the appropriate personnel

- Coordinating with the USACE QA representative to ensure QC objectives are appropriate for the task being performed
- Ensuring classification of MEC-related items is accurate and consistent IAW Table 4-2
- Inspecting a minimum 20% of scrap material for proper classification
- Preparing Deficiency Notices (DN) on all QC failures and tracking corrective actions to closure on the Deficiency Notice Log
- Conducting analysis to determine the root cause of process failures as they occur
- Recommending to the SM / SUXOS any actions to be taken in the event of a QC failure
- Recommending corrective actions to the SM and Site Geophysicist for failures contributed to DGM operations (e.g., missed blind QC seed test items)
- Advising the DGM, Dive and MEC Teams on all QC-related site matters
- Reporting non-compliance with QC criteria to the project personnel
- Has STOP WORK authority for issues regarding QC at the project site.

4.3 GEOPHYSICAL DATA QUALITY OBJECTIVES

Data obtained during MEC operations must support the decision-making process. Consequently, data must be of a sufficient quantity and quality to make defensible decisions to provide an acceptable level of certainty for the decision maker(s).

4.3.1 DATA QUALITY OBJECTIVES PROCESS

The DQO process, as defined in EPA QA/G-4W, Data Quality Objectives Process for Hazardous Waste Site Investigations, is iterative and is normally applied to operations requiring the application of data gathered as a result of the conduct of analytic sampling. The output from one step may lead to the reconsideration of prior steps. This iteration leads to more efficient design of data collection operations. Data users, relevant technical experts and members of the QC staff will participate in the DQO process planning to ensure that their specific needs are included prior to the data collection.

DQOs provide the objective basis for quantitative definition of project requirements. DQOs shall be developed and used to ensure that the amount, type, and quality of data obtained during a field sampling project are adequate to support project decisions with a known level of confidence. Project DQOs for this RI/FS are located in Table 3-1.

The DQO process will include the following steps:

1. State the problem
2. Identify the decision
3. Identify inputs to the decision
4. Define the study boundaries
5. Develop a decision rule
6. Specify limits of decision errors
7. Optimize the design for obtaining data.

4.3.2 SPECIFIC ANALYTICAL OR STATISTICAL GEOPHYSICAL DQOS

The following Geophysical DQOs, with full sheets in Appendix O (see Appendix O for the detailed Geophysical DQOs), have been developed for the RI/FS for the Culebra Island Site, Puerto Rico:

- DQO for Geophysical Equipment Performance
- DQO for Survey/Location Equipment Performance
- DQO for Data Collection
- DQO for MEC Identification
- DQO for Data Management
- DQO for Operational Verification of Survey/Investigation Equipment
- DQO for Detector Team Performance Evaluation
- DQO for Analog Instrument System Performance

4.4 QUALITY CONTROL TEST METHODS AND AUDIT PROCEDURES

This section discusses QC methods and procedures used during project operations.

4.4.1 INSPECTIONS

USA will conduct inspections to verify whether quality-related activities comply with this QC Plan. A list of the audit procedures based on the DFWs is provided in Table 4-1. Internal inspections will address activities performed by the project team. External inspections will address activities performed by project subcontractors, laboratories, and equipment and material suppliers.

The UXOQCS will implement the three-phase control process for each of the DFWs in Table 4-1 to audit/inspect the subtasks for compliance with the approved WP, SOPs and Geophysical DQOs. The three-phase control process includes the preparatory, initial and follow-up phase audits/inspections. The inspections are documented using the QC Surveillance Forms prepared for each DFW (located in Appendix F).

4.4.1.1 Preparatory Phase

A preparatory phase inspection is performed prior to the beginning of work on each DFW. The UXOQCS will review the DFW scope and applicable specifications (Geophysical DQOs) and verify that the necessary resources, controls and conditions are in place and compliant with the WP before the work activities begin.

4.4.1.2 Initial Phase

The UXOQCS performs an initial phase inspection for each DFW once a representative sample of the work has been completed. The purpose of this inspection is to check the preliminary work for compliance with procedures and contract specifications, to verify through inspection and testing the acceptable level of workmanship. The UXOQCS will review the preparatory phase QC Surveillance Forms to check for omissions and resolve any differences of interpretation by project personnel and the contract requirements.

4.4.1.3 Follow-up Phase

The UXOQCS performs a follow-up phase inspection periodically while work progresses for each DFW. The frequency of the follow-up phase is specified in Table 4-1 by DFW. The purpose of the inspection is to ensure continuous compliance and an acceptable level of workmanship. The UXOQCS will observe the same activities as under the initial inspection and ensure that discrepancies between site practices and approved specifications are identified and resolved. Corrective actions for unsatisfactory conditions or practices will be verified by the UXOQCS prior to continuing work on the affected DFW.

The inspection program is established to provide the following:

- An objective and independent evaluation of compliance with established policies and procedures (Work Plan, SOPs, AHAs, etc.)
- A mechanism for verifying the implementation of corrective actions recommended as the result of inspections.

Personnel performing QC inspections are knowledgeable about and have received training in QC techniques and methodologies, this QC Plan, and applicable regulations. They will also be technically knowledgeable of the processes being inspected. Inspections will be performed in accordance with written procedures or checklists. Personnel performing QC inspections will not have direct responsibilities in the areas they are assessing.

System and performance inspections will be undertaken. System inspections will evaluate the components of the QC system including evaluating items such as approach and adequacy of the preparation step, inspection of the schedules and plan delivery dates, and tracking systems for QC activities. Performance inspections evaluate actual QC activities such as design control, on-site data gathering, calibration and control, inspection and testing activities, and documentation.

Inspecting QC personnel will document inspection results, which will be reviewed by the Project Manager. When unsatisfactory or nonconforming conditions or items are found, the responsible organization will implement corrective actions in a timely manner. Previously unsatisfactory areas will be re-inspected to ensure that satisfactory corrective actions have been completed. The results of the inspections will be shared with the team with regard to needed rework and lessons learned.

Records of all inspections will be maintained and controlled as QC records.

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Table 4-1: Definable Features of Work Audit Procedures

Definable Feature of Work	Reference	Audit Procedures	QC Phase	Frequency of Audit	Pass/Fail Criteria	Action if Failure Occurs
1. Mobilization of Equipment, Supplies, and Personnel & Site Training	WP Sections 2.2.4 and 3.6.3	Visual Observation and Document Review	PP/IP/FP	Once and Follow-up as Required	All personnel required for the work activities have been identified, are available, and meet the requirements and qualifications for the positions or waivers from the USAESCH have been obtained.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance before personnel are assigned project tasks
	WP Sections 2.2.4 and 3.6.3	Visual Observation and Document Review	PP/IP/FP	Once and Follow-up as Required	All personnel are properly trained and certified to operate equipment and machinery.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance before personnel operate equipment and machinery
	WP and APP	Document Review	PP/IP/FP	Once and Follow-up as Personnel are added	All field personnel have reviewed the RI Work Plan and the Accident Prevention Plan.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance before personnel commence assigned project tasks
	APP	Document Review	PP/IP/FP	Once and Follow-up as Personnel are added	All personnel have signed the Employee Sign-off Forms for the Site Health and Safety Plan, the Certificate of PPE training and that all Activity Hazard Analyses have been completed.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance before personnel commence assigned project tasks
	APP	Document Review	PP/IP/FP	Once and Follow-up as Material is Introduced to Project	Material Safety Data Sheets are available onsite for all hazardous materials used or encountered onsite	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance before personnel are exposed to the hazardous material of concern
	WP Section 2.6 Project Schedule	Visual Observation and Document Review	PP/IP/FP	Once and Follow-up as Required	All equipment is received on island as needed to support the project schedule.	Document deficiency and report to SUXOS for resolution
	WP Section 3.1.2	Visual Observation and Document Review	PP/IP/FP	Once and Follow-up as Required	All required equipment is functional, properly calibrated, and complies with contract specifications.	Document deficiency, ensure any faulty equipment is pulled from service and report to SUXOS for resolution, follow-up to verify compliance

Definable Feature of Work	Reference	Audit Procedures	QC Phase	Frequency of Audit	Pass/Fail Criteria	Action if Failure Occurs
	WP Section 2.2	Document Review	PP/IP/FP	Once	Coordination is performed with personnel on Culebra, FWS, DNER, PREQB, the U.S. Coast Guard, FAA and USAESCH.	Document deficiency and report to SUXOS for resolution prior to initiating project tasks
	WP Section 5.4 and Puerto Rico Explosives Law	Document Review	PP/IP/FP	Once and Follow-up as Required	Transportation support for the movement of hazardous cargo is coordinated prior to the scheduled event in accordance with the dangerous cargo regulations.	Document deficiency and report to SUXOS for resolution prior to movement of hazardous cargo
2. Preparation of the Work Areas and Staging Areas	WP Section 2.10	Document Review	PP/IP/FP	Once and Follow-up as Required	Coordination with support facilities has been conducted.	Document deficiency and report to SUXOS for resolution prior to initiating project tasks
	SSHP	Visual Observation and Document Review	PP/IP/FP	Daily	Work zones and exclusion zones are properly established.	Document deficiency and report to SUXOS for resolution prior to initiating project tasks
	SSHP	Visual Observation and Document Review	PP/IP/FP	Weekly	Break and rest areas established in accordance with reference.	Document deficiency and report to SUXOS for resolution prior to initiating project tasks
3. Set-up of Test Strip	WP Section 3.3.1	Visual Observation and Document Review	PP/IP/FP	Initially and on each occurrence as Test Strip is relocated	Test Strip location represents, as closely as possible, actual site conditions (e.g., terrain, vegetation, background noise, geology, infrastructure, etc.).	Document deficiency and report to SUXOS for resolution prior to testing equipment in the Test Strip
	WP Sections 3.3.1	Visual Observation and Document Review	PP/IP/FP	Once	Test Strip is seeded with four ISOs (two small and two large), two horizontal at depths 3 and 7 times the ISO diameters, and two vertical at the same 3 and 7 times diameter depth	Document deficiency and report to SUXOS for resolution prior to testing equipment in the Test Strip

Definable Feature of Work	Reference	Audit Procedures	QC Phase	Frequency of Audit	Pass/Fail Criteria	Action if Failure Occurs
	WP Sections 3.3.1 and Geophysical DQO for operational verification of survey/investigation equipment	Visual Observation and Document Review	PP/IP/FP	Once	The capabilities and limitations of each sensor and positioning system to detect the seed items in the Test Strip are established and documented.	Document deficiency and report to SUXOS for resolution prior to using equipment on project tasks, follow-up to verify compliance
	WP Sections 3.5 and Geophysical DQOs for Data Collection and Management	Visual Observation and Document Review	PP/IP/FP	Once and Follow-up as Required	Data transfer, processing, analysis, and reacquisition are in accordance with the Geophysical DQOs	Document deficiency and report to SUXOS for resolution prior to incorporation of data into project data base
	WP Section 3.4 and Geophysical DQO for Detector Team Performance Evaluation	Visual Observation and Document Review	PP/IP/FP	Once and Follow-up as Required	The background noise, sample density, MEC detection, false positives, positioning accuracy, reacquisition, anomaly selection, and data management are established or refined in accordance with the Geophysical DQO	Document deficiency and report to SUXOS for resolution prior to using equipment on project tasks
4. Explosives Management	WP Section 5.4 and SOP OPS-07	Visual Observation and Document Review	PP/IP/FP	Once and Follow-up as Required	The Type II Magazine is properly grounded in accordance with National Fire Protection Association requirements, and that lightning protection systems are in place and functioning properly.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance prior to placing explosive in the magazine
	WP Section 5.5 and SOP OPS-07	Visual Observation and Document Review	PP/IP/FP	Once and Follow-up as Required	Explosives are transported IAW DOT regulations.	Document deficiency and report to SUXOS for resolution prior to movement of explosives

Definable Feature of Work	Reference	Audit Procedures	QC Phase	Frequency of Audit	Pass/Fail Criteria	Action if Failure Occurs
	WP Section 5.4 and SOP OPS-07	Visual Observation and Document Review	PP/IP/FP	Once and Follow-up as Required	The proper fire extinguishers are present in the magazines area and that the land surrounding the magazines is clear of combustible materials for a distance of at least 50 ft.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance prior to placing explosive in the magazine
	WP Section 5.3 and SOP OPS-07	Visual Observation and Document Review	PP/IP/FP	Once and Follow-up as Required	The cargo manifests are correct and the explosives received match.	Document deficiency and report to SUXOS for resolution prior to acceptance of the explosives shipment
	WP Section 5.5 and SOP OPS-07	Visual Observation and Document Review	PP/IP/FP	Once and Follow-up as Required	The explosives routes to/from the Type II Magazine are followed.	Document deficiency and report to SUXOS for resolution prior to the movement of explosives
	WP Section 5.4 and SOP OPS-07	Visual Observation and Document Review	PP/IP/FP	Once and Follow-up as Required	Explosives are properly stored IAW applicable ATF regulations.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
	WP Section 5.7 and SOP OPS-07	Visual Observation and Document Review	PP/IP/FP	Weekly	Stock and inventory procedures for explosive materials are followed.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
	WP Section 3.6.10 and SOP OPS-03	Visual Observation and Document Review	PP/IP/FP	Per Demolition Operation	Demolition procedures are followed during demolition operations.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
5. Vegetation Clearance	SOP OPS-21	Visual Observation and Document Review	PP/IP/FP	Once and Follow-up as Required	Vegetation clearance equipment is available, properly operated and maintained.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
	SOP OPS-21 and APP	Visual Observation and Document	PP/IP/FP	Per Occurrence	PPE is properly worn and maintained.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance

Definable Feature of Work	Reference	Audit Procedures	QC Phase	Frequency of Audit	Pass/Fail Criteria	Action if Failure Occurs	
		Review					
	WP Section 3.4.1 and SOP OPS-21	Visual Observation	PP/IP/FP	Once and Follow-up as Required	Vegetation clearance meets the project requirements.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance prior to commencing DGM tasks	
6. DGM Operations	WP Section 3.4 and SOP OPS-05	Visual Observation and Document Review	PP/IP/FP	Daily	Daily testing of instruments (EM61-MK2, positioning equipment, survey equipment, etc.) is performed prior to conducting DGM field activities.	Document deficiency, report to Project Geophysicist and SUXOS for resolution, follow-up to verify compliance	
	PWS, Table 7-1	Visual Observation and Document Review	PP/IP/FP	Daily	Static Repeatability (instrument functionality): Response (mean static spike minus mean static background) meet the PWS requirements	The day's data fails, unless seed item is mapped that day with repeatable anomaly characteristics. Document deficiency, report to Project Geophysicist and SUXOS, follow-up to verify compliance	
	PWS, Table 7-1	Visual Observation and Document Review	PP/IP/FP	By dataset	The Along Line Measurement Spacing: $98\% \leq 25\text{cm}$ along line	The dataset submittal fails Document deficiency, report to Project Geophysicist and SUXOS, follow-up to verify compliance	
	PWS, Table 7-1	Visual Observation and Document Review	PP/IP/FP	By dataset or grid	Verify grid Coverage: $>90\%$ coverage $>90\%$ at a 2.5 -ft line spacing	By Grid Dataset Submittal fails unless gaps filled or additional data collected. Document deficiency, report to Project Geophysicist and SUXOS, follow-up to verify compliance	Inspected by UXOQCS
	PWS, Table 7-1	Visual Observation and Document Review	PP/IP/FP	One test item per grid or dataset	The Dynamic Detection Repeatability (Grids): The test item anomaly characteristics (peak response and size) are repeatable within the allowable variation, $\pm 25\%$	Submittal fails. Document deficiency, report to Project Geophysicist and SUXOS, follow-up to verify compliance	
	PWS, Table 7-1	Visual Observation and Document Review	PP/IP/FP	Repeat test strip once per system, per lot ¹ or daily	The Dynamic Detection Repeatability (Transects): a. #anomalies on repeat segment within $\pm 20\%$ or ± 8 of original or	Lot or day's data fails. Document deficiency, report to Project Geophysicist and SUXOS, follow-up to verify compliance	

Definable Feature of Work	Reference	Audit Procedures	QC Phase	Frequency of Audit	Pass/Fail Criteria	Action if Failure Occurs
					within range of adjacent sections	
	PWS, Table 7-1	Visual Observation and Document Review	PP/IP/FP	One test item per grid or dataset	The Dynamic Positioning Repeatability (Grids): Position offset of test item target $\leq 35\text{cm} + 1/2$ line spacing ($\leq 50\text{cm} + 1/2$ line spacing for fiducially positioned data)	Submittal fails. Document deficiency, report to Project Geophysicist and SUXOS, follow-up to verify compliance
	PWS, Table 7-1	Visual Observation and Document Review	PP/IP/FP	Two test items per system, per lot (can be same as detection repeatability test items)	The Dynamic Positioning Repeatability (Transects): The test item anomaly characteristics (peak response and size) are repeatable within the allowable variation, $\pm 25\%$ and the position offset is ≤ 2 meters.	Lot submittal fails. Document deficiency, report to Project Geophysicist and SUXOS, follow-up to verify compliance
	PWS, Table 7-1	Visual Observation and Document Review	PP/IP/FP	By dataset	Target Selection: All dig list targets are selected according to the project design	Submittal fails. Document deficiency, report to Project Geophysicist and SUXOS, follow-up to verify compliance
	PWS, Table 7-1	Visual Observation and Document Review	PP/IP/FP	By MRS allocation of anomaly excavations ²	Anomaly Resolution: If MEC, 70% confidence < 10% unresolved. If no MEC 90% confidence < 5% unresolved	Lot submittal fails. Document deficiency, report to Project Geophysicist and SUXOS, follow-up to verify compliance
	PWS, Table 7-1	Visual Observation and Document Review	PP/IP/FP	Daily	Geodetic Equipment Functionality: Check geodetic equipment position offset of known/temporary control point is within expected range as listed in the WP	Redo affected work or re-process affected data. Document deficiency, report to Project Geophysicist and SUXOS, follow-up to verify compliance

Definable Feature of Work	Reference	Audit Procedures	QC Phase	Frequency of Audit	Pass/Fail Criteria	Action if Failure Occurs
7. Analog Operations	PWS, Table 7-2	Visual Observation and Document Review	PP/IP/FP	Daily	Instrument Functionality: Analog instruments detect all items in the test strip	Replace faulty equipment, remedial training. Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
	PWS Table 7-2	Visual Observation and Document Review	PP/IP/FP	Per lot ¹	Dynamic Repeatability (transect used only for density estimates): Repeat a segment of transect & show number of counts repeated within the greater of $\pm 20\%$ or ± 8 digs/flags	Redo lot. Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
	PWS Table 7-2	Visual Observation and Document Review	PP/IP/FP	Per lot ¹	Dynamic Repeatability (transects with digging): Repeat a segment of the transect & show extra flags/digs not greater than the greater of 20% or 8 digs/flags	Redo lot. Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
	PWS Table 7-2	Verify that all blind seeds are included on analog dig list Visual Observation and Document Review	PP/IP/FP	Per operator/per lot: 1 large/deep blind seed item/ISO (BSI/ISO) and 1 small/shallow BSI/ISO	All BSI/ISO are included on the analog dig list	Redo lot. Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
	PWS Table 7-2	Visual Observation and Document Review	PP/IP/FP	Per operator/per lot: 1 large/deep BSI/ISO and 1 small/shallow BSI/ISO	Detection and Recovery: BSI/ISO recovered – 80% if MEC, 100% if no MEC	Redo lot. Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
	PWS Table 7-2	Visual Observation and Document	PP/IP/FP	By MRS allocation of anomaly	Anomaly Resolution: If MEC, 70% confidence < 10% unresolved. If no MEC 90%	Redo lot. Document deficiency and report to SUXOS for resolution, follow-up to verify compliance

Definable Feature of Work	Reference	Audit Procedures	QC Phase	Frequency of Audit	Pass/Fail Criteria	Action if Failure Occurs
		Review		excavations ²	confidence < 5% unresolved	
	PWS Table 7-2	Visual Observation and Document Review	PP/IP/FP	Daily	Geodetic Equipment Functionality: Position offset of known/temporary control point is within expected range as listed in the WP	Redo affected work. Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
8. Underwater Visual Investigation	WP Section 3.5	Visual Observation and Document Review	PP/IP/FP	Daily as Required	Pre-operations checks performed on ROV and other equipment used to collect underwater data	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
	WP Section 3.5	Visual Observation and Document Review	PP/IP/FP	Daily as Required	Expanded survey conducted on MEC like items using the ROV	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
	WP Section 3.5	Visual Observation and Document Review	PP/IP/FP	Daily as Required	Post-operations checks performed on ROV and other equipment used to collect underwater data	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
9. Intrusive Operations	WP Sections 3.7, SSHP	Visual Observation and Document Review	PP/IP/FP	Daily	Site security features and Exclusion Zones around beaches to be excavated have been erected and are maintained.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
	SSHP	Visual Observation and Document Review	PP/IP/FP	Daily	All health and safety equipment and supplies are complete and all personnel are aware of its location in the operations area.	Document deficiency and report to SUXOS for resolution prior to commencing/continuing project activities, follow-up to verify compliance
	APP	Visual Observation and Document Review	PP/IP/FP	Daily	Team safe separation distances are in place and complied with.	Document deficiency and report to SUXOS for resolution prior to commencing/continuing project activities, follow-up to verify compliance

Definable Feature of Work	Reference	Audit Procedures	QC Phase	Frequency of Audit	Pass/Fail Criteria	Action if Failure Occurs
10. MPPEH Management	WP Section 3.7	Visual Observation and Document Review	PP/IP/FP	Daily as Required	UXO Technician II and UXO Technician III are conducting independent, 100% inspections of all recovered items to determine if free of explosives hazards engine fluids, illuminating dials or other visible liquid HTRW materials.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
	WP Section 3.7	Visual Observation and Document Review	PP/IP/FP	Daily as Required	Random sampling of all MPPEH collected finds no items contain an explosive hazard, engine fluids, illuminating dials or other visible liquid HTRW materials.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
	WP Section 3.7.10 and 5.2	Visual Observation and Document Review	PP/IP/FP	Prior to Shipment	All documents for shipment of MPPEH are properly completed.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
	WP Section 3.7.10	Visual Observation and Document Review	PP/IP/FP	Prior to Shipment	Chain of custody and final disposition of MPPEH documentation is filed and incorporated into the RI Report.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
11. Demobilization	WP Section 2.0	Visual Observation and Document Review	PP/IP/FP	Prior to Demobilization	All equipment and files are packaged and shipped to corporate headquarters, all leased/rented equipment is returned off lease/rental and all project support agreements are terminated.	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
	WP Section 2.0	Visual Observation and Document Review	IP/FP	End of Field Tasks	A walkthrough of the project area is conducted to ensure all excavations have been backfilled and no equipment remains onsite	Document deficiency and report to SUXOS for resolution, follow-up to verify compliance
12. Project	WP Section	Visual	PP/IP/FP	Weekly	Project Status Reports are	Document deficiency and report to SUXOS for resolution,

Definable Feature of Work	Reference	Audit Procedures	QC Phase	Frequency of Audit	Pass/Fail Criteria	Action if Failure Occurs
Reporting and Submittals	2.5 and PWS	Observation and Document Review			reviewed for accuracy and thoroughness IAW the PWS	follow-up to verify compliance
	WP Section 2.5 and PWS	Visual Observation and Document Review	PP/IP/FP	Prior to submittal of report	The records of telephone conversations, written correspondence concerning this Task Order and meeting minutes are attached to the Project Status Report in accordance with DID MR-045 and MR-055	Document deficiency and report to SUXOS and PM for resolution, follow-up to verify compliance

¹See Subsection 4.4.3 for the definition of a lot

²See Subsection 4.4.3 for the anomaly dig allocations by MRS

4.4.2 TEST AND BLIND SEED ITEMS/INDUSTRY STANDARD OBJECTS

Test items are employed to verify the DGM performance requirements for dynamic detection and positioning repeatability as described in Table 4-1 for DGM Operations DFW. For the Analog Operations DFW, BSI/ISOs are used per Table 4-1 to verify coverage and detection along the beach transects.

4.4.3 ANOMALY RESOLUTION

The UXOQCS will verify anomaly resolution of both the DGM and analog digs base on the allocation of investigations by MRS. Table 4-2 below outlines the number of digs allocated for DGM and analog, and the number of QC checks required for both to achieve a 70% confidence that there are <10% unresolved anomalies if MEC is detected and a 90% confidence that there are <5% unresolved anomalies if no MEC is detected as prescribed in the PWS, Tables 7-1 and 7-2. The number of QC checks in Table 4-2 is based on the calculations in Table 7-3 of the PWS, Acceptance Sampling Table for Anomaly Resolution.

Table 4-2: QC Anomaly Resolution Requirements by MRS

MRS	DGM Digs Allocated ¹	Analog Digs Allocated ¹	QC Checks of DGM Digs If MEC ²	QC Checks of DGM Digs If No MEC ²	QC Checks of Analog Digs If MEC ³	QC Checks of Analog Digs If No MEC ³
13	284	66	12	42	11	33
10	333	17	12	42	9	16
11	339	61	12	43	11	32
6	412	38	12	43	11	34
9	176	24	12	40	10	21
8	227	23	12	41	10	20

¹ Digs are allocated in proportion to the design coverage

² The DGM lot size is defined as a grid approximately 2500 sq ft in size

³ The analog lot is defined as the beach area investigated

4.4.4 DEFICIENCY MANAGEMENT

All deficiencies or nonconforming conditions (as defined in the pass/fail criteria in Table 4-1) discovered during inspections or other QC functions will be noted on a Deficiency Notice (DN) form. The DN will identify, at a minimum, any corrective action required, the individuals reviewing and approving the actions, and the actions taken to prevent recurrence. A Deficiency Notice Log will be maintained to document and track corrective actions to closure and be included in the RI report. The UXOQCS will be responsible for tracking deficiencies to closure and reporting their status on daily reports and log forms (see Appendix F for the DN and Deficiency Notice Log forms).

4.4.4.1 Root Cause Analysis

The UXOQCS will conduct a Root Cause Analysis to determine if the failure is the result of the process, procedures, equipment and/or personnel and to what extent of previously performed work may have been affected by the failure. The UXOQCS will provide his findings to the PM, Corporate QC Manager and SUXOS with suggested or required corrective actions. Once approved by management, the team will implement the corrective actions. The Root Cause Analysis and corrective actions will be attached to the weekly QC report. All target reacquisition and intrusive quality control measures and metrics will be documented, with copies sent to the appropriate personnel for review and inclusion into other documents as deemed necessary. Figure 4-1 illustrates the flow of the root cause and effect process that the UXOQCS will use to determine failure causes.

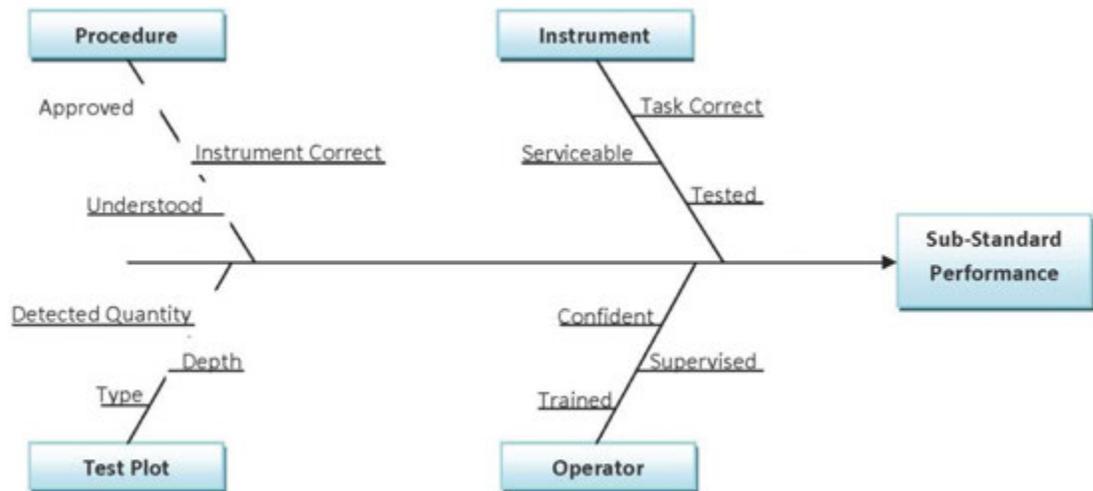


Figure 4-1: Cause and Effect Process

4.4.4.2 Corrective Actions

Following the root cause analysis and approval of corrective actions by management, project personnel will implement these actions to correct the problem. Potential remedies to be considered may include the following:

- Supplemental training of personnel
- Changes of equipment or modification of equipment currently in use
- Acquisition of supplemental equipment
- Implementation of new procedures or modification of existing procedures
- Changes in QC procedures.

The UXOQCS will document the application of the corrective actions on the DN. Through follow-up phase surveillance, the UXOQCS will verify that the corrective action implemented has rectified the deficient condition and is sufficient to prevent recurrence.

4.5 FIELD QUALITY CONTROL INSPECTIONS, AUDITS AND REPORTS

The UXOQCS is responsible for verifying that site personnel perform operational checks of instruments and equipment prior to using them onsite. The UXOQCS will periodically check the project logbooks listed below to ensure the log entries are complete and accurate. Inspections will be performed daily at random, with unscheduled checks of the site in general to ensure personnel accomplish all work as specified in the Work Plan. The UXOQCS will utilize the process outlined in Figure 4-2, Quality Control Process, and Table 4-1, Definable Features of Work Audit Procedures, to ensure all field tasks meet quality standards prior to submittal for the Quality Assurance process. The UXOQCS will submit a report to the Site Manager detailing the results of these checks.

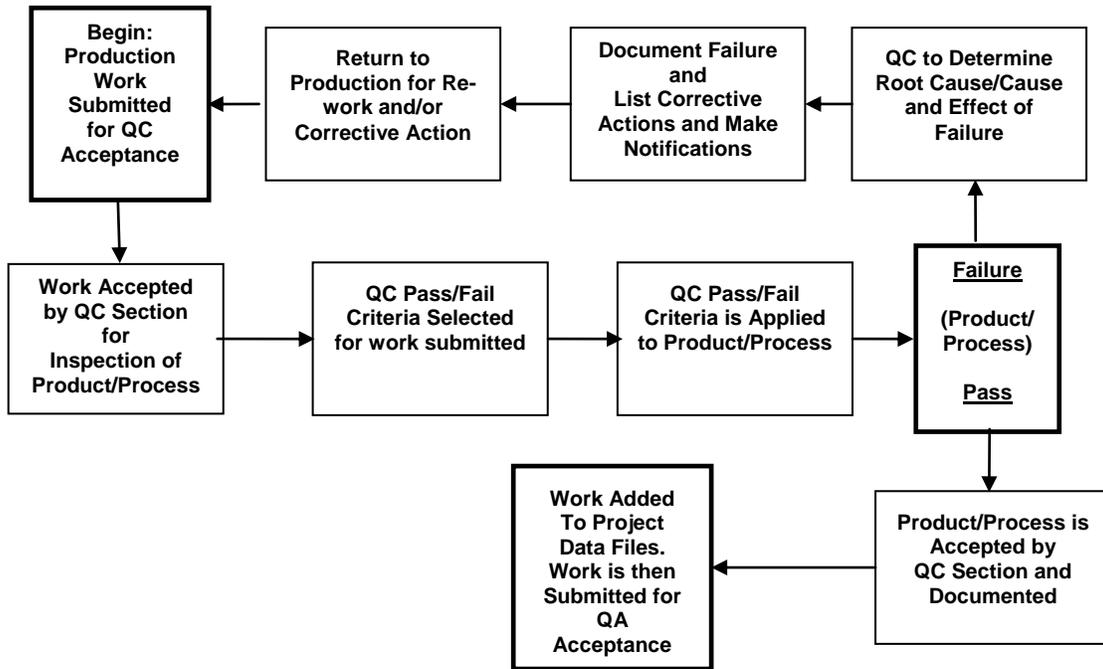


Figure 4-2: Quality Control Process

4.5.1 EQUIPMENT TESTING PROCEDURES AND FREQUENCY

Instruments and equipment, such as geophysical/navigational, video, and data analysis and transfer systems, used to gather and generate site specific data, e.g. GPS, noise, and data sampling densities, to support the field activities, will be tested with sufficient frequency and in such a manner as to ensure that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Instruments or equipment failing to meet the standard will be repaired, recalibrated, or replaced. Replaced instruments or equipment must meet the same specifications for accuracy and precision as the item removed from service. Operator proficiency will also be evaluated regularly for proper instrument set up, operation, survey technique, and data transfer. The Site Geophysicist will conduct training refreshers, if necessary.

Equipment to be tested for use at the project site includes but is not limited to the EM61-MK2, hand-held detectors and the DGPS. Items such as cellular telephones and radios will be tested for serviceability at the start of each workday. Results of these tests will be recorded in the Daily Log. Items failing these tests will be repaired or replaced prior to operations commencing.

4.5.2 CALIBRATION

The UXOQCS will check to ensure that instruments and equipment are calibrated or recalibrated in accordance with the manufacturer's recommendation or owner's manual. Calibrations will be completed on a prescribed schedule and the calibration results recorded in the daily field logbook.

If necessary, each DGM Instrument Operator will re-null the EM61-MK2, if the operator observes a shift in local background conditions or any other cause for instrument drift prior to opening and beginning any DGM survey file. The EM61-MK2 operator **will not** re-null the instrument during any DGM survey. No other calibration is expected.

Recalibration will be performed as necessary with the reason for the recalibration and the results recorded in the daily field logbook.

4.5.3 MAINTENANCE

The UXOQCS will check field logbooks to ensure that maintenance of vehicles and equipment are performed on a regular schedule and in accordance with the manufacturer's recommendation or owner's manual for equipment requiring regular upkeep.

USA will coordinate scheduled maintenance of the following equipment in accordance with manufacturer recommendations or the owner's manual.

- Vehicles
- Personal Protective Equipment
- Communications Equipment
- Geophysical, Navigational Equipment, and Personal Digital Assistant (PDA)
- Handheld Sensors
- Emergency Equipment.

Replacement equipment will meet the same specifications for accuracy and sensitivity as the equipment removed from service. Geophysical instruments will be checked on the test strip daily and after any repairs. They will be required to demonstrate a consistent detection rate for all seed items and any identified background anomalies. Repair or replacement of parts will meet the manufacturer specifications and recommendations. The UXOQCS will document and maintain records pertaining to the testing, repair, and/or replacement of equipment on site.

Repair or replacement parts will meet the manufacturer's requirements and be installed by personnel authorized to replace parts or make repairs. Records pertaining to the testing, repair, or replacement of instruments and equipment will be maintained on site by the UXOQCS.

4.5.4 LOGS AND RECORDS

Activity Logs will be maintained daily, as applicable; all entries will be in ink. Logbooks will be bound and pages consecutively numbered. Logbooks and records may be supplemented by the use of preprinted forms (e.g., safety inspection forms, tailgate safety briefings, etc). These forms help to ensure uniformity of activities being conducted, inspected, and reviewed. Forms are located in Appendix F of the work plan. The following logbooks and records will be maintained on site and are subject to inspection by the UXOQCS.

4.5.5 UXO QUALITY CONTROL REPORT

The UXOQCS prepares daily QC Report and a weekly QC Report (the report forms are located in Appendix F). These documents are kept on-site. The weekly QC report is submitted to the PM for distribution to the appropriate personnel. This report includes the following information:

- The periodic assessments of work performed
- Significant QA/QC problems and corrective actions taken
- Conformance or non-compliance issues
- Work progress
- Lessons learned, and change recommendations
- Signature of the UXOQCS.

4.5.5.1 Daily Journal

The Daily Journal will be maintained by the SUXOS; this journal provides a summary of all operations conducted on site, to include:

- Date and recorder of information
- Start and end time of work activities

- Work stoppage
- Visitors and escorts
- Weather conditions
- Changes to the work plan, SSHP, policies or procedures
- Injuries and /or illnesses
- Safety briefings
- MEC encountered
- Relevant events and training
- Signature of the SUXOS.

4.5.5.2 Field Logbooks

The Field Logbooks are maintained by the Supervisory Personnel. These logbooks are used to record site activities and field data. Logbooks are maintained in a neat and legible manner and provide an historic record of site activities, to include:

- Date and team location
- Personnel and work performed
- Equipment and instrument checks
- Injuries and/or illnesses
- Changes to work instructions
- Work stoppage
- Visitors
- Other relevant events
- Signature of Supervisor.

4.5.5.3 Safety Logbook

The site UXOSO will maintain the Safety Logbook. This logbook is used to record all safety matters associated with the project site, including:

- Safety briefings and/or meetings
- Training
- Safety inspections and audits performed
- Work stoppage due to safety issues
- Visitors
- Accidents, incidents, and near misses with corrective action taken
- Site control measures (e.g., EZ, TSD, MFR)
- Other relevant events
- Date and teams checked
- Signature of the UXOSO.

4.5.5.4 Quality Control Logbook

The Quality Control Logbook will be maintained by the UXOQCS. This logbook is used to record all QC matters associated with the project site, including:

- Equipment testing and results
- QC inspections performed,
- Locations and identification numbers of emplaced BSI/ISOs

- Work stoppage due to QC issues
- Equipment monitoring results
- Non-conformance reporting
- Other relevant events
- Date and teams checked
- Signature of UXOQCS.

4.5.5.5 Training Records

Training records will be maintained by the PM. These records contain any licenses, permits, certificates, or other qualifying data, to include:

- Date and nature of training
- Personnel attending and instructor(s)
- Visitor training and briefings
- Signature of instructor and SUXOS, UXOSO or UXOQCS.

4.5.5.6 MEC and Anomaly Excavation Records

The MEC and anomaly records are individually prepared records for each operating team. These records are prepared by the team supervisor, and are used to record data on anomaly excavations and MEC encountered. These records also include:

- Date and target identifier
- Identification of item(s) located
- Classification
- Distance from marked target location and depth encountered
- Type, condition, depth, and location of any MEC encountered
- Disposition of MEC
- Location and identification number of recovered BSI/ISOs
- Other relevant data
- Signature of Supervisor.

4.5.5.7 DGM

The DGM Logbook will be maintained by the Site Geophysicist. This logbook is used to record all DGM matters associated with the project site, including:

- Equipment testing and results
- DGM inspections performed
- Work stoppage due to DGM issues
- Non-conformance reporting
- Other relevant events
- Date and teams checked
- Signature of Site Geophysicist.

4.5.5.8 DGM Report

The Site Geophysicist and UXOQCS will prepare a weekly DGM Quality Control Report. The UXOQCS will keep the original on-site and submit a copy to the PM for distribution to the appropriate personnel. This report will include:

- A summary of daily instrument Test Results

- Evaluation of all DGM data against project metrics (e.g. noise, sample spacing, data processing);
- DGM work progress
- Lessons learned, and change recommendations (e.g. document any QC failures and the action taken)
- Signature of the Site Geophysicist and the UXOQCS.

4.5.5.9 Photographic Logbook

The Photographic Logbook will be maintained by the SUXOS. This logbook is used to record all photographs taken on the project site. These photographs are used to document MEC encountered, and before, during, and after work and/or site conditions. Photographs will include:

- Date and time taken
- Unique identifying number(s) relating to the Photographic Logbook
- Location photograph was taken
- Brief description of the subject matter.

4.5.6 DAILY REVIEW OF FIELD DATA

During daily field activities or at least once daily, the UXOQCS will review field data to ensure accurate classification and documentation of recovered MEC related items. This review will allow for reconstruction of what an item was and whether or not its classification is correct.

4.6 CONTRACT SUBMITTAL QUALITY CONTROL PROCESS

Documents required under this contract will be developed and maintained by a project team consisting of the USA Project Manager, Project Engineer, Project Geophysicist, GIS Manager, and Corporate QCM. These team members will contribute their corporate knowledge and experience to the documents to ensure technical quality.

- The USA Project Manager will take the lead in development of contract documents, and will schedule a peer review and a QC review in sufficient time to meet project milestones for delivery of submittals
- The Project Engineer will provide technical writing support to develop the documents, and will review completed documents to ensure accuracy and completeness
- The PM will review and supply information and documents to ensure accuracy and completeness of procedures and reports
- The Project Geophysicist will ensure a technically sound approach to fieldwork, and accuracy and completeness of reporting on geophysical data
- The GIS Manager will develop digital database and maps, overlays of beaches and exclusion zones, and other spatial data. The GIS Manager will prepare all drawings or maps needed for submittals, and will perform QC of civil survey data
- After the project team has performed a review of documents, the Corporate QC Manager and UXOQCS will perform a QC review to ensure overall quality and completeness.

Comments on submitted documents will be directed by project personnel to the appropriate subject matter expert for resolution.

Changes to final work plans will be submitted to the PM immediately upon approval. The PM will be responsible for ensuring that the changes are posted to the hard copy on file and that all field personnel are made aware of the changes.

4.7 FIELD QUALITY CONTROL INSPECTIONS, AUDITS, AND REPORTS

Project QC inspections, audits, and reports are divided into MEC intrusive and DGM operations at the site. Personnel responsible for the inspections, reviews, corrections, and reports are identified in the following paragraphs.

The UXOQCS is responsible for the accomplishment of operational checks of instruments and equipment by site personnel. The appropriate log entries will be made. Inspections will be performed daily at random, with unscheduled checks of the site in general to ensure personnel accomplish all work as specified in the Work Plan. The UXOQCS will utilize the process outlined in Figure 4-2, Quality Control Process, and Table 4-1, Definable Features of Work, to ensure all field tasks meet quality standards prior to submittal for the Quality Assurance process. The UXOQCS will submit a report to the Site Manager detailing the results of these checks.

4.7.1 UXO QUALITY CONTROL REPORT

The UXOQCS prepares daily information and a weekly QC Report. These documents are kept on-site. The weekly QC report is submitted to the PM for distribution to the appropriate personnel. This report includes the following information:

- The periodic assessment of performed
- Significant QA/QC problems and corrective actions taken
- Conformance or non-compliance issues
- Work progress
- Lessons learned, and change recommendations
- Signature of the UXOQCS.

4.7.2 CLASSIFICATION OF MEC-RELATED ITEMS

To ensure accurate classification of MEC-related items (with respect to their explosive hazard), as the information is used to make decisions about the response action, USA will inspect suspect MEC and classify these items in accordance with Table 4-3. The list is not all inclusive, but reflects the types of MEC related material that may be encountered at the project site. The numbers in the table refer to footnotes that are found on the next page. It is important to read the footnotes, as they provide additional information of importance to understanding.

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Table 4-3: Classifications of MEC-Related Items

Type of Material	Classification Following Inspection:					
	Presents Explosive Hazards			Does Not Present Explosive Hazards		
	MEC			MC ⁽³⁾	Munitions Debris	Other
UXO	DMM ⁽¹⁾	MC ⁽²⁾				
Used military munitions, on a range, fired	X				X	
Unused military munitions, on a range, apparently discarded		X			X	
Used military munitions, in a burial pit, on a former range	X ⁽⁴⁾				X	
Unused military munitions, in a burial pit on a former range		X ⁽⁴⁾			X	
Explosives in the soil			X ⁽⁵⁾	X		
Target from a range (other than small arms range)	X ⁽⁶⁾	X ⁽⁶⁾	X ⁽⁶⁾			X ⁽⁷⁾
Remnants of munitions from a former range	X ⁽⁸⁾	X ⁽⁸⁾	X ⁽⁸⁾		X ⁽⁹⁾	

Footnotes:

- (1) Discarded Military Munitions (DMM): Munitions generally considered as DMM include: buried munitions; un-recovered kick outs from open detonations; munitions left behind or discarded accidentally during munitions-related activities; munitions intentionally disposed of without authorization during munitions-related activities. Munitions removed from storage for the purpose of disposal that are awaiting disposal are not DMM.
- (2) Munitions Constituents: MC is both (a) an explosive; and (b) present in sufficient concentrations to present explosive hazards.
- (3) This is MC that is either (a) not an explosive (e.g., lead, beryllium, and cadmium); or (b) an explosive not present in sufficient concentrations to present explosive hazards.
- (4) Although military munitions in a burial pit will normally be DMM, some may be UXO. For explosives safety reasons, munitions in a burial pit should be approached as UXO until assessed by technically qualified personnel (e.g., Explosive Ordnance Disposal (EOD) personnel, UXO-qualified personnel) and determined that they are not UXO or that they do not present explosive hazards similar to UXO.
- (5) Explosive soil is typically found in sumps and settling lagoons for explosives-laden wastewater, and in and around drainage ditches and pipes that carry the wastewater to such sumps and lagoons.
- (6) A target is a type of range-related debris. Although a target is not MEC, it may contain UXO, DMM, or MC. Prior to its release from DoD control, its explosives safety status must be documented.

- (7) A target's explosives safety status must be documented and any demilitarization required to remove its military characteristics must be performed prior to its release from DoD control.
- (8) UXO, DMM, or MC may be found on operational ranges and on former ranges (previously referred to as closed, transferring or transferred ranges). An inspection of the material will determine into which category this material falls. For example, if a projectile breaks apart on impact, one could find (a) a sheared-off fuze, which would be UXO or (b) explosive filler, which would be MC that broke away from the projectile's open body. If during an open detonation of an unserviceable munitions that is conducted on an operational range, the donor charge detonates, but the munitions being destroyed breaks up, but does not detonate, the remnants of the munitions would be DMM or, if explosive residue (e.g., clumps of TNT), MC.
- (9) Fragments, while munitions debris, may be evidence of HE usage at the site. For such fragments, USA will indicate evidence of HE in its classification. After determination of its explosives safety status, scrap metal from used munitions on a range that is documented as safe would, after any demilitarization required removing its military characteristics, be available for release from DoD control. In additions to these DoD requirements, other regulatory criteria may apply.

4.8 QUALIFICATIONS AND TRAINING

4.8.1 EMPLOYEE QUALIFICATIONS

The PM will maintain personnel files on each employee at the project site. These files include copies of necessary license, permits, training records, certificates of qualifications, and resumes that support the employee's placement and position. Prior to an employee's initial assignment or before any change in duties or assignment the PM will review the employee's files to ensure necessary qualifications are met. All site records and documentation are subject to inspection and review by the UXOQCS.

- Site UXO personnel must meet the minimal qualifications as outlined in DDESB TP-18, dated 20 December 2004.
- Dive personnel must also meet the requirements set forth in the PWS, USACE requirements, and applicable sections of 29 CFR 1910.120, Subpart T.
- Personnel assigned to DGM operations as operators, QC, and geophysicist have received additional training necessary to carry out requirements found in Chapter 3 of this work plan.

4.8.2 EMPLOYEE TRAINING AND SITE SPECIFIC REQUIREMENTS

USA ensures that only qualified and properly trained personnel are assigned to positions on project sites. Prior to mobilization of personnel, USA ensures that training required by USA, OSHA 29 CFR 1910.120, and the EM 385-1-1 has been completed for all personnel assigned to the project as shown in Table 4-4 below.

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Table 4-4: Training

Training Course	Personnel Attending
40-Hour HAZWOPER Training	All personnel who have not previously received this training or who do not qualify for certification through documented experience or training equivalent to that in paragraphs (e)(1) through (e)(4) of 29 CFR 1910.120.
8-Hour Supervisor Course	All USA management and supervisory personnel. This includes the SUXOS, UXOSO, UXOQCS, and UXO Technicians III (UXOTIIIs).
8-Hour Refresher Course	All site personnel, except those who have completed their initial 40-Hour HAZWOPER training within the past year.
First Aid and Cardiopulmonary Resuscitation (CPR) Training	At least two site personnel will have current first aid and CPR training.
30-Hour OSHA Construction Safety Course	Training Requirement for UXOSO IAW with EM 385-1-1, Section 01.A.17

In addition, prior to the start of operations all personnel will receive the following as a minimum:

- Familiarization with the Work Plan and its policies and procedures
- APP/SSHP/AHA/SOP orientation
- Emergency Response Plan training
- PPE training
- Environmental considerations peculiar to the operations on the project site
- Instruction and training on equipment usage and safe work practices
- Daily safety training outlining the day's activities.
- Visitors to the site will be provided with a site orientation and safety briefing prior to entering the exclusion area (while onsite, visitors will be escorted at all times by a UXO technician).

Training is conducted by the SUXOS, UXOSO/UXOQCS, or other designated personnel and records of attendance are maintained on site. Certificates of Training are issued when applicable.

4.8.3 DGM EQUIPMENT OPERATOR TRAINING

USA will field only qualified DGM equipment operators to ensure quality work and quality data. The Site Geophysicist will be trained in instrument set-up and operation and in survey management. Personnel will be qualified and experienced in positioning sensor data with line/station/fiducials and RTK-DGPS, data transfer, DGM quality control, data processing, data analysis with anomaly selection and categorization, data delivery and reporting, and in anomaly reacquisition; including the set up and operation of the RTS. The Site Geophysicist will manage all DGM operational personnel and equipment.

The Project Geophysicist will conduct the training at the project site. Previous experience will be reviewed, documented, and verified with practical exercises at instrument test strip. All trained personnel will be issued a certificate of training, signed by USA's Project Geophysicist.

4.8.4 UXOQCS

The UXOQCS will have experience providing QC support on MR projects. The UXOQCS has received additional corporate training and has experience inspecting DGM team operations as well as all facets of

an MEC project. Training includes the placement of QC BSI/ISOs, and the set up and use of the RTS to determine BSI/ISO locations in both local and State Plane coordinates. The UXOQCS is also experienced in the use of all analog sensors that may be used on this project.

4.8.5 SITE GEOPHYSICIST

USA's Site Geophysicist will have a degree in geophysics, engineering geophysics, or closely related field and will have directly related MEC geophysical experience. The Site Geophysicist will report to the Project Geophysicist and work closely with the site UXOQCS during DGM operations.

4.8.6 PROJECT GEOPHYSICIST

USA's Project Geophysicist will have a minimum of five years' experience in all aspects of DGM in support of the RI. The Project Geophysicist will have oversight of all DGM operations, personnel training and certification, data formatting and delivery, and project DGM reporting. The Project Geophysicist will work closely with the Corps' Project Geophysicist and USA's Site Geophysicist on all project DGM operations, quality control metrics, and DGM decisions and recommendations. They will work with the site UXOQCS to document the detection of emplaced test items.

4.9 EQUIPMENT TESTS, FUNCTIONAL CHECKS, CALIBRATION, AND MAINTENANCE

4.9.1 TESTING PROCEDURES AND FREQUENCY

Instruments and equipment, such as geophysical/navigational, video, and data analysis and transfer systems, used to gather and generate site specific data, i.e. GPS, noise, and data sampling densities, to support the field activities, will be tested with sufficient frequency and in such a manner as to ensure that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Instruments or equipment failing to meet the standard will be repaired, recalibrated, or replaced. Replaced instruments or equipment must meet the same specifications for accuracy and precision as the item removed from service. Operator proficiency will also be evaluated regularly for proper instrument set up, operation, survey technique, and data transfer. The Site Geophysicist will conduct training refreshers, if necessary.

Equipment to be tested for use at the project site is identified in Chapter 5 of this work plan. This includes but is not limited to the EM61-MK2 and the DGPS.

Items such as cellular telephones and radios will be tested for serviceability at the start of each workday. Results of these tests will be recorded in the Daily Log. Items failing these tests will be repaired or replaced prior to operations commencing.

4.9.2 ROUTINE EQUIPMENT CHECKS

Each DGM team will follow the equipment SOPs (see Appendix K) for set up, operation, and data transfer. These SOPs include all QC checks. Specific QC tests include:

- DGPS Reoccupation QC Test any day the DGPS is used (offset < 2m)
- Initial 6-line Test whenever a new DGM team arrives (appropriate data processing for repeatable amplitude response +/- 20% from previous measurements, and accurate peak positioning within 0.66 ft (0.2 m))
- Daily Equipment Warm-up (e.g. a minimum of 5 minutes)
- AM and PM Static QC Tests: <2.5mV p-p on Time Gate 3, +/-20% Spike response, no cable related problems, and operator noise is <2mV on time gate 3; check all time gates.
- AM and PM Repeat QC Tests: < +/- 25% amplitude and size variation, and < 2m location offset
- Anomaly selection review, including all anomaly decision tools
- BSI detection results
- Any analog sensors will be tested over a known object each day they are used. The known anomaly will be a seed item that meets the size and depth requirements necessary to determine the serviceability of the instrument.

- DGM Reacquisition QC tests will include a positioning system reoccupation test each day of reacquisition, and verification by the UXOQCS that any refined anomaly offset from the reported anomaly location does not exceed 2m.

4.10 CALIBRATION

The UXOQCS will check to ensure that instruments and equipment are calibrated or recalibrated in accordance with the manufacturer's recommendation or owner's manual. Calibrations will be completed on a prescribed schedule and the calibration results recorded in the daily field logbook.

If necessary, each DGM Instrument Operator will re-null the EM61-MK2, if the operator observes a shift in local background conditions or any other cause for instrument drift prior to opening and beginning any DGM survey file. The EM61-MK2 operator **will not** re-null the instrument during any DGM survey. No other calibration is expected.

Recalibration will be performed as necessary with the reason for the recalibration and the results recorded in the daily field logbook.

4.10.1 MAINTENANCE

The UXOQCS will check field logbooks to ensure that maintenance of vehicles and equipment are performed on a regular schedule and in accordance with the manufacturer's recommendation or owner's manual for equipment requiring regular upkeep.

USA will coordinate scheduled maintenance of the following equipment in accordance with manufacturer recommendations or the owner's manual.

- Vehicles
- Personal Protective Equipment
- Communications Equipment
- Geophysical, Navigational Equipment, and Personal Digital Assistant (PDA)
- Handheld Sensors
- Dive Equipment
- ROV
- Emergency Equipment.

Replacement equipment will meet the same specifications for accuracy and sensitivity as the equipment removed from service. Geophysical instruments will be checked on the test strip daily and after any repairs. They will be required to demonstrate a consistent detection rate for all seed items and any identified background anomalies. Repair or replacement of parts will meet the manufacturer specifications and recommendations. The UXOQCS will document and maintain records pertaining to the testing, repair, and/or replacement of equipment on site.

Repair or replacement parts will meet the manufacturer's requirements and be installed by personnel authorized to replace parts or make repairs. Records pertaining to the testing, repair, or replacement of instruments and equipment will be maintained on site by the UXOQCS.

4.11 ACCURACY

The Site Geophysicist will verify accurate sensor positioning is being maintained primarily by the AM and PM Repeat QC Test results and positioning system Reoccupation QC Test results. The UXOQCS will perform weekly reviews of the MEC data to ensure accurate categorization of munitions related items encountered and to ensure that all MEC items are accounted for on site documents/registers. The UXOQCS will evaluate the accuracy of all project GIS, e.g. project map, before posting to the project web site.

PWS coverage will be evaluated by the UXOQCS to determine if the geographic features are correct. Errors found will be corrected and noted in the operations field logbook. The accuracy of any grid corners

that are established for Line/Station/Fiducial positioning will be to the closest 0.3m. A detected error will result in the data being examined and the correct location and place points will then be determined in the project GIS data set to represent identifiable elements of the feature (i.e., corners or intersections).

4.12 QUALITY CONTROL OF FIELD PROCEDURES

4.12.1 DGM - INTERIOR

The UXOQCS will perform a QC Inspection of a minimum of 20% of the anomalies selected for investigation. For QC inspections, the UXOQCS will use an EM61-MK2. All QC inspections will be documented for acceptance or non-acceptance of the work performed.

MEC detection acceptance standards for this project are based on the known site anomalies previously identified and then reacquired and the site-specific test strip results. Any portion of the process or analysis not consistent with the Geophysical DQO (see Appendix O), DFW (see Table 4-1), or Section 3 is considered a quality failure if meeting the criteria for selection, reacquisition and investigation. USA will correct the quality deficiency and perform QC reviews on the affected area before submitting to the Government for verification and acceptance.

See Table 4-1 and the Geophysical DQO for Performance and Acceptance Criteria.

4.12.2 ANALOG – BEACHES

The UXOQCS will perform a QC Inspection of a minimum of 20% of the completed lot. For QC inspections, the UXOQCS will use the handheld analog sensor selected and that has been tested against the known site anomalies. All QC inspections will be documented for acceptance or non-acceptance of the work performed.

USA will employ QC blind seed items (BSI) at the minimum rate consistent with the requirements found in Table 4-1 per lot in the work areas as an additional quality check of the investigative process. The BSI will be industry standard objects that meet the criteria outlined in the PWS, buried at detectable depths. In the event that a BSI is not flagged, the UXOQCS will initiate an immediate root cause analysis (Figure 4-1) to document the cause of the failure, estimate the impact on previous work. The UXOQCS will provide his findings to the PM and SUXOS with suggested or required corrective actions. Once the corrective actions are approved by management, the UXO Teams will implement them. The root cause analysis and corrective actions will be attached to the weekly QC reports.

MEC detection depths for this project are based on the PWS stated depth and the ITP results. Any item remaining in a selected anomaly location (flagged position) after excavation is considered a quality failure if it meets the criteria for prosecution by depth and selection. USA will correct the quality deficiency, re-sweep, and perform QC reviews on the affected area before submitting to the Government for verification and acceptance.

The UXOQCS will perform a QC Inspection of a minimum of 20% of the analog surface and subsurface clearance areas. For QC inspections, the UXOQCS will use a handheld sensor as appropriate. All QC inspections will be documented for acceptance or non-acceptance of the work performed.

See Table 4-1 and the Geophysical DQO for the Performance and Acceptance Criteria.

4.13 DIGITAL GEOPHYSICAL MAPPING QUALITY CONTROL

Quality Control for DGM covers all aspects of DGM operations, from equipment set up, operation, surveying, data processing and analysis, data management and reporting/delivery, as well as operator training. Most of these DGM QC checks are part of the SOPs and are included in Appendix K. This section describes USA's DGM QC methods and procedures that are specific to the UXOQCS and the Project Geophysicist. They include:

- Verifying operator training
- Test Item placement and evaluation
- Routine checks and audits to ensure that the DGM teams are following the approved work plan and DGM SOP and Checklists

- DGM data quality checks, including RTK-DGPS Reoccupation accuracy, sensor static and dynamic noise, repeat response amplitude and position, sampling density down-line (e.g. speed) and across-line
- DGM anomaly selection checks
- Anomaly Reacquisition and Intrusive QC checks
- Post intrusive DGM checks.

4.13.1 OPERATOR TRAINING

USA will field only qualified DGM personnel to ensure quality work and quality data. The Site Geophysicist will be fully trained in instrument set up and operation and in survey management. Personnel will be fully qualified and experienced in positioning sensor data with line/station/fiducials and RTK-DGPS, data transfer, DGM quality control, data processing, data analysis with anomaly selection and categorization, data delivery and reporting, and in anomaly reacquisition; including the set up and operation of the RTS.

The Site Geophysicist will manage all DGM operational personnel and equipment. The geophysical instrument operators will be fully trained and experienced in instrument set up, operation, routine quality control tests, and data acquisition with real time quality monitoring and positioning with either line/station/fiducials or RTK-DGPS. They will as well be fully trained and experienced in data transfer, data preprocessing and delivery of the data to the Site Geophysicist. They will also be trained and experienced in anomaly reacquisition. The UXO technicians on each DGM team will be trained in the instrument set up and operation, including sensor positioning with line/station/fiducials or RTK-DGPS. They will be experienced in hand held instruments used for sensing and flagging anomalies in areas that are not suitable for DGM, and will be capable of operating the RTS in support of establishing the location of the flags they placed, and anomaly reacquisition.

4.13.2 CORPORATE TRAINING

Most training will be performed at the USA Corporate office in Oldsmar, Florida. Previous experience will be reviewed, documented, and verified with practical exercises at an exercise area convenient to the Oldsmar office. All trained personnel will be issued a certificate of training, signed by USA's Senior Geophysicist.

4.13.3 UXOQCS

The UXOQCS will have experience providing QC support on MR projects. The UXOQCS will be familiar with and experienced checking DGM teams using the DGM SOP and Checklists. Training will include the placement of QC BSI, and the set up and use of the RTS to determine BSI locations in both local and State Plane coordinates. They will also be experienced in the use of all analog sensors that may be used on this project. The UXOQCS will work with the project PLS to get the location of each BSI.

4.13.4 PROJECT GEOPHYSICIST

USA's Project Geophysicist will have a minimum of five years' experience in all aspects of DGM in support of munitions response projects. The Project Geophysicist will have oversight of all DGM operations, personnel training and certification, data formatting and delivery, and project DGM reporting. The Project Geophysicist will work closely with the Corps' Project Geophysicist and USA's Site Geophysicist on all project DGM operations, quality control metrics, and DGM decisions and recommendations. They will work with the site UXOQCS to document the detection of QC BSIs.

4.13.5 ON-SITE PROFICIENCY DEMONSTRATION

All DGM field personnel and equipment will demonstrate their ability to meet Geophysical DQOs on the existing Test Strip prior to any field work. This will include the initial mobilization of each team and will be repeated, as necessary, when personnel are replaced or equipment is replaced or repaired. The UXOQCS will observe all of these activities to ensure both the Work Plan and DGM SOPs are being followed.

4.14 PERIODIC CHECKS AND AUDITS

4.14.1 DAILY UXOQCS CHECKS

USA's UXOQCS will conduct audits of operational checks to ensure the DGM teams are following the Work Plan requirements and SOPs. DGM SOPs and Checklists include:

- Out of the Box Tests
- EM61-MK2 SOP
- DGPS SOP
- Daily Static, Dynamic Repeat, and Position QC Tests
- Daily Position Reoccupation Accuracy Test
- Data Storage and Transfer Checklist
- Checklist for Field Editing and Processing
- Data Management Checklist
- Anomaly Reacquisition SOP.

4.14.2 DAILY DGM DATA QC

The Project Geophysicist will review each day's DGM data for completeness. Project Geophysicist will review the QC Test data and compare the results to those provided by the Site Geophysicist. Any discrepancies will be resolved prior to data submittal. Project Geophysicist will randomly select, process and analyze 10% of selected survey data and compare the results to those provided by the Site Geophysicist.

4.14.3 QC BLIND SEED ITEMS (BSIs)

USA's UXOQCS will place QC BSIs at the minimum rate of two BSIs per lot for analog operations. These items will be appropriate simulants within the range of expected MEC. The UXOQCS will establish the location of each BSI using the DGPS, the Laser Distance Meter, or Tape Measures, and will forward those locations to the Project Geophysicist after the generation for inclusion into the data. The UXOQCS will report the QC BSI detection results in the weekly QC report.

4.14.4 CORRECTIVE ACTION, IF REQUIRED

Any QC test failure or failure to detect and report a QC BSI will result in the initiation of a root cause analysis to document the cause of the failure, assess any impact of previous work, and initiate a corrective action, including:

- Verifying BSI burial depth and location accuracy
- Training refresher
- Equipment repair/replacement
- QC BSI failure
 - BSI location error
 - BSI behind obstruction and not covered by the sensor
 - BSI buried too deep
 - Data processing positioning error
 - Data analysis and anomaly selection error.

4.14.5 ANALOG RESOLUTION QC

Following the location of anomalies, a review of flag/anomaly selection will be made, typically this will be based on evenly spacing the selection along transect for analog.

4.14.6 REACQUISITION QC

The UXOQCS will monitor and verify that the reacquisition teams are following the approved Work Plan and SOPs. Routine reacquisition QC tests will include:

- Positioning system Reoccupation QC Test (offset ± 0.5 ft (0.15 m); Compare reacquisition anomaly peak is within $\pm 20\%$ of reported peak.

The reacquisition team will verify that all reacquisition QC test results meet project objectives. The UXOQCS will verify that the Dig Lists are being updated with the reacquisition peak response values and location offsets are within Geophysical DQO tolerances of the reported anomaly location or as established at the test strip.

4.14.7 POST-INTRUSIVE OBJECT/ANOMALY CHECK

The intrusive teams will investigate each refined anomaly location and report their findings on the Dig List (captured on PDA). In addition to the standard field QC checks on the intrusive results, the UXOQCS will verify the Project Geophysicist's 100% review of the reported anomaly results. If the recovered object matches the data signature, the anomaly will "pass" and be recorded in the results of the Dig List. If the recovered anomaly does not match the data, he or she will:

- Check the processed data
- Check reacquisition accuracy and refinement;
- Require the intrusive team to reinvestigate the anomaly.

4.15 DGM QC REPORTS

The Site Geophysicist will generate and maintain a daily DGM report. Daily reports will be summarized into a weekly report that will include a DGM QC section. The weekly DGM QC report section will:

- Document any DGM QC failures, their root cause analysis, impact assessment on previous work, resulting corrective action(s), and any rework results
- Summarize all daily QC reports.

This weekly report will be signed by the Site Geophysicist and UXOQCS, and submitted with the weekly data delivery.

4.16 LESSONS LEARNED PROGRAM

As required by ER 1110-1-12, USA will develop a Lessons Learned Program (LLP) to provide for the exchange of information regarding problems that may occur during the response RI activities on this project site.

4.16.1 LESSONS LEARNED OBJECTIVE

The objective of the LLP is to capture and share experience or recognized potential problems or better business practices to:

- Prevent the recurrence of repetitive design/execution deficiency
- Clarify interpretation of regulations or standards
- Reduce the potential for mistakes in high risk/probability areas of concern
- Pass on information specific to an installation or project
- Promote a good work practice that should be ingrained for repeat application
- To promote efficient and cost-effective business practice.

4.16.2 TEAM RESPONSIBILITIES

The USA project team will be responsible for identifying and submitting lessons learned for review and approval. Throughout this the MEC response activity, USA project team members will consider how their experiences might be appropriate for the LLP.

4.16.3 PROJECT MANAGEMENT RESPONSIBILITY

The PM will review and approve all lessons learned for submittal to the Corps PM for potential discussion with the project development team during After Action Reviews.

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5.0 EXPLOSIVES MANAGEMENT PLAN

5.1 GENERAL

This plan outlines the procedures USA will use to complete the RI/FS at Culebra Island Site. The procedures are in accordance with the following regulations and TMs:

- DOD 4145.26-M, Contractor's Safety Manual for Ammunition and Explosives
- DOD 6055.9-M, DoD Ammunition and Explosives Safety Standards
- Applicable Sections of the Department of Transportation (DOT), 49 CFR Parts 100-199
- Army Regulation (AR) 385-64, Ammunition and Explosives Safety
- AR 190-11, Physical Security of Arms, Ammunition and Explosives
- Engineer Manual (EM) 1110-1-4009 Engineer Manual, Ordnance and Explosives
- EP 1110-1-18 Engineer Pamphlet, Ordnance and Explosives Response
- Explosive Law for Commonwealth of Puerto Rico
- USACE EM 385-1-97, Explosives Safety and Health Requirements Manual
- USACE EM 385-1-1, Safety and Health Requirements Manual
- Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) Publication 5400.7, Federal Explosives Laws and Regulations.

5.2 ACQUISITION

USA will use commercial explosives obtained through a local explosives supplier for disposal and venting of MEC. USA has an ATF permit (see Appendix L) to purchase, store, and use explosives and will supply commercial demolition material for disposal and venting operations. USA personnel have a letter of clearance from the BATFE for the use of explosives. As required by Commonwealth of Puerto Rico, USA will have a Blaster's License issued for the RI/FS. USA will provide the explosives distributor a certified statement of the intended use of the explosive material. The ATF permit will be posted on site and will be available for Federal, state, or local inspection.

5.2.1 DESCRIPTION AND ESTIMATED QUANTITIES

USA will store explosives on-site in the Type II magazine approved in Amendment 1 to the Explosive Safety Submission. USA will store less than 100 pounds of bulk and initiating explosives on site.

5.2.2 ACQUISITION SOURCE

USA will purchase explosives from licensed commercial suppliers such as Austin Powder Company on the Puerto Rico main island. The SUXOS will be authorized in writing to request and receive explosives from the commercial suppliers.

5.2.3 LISTING OF PROPOSED EXPLOSIVES

Table 5-1 lists the types and quantities of explosives that may be used.

Table 5-1: Typical Explosives and Quantities for RI/FS

Type of Explosive	Descriptions	Quantity
1 lb	Booster Black Cap	20 ea
Electric Caps	Rock Star Detonators	100 ea
Detonating Cord	80 Grain	1 roll 500 Ft
Perforators	19.5 gram Shaped Charges	50 ea

5.3 INITIAL RECEIPT

Shipments of explosives will be by commercial carrier from the explosives supplier. The explosive supplier is responsible for all permits and documentation required by Federal, Commonwealth of Puerto Rico, and local regulations for movement of explosives to the air terminal. USA will coordinate with the Mayor's Office and the Puerto Rico State Police to receive and transport the explosives to the Type II magazine.

5.3.1 PROCEDURES FOR RECEIPT OF EXPLOSIVES

On receipt, the type, quantity, and lot number of each explosive item will be checked against the shipping manifest and recorded on the USA Explosives Usage Form and the Daily Operations Journal (see Appendix F USA Forms).

5.3.2 PROCEDURES FOR RECONCILING DISCREPANCIES IN QUANTITIES SHIPPED AND RECEIVED

The SUXOS will reconcile the delivery shipping documentation with the requested amounts ordered and received. The SUXOS will not sign for or accept shipments with shortages or overages until the discrepancies are corrected.

5.4 STORAGE

On-site storage of explosives is anticipated.

5.4.1 ESTABLISHMENT OF STORAGE FACILITIES

USA will store explosives in the existing ATF Type II magazine, previously sited on Culebra. USA will comply with ATF, Federal, and local storage and compatibility criteria and procedures, including the required USAESCH approved Explosive Siting Plan (ESP).



Figure 5-1: Site of Type II Magazine

USA will maintain the magazine to comply with the magazine criteria and quantity distance (QD) requirements established in ATF Regulation ATF P 5400.7 and DOD 6055.9-M, DOD Ammunition and Explosives Safety Standards.

5.4.2 PHYSICAL SECURITY OF STORAGE FACILITIES

The magazine will be locked with high security padlocks (2) meeting ATFP 5400.7 Section 55.208 (a) and is enclosed by a chain link fence, IAW 6055-9 M, and EM 1110-1-4009. The magazine will remain locked except when receipts and issues are being made. The two locks on the magazine will require two different keys. One key will be kept by the SUXOS and the second key will be kept by the UXOQCS. The SUXOS will maintain the key to the fence enclosing the magazine. The magazine storage area will be inspected each work week by the SUXOS and UXOSO/UXOQCS to ensure the integrity of the enclosure.

5.5 TRANSPORTATION

Transportation of MEC and explosives will comply with all Federal, state, and local regulations. Permits are not required under CERCLA for on-site or on Federal installations for transportation of explosives or conventional MM. USA will request permission from the Mayor's Office to use the docks at DNER or the

Ferry Dock in the City of Dewey, Culebra, PR. Coordination will be made with the Puerto Rican State Police to provide an escort during transport of any explosives to or from the magazine to each MRS on the island or to the docks on the island. From the docks explosives will be transported by water to Cayo Luis Pena (MRS 13) or Cayo Norte (MRS 08). USA plans to transport all explosives to the island of Culebra using helicopters.

5.5.1 PROCEDURES FOR TRANSPORTATION FROM STORAGE TO DISPOSAL LOCATION

IAW with DOT regulations, USA will transport explosives in IME-22 containers for transportation of explosives to the disposal sites. USA will comply with the following:

- Initiating explosives, such as blasting caps, will remain separated at all times. Blasting caps may be transported in the same vehicle as long as they are in a separate IME-22 container (49 CFR 173.63) and secured away from other items.
- Compatibility requirements will be observed.
- Only UXOTIII's and above may be issued and transport explosive materials. The receiving party shall sign the receipt documents for accountability.
- Operators transporting Hazard Division (49 CFR 173.50) 1.1 explosives will have a valid driver's license.
- Drivers will comply with posted speed limits but will not exceed a safe and reasonable speed for conditions. Vehicles transporting explosives off-road will not exceed 25MPH.
- Personnel will not ride in the cargo compartment with explosives or MEC.

5.5.2 EXPLOSIVE TRANSPORTATION VEHICLE REQUIREMENTS

Explosives will be transported in closed containers in the beds of vehicles whenever possible. The load shall be well braced and, except when in closed vehicles, covered with a fire-resistant tarpaulin or placed in an appropriate shipping container.

- Initiating explosives, such as blasting caps, will remain separated at all times. Blasting caps may be transported in the same vehicle as long as they are in a separate container and secured away from other items.
- Compatibility requirements will be observed.
- Only UXO Technicians III and above may be issued explosive materials and transport them. The receiving party shall sign the receipt documents for accountability;
- Operators transporting explosives will have a valid driver's license;
- Drivers will comply with posted speed limits but will not exceed a safe and reasonable speed for conditions. Vehicles transporting explosives off-road will not exceed 25 MPH.
- Personnel will not ride in the cargo compartment with explosives or MEC.
- Vehicles transporting explosives or MEC will be inspected prior to load out using the Motor Vehicle Inspection form DD FORM 626 (Appendix F), and will be properly placarded.
- Vehicle engine will not be running and the wheels will be chocked when personnel are loading/unloading explosives.
- Beds of vehicles will have a bed liner, dunnage, or sand bags to protect the explosives from contact with the metal bed and fittings.
- Vehicles transporting explosives will have a first aid kit, two 10-BC rated fire extinguishers, and a means of communications.

5.5.3 TRANSPORTATION BY VESSEL

Movement of explosives from Culebra to Cayo Luis Pena will require the use of a contracted and licensed vessel. Transport of explosives by waterborne vessel requires adhering to the applicable sections contained in 49 CFR (DOT) and U.S. Coast Guard directives.

Specifics, such as safety requirements, placarding, stowage, security, personnel, and emergency procedures are detailed in the SOP Explosives Transportation –Open Water Vessels, contained in Appendix K.

5.6 RECEIPT PROCEDURES

The SUXOS will strictly control access to all explosives. All receipts, issues, and usage of explosives will be properly documented and verified, through physical count, by the UXOQCS.

5.6.1 RECORDS MANAGEMENT AND ACCOUNTABILITY

On receipt, the type, quantity, and lot number of each explosive item will be checked against the manifest and recorded on the Explosives Usage Form (Appendix F). The original receipt documents and an inventory will be maintained on file by the SUXOS. All original explosive records will be forwarded to USA Oldsmar for archive in accordance with ATF regulations and requirements. ATF requires USA to maintain explosive records for commercial purchases for a period of 5 years. Copies of all records will be maintained on site by the SUXOS and be available for inspection by authorized agencies. Their respective lot number will track explosive items until the item is expended or transferred to Government control and accountability.

5.6.2 AUTHORIZED INDIVIDUALS

USA is required to provide commercial suppliers with documentation of individuals authorized to request and receive explosives. The individual authorized to receive and issue explosives is the USA SUXOS and in some cases, if the SUXOS is not available, the UXOQCS. On site, the SUXOS will designate, in writing, the individual who is authorized to transport and use explosives.

5.6.3 CERTIFICATION

The SUXOS and UXO Technician III team leader performing demolition will sign and date the explosives usage form certifying that the explosives were used for their intended purpose.

5.6.4 PROCEDURES FOR RECONCILING RECEIPT DOCUMENTS

The SUXOS and UXOQCS will be responsible for performing a review of the explosives usage record. If there is a discrepancy between the amount received and the amount of explosives consumed, then these individuals will review the receipt documentation to see if the records are correct. If the records review does not reconcile the discrepancy, then it will be reported to the Contracting Officer and USA-Oldsmar for investigation.

5.7 INVENTORY SCHEDULING

Explosives will be inventoried at least weekly by the SUXOS (or approved designee), the UXOQCS, and a Team Leader. Complete inventories will also be conducted after any issues/turn-ins of demolition material.

5.7.1 STORAGE FACILITY PHYSICAL INVENTORY PROCEDURES

The SUXOS will strictly control access to all explosives. All issues and turn-ins of explosives will be properly documented and verified, through physical count, by the SUXOS or his approved designee. On receipt, the type, quantity, and lot number of each explosive item is recorded on the Magazine Data Card (see Appendix F).

The SUXOS will review all requests for explosives from the individual operating sites and only sufficient explosives for the day's operations will be requested and issued. Issues of explosives will be recorded on Explosives Usage Records, deducted from the Magazine Data Cards, and annotated in the daily journal. This procedure will ensure that the issued explosives are accounted for while they are in the possession of individual users. The end user of explosives shall certify on the Explosives Usage Record that the explosives were used for their intended purpose. Entries made on the Explosives Usage Records and Magazine Data Cards will be verified through physical count by the UXOTIII when drawing or turning-in the explosives and verified by the UXOQCS.

- At the end of each disposal operation the UXOQCS and the Demolition Team UXOTIII will reconcile the entries on each Explosives Usage Record, and will turn these records over to the SUXOS. The record of ordnance items destroyed with the explosives consumed will be kept in the SUXOS daily log.
- Entries made on the Explosives Usage Records and Magazine Data Cards will be verified through physical count by the Demolition Team UXOTIII when drawing or turning-in the explosives and the UXOQCS will verify the record.

5.7.2 PROCEDURES FOR RECONCILING INVENTORY DISCREPANCIES

The SUXOS, UXOQCS, and a UXOTIII will be responsible for performing a weekly inventory of the explosives within the magazine. If there is a discrepancy between the inventory and the volume of explosives within the magazine, then they will review the Magazine Data Card and Explosives Usage Record to see if the inventory records are current. If the records review does not reconcile the discrepancy, then it will be reported to the USACE OE Safety Specialist, Contracting Officer, and USA PM for investigation.

5.7.3 INVENTORY SCHEDULING

SUXOS, UXOQCS, and a UXOTIII will perform weekly inventories of the explosives within the magazine.

5.7.4 REPORTING LOSS OR THEFT OF EXPLOSIVE MATERIALS

If it is confirmed that ordnance or explosives are missing, then the SUXOS will contact the Contracting Officer immediately by telephone and in writing within 24 hours. The USACE OE Safety Specialist and USA-Oldsmar will be notified following the notification of the Contracting Officer. USA-Oldsmar will notify ATF and immediately begin an investigation.

5.7.5 PROCEDURES FOR RETURN TO STORAGE OF EXPLOSIVES NOT EXPENDED

Explosives that were issued for use, but were not expended will be returned daily to the magazines, at the completion of disposal operations. The Demolition Team UXOTIII will return the unused explosives to the storage magazine and record the items on the Magazine Data Card and Explosives Use Record.

5.8 DISPOSAL OF REMAINING EXPLOSIVES

ATF requires an accounting of all explosives purchased and used; therefore, at project completion all unused explosives still in the sealed containers will either be disposed of by detonation, or by transferring custody and accountability to an incoming contractor, a Government agency, or returned to the distributor.

5.9 ECONOMIC ANALYSIS

Because of ATF requirements and prohibition for returning used open packaging, these explosives will be consumed at the site. An economic analysis of the explosives disposal alternatives will not be required.

5.10 FORMS

USA will use internal USA forms Magazine Data Card and Explosives Usage Record for explosives receipt, issue, inventory, and DD Form 626 for vehicle inspections. These forms are in Appendix F.

6.0 EXPLOSIVES SITE PLAN

The Explosives Site Plan was prepared as a separate document and is included in Appendix P.

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7.0 ENVIRONMENTAL PROTECTION PLAN

7.1 GENERAL

This Environmental Protection Plan (EPP) has been specifically developed to address environmental protection issues associated with performing DGM, Anomaly Resolution, and Intrusive Investigation during the RI at the Culebra Island site. Specifically, this plan is intended to provide adequate procedures to safeguard the environmental condition of land and water in and around each MRS, beaches and access routes, and to mitigate and/or minimize the environmental impact from USA's operations.

Tables 7-1 and 7-2 list the federally protected plant and animal species that are known to occur or that have the potential to occur on Culebra and the surrounding cays.

Appendix M contains the document *Standard Operating Procedures for Endangered Species Conservation and their Habitat on DERP-FUDS Project No. I02PR006802 Culebra, Puerto Rico*. This SOP provides specific procedures currently approved by FWS for DERP-FUDS operations in Culebra and surrounding cays and is being incorporated into this EPP.

7.1.1 DEFINITIONS

For the purposes of this plan, the definitions of "Environmental Protection" and "Environmental Impact" are as follows:

- **Environmental Protection:** Preservation of the environment in its natural state to the greatest extent possible.
- **Environmental Impact:** Disturbance, damage, and/or contamination of the soil, air, and/or water. (Engineering Evaluation/Cost Analysis (EE/CA) Former Culebra Island Naval Facility Culebra Island, Puerto Rico, Site Number: I02PR006802, dated 27 June 2006, stated in paragraph 7.5.1.4, Short Term Effectiveness: "In the event that MEC is discovered and detonation is the preferred disposal option, the area may be affected by noise and ground shock. Environmental impacts from clearance should be minimal.")

7.1.2 ENVIRONMENTAL GOALS

The work at the Culebra MRS sites is being performed to gather the data necessary to determine the nature and extent of MEC and MC contamination on the Culebra Island Munitions Response Sites (MRS) 06, 09, 10, and 11; the Cayo Norte Impact Area (MRS 08); and the Cayo Luis Pena Impact Area (MRS 13), in order to assess the risk to human health and the environment due to the presence of MEC and MC, and to establish criteria for cleaning up each MRS. The following are environmental goals of the project:

- Perform operations in a manner that minimizes the disturbance of soil, water, and vegetation
- Leave the land in as near a natural condition as operationally possible.

To accomplish these goals, USA will implement procedures to control air and/or noise pollution; manage site-wastes; and control water pollution throughout this project. These procedures will focus on preventing contaminants from leaving the source, from entering potential contaminant transport pathways, and from reaching receptors.

7.1.3 ENVIRONMENTAL COORDINATION

USA's SUXOS will coordinate all land resources management, waste management, pollution control, and abatement activities with the on-site USACE OE Safety Specialist and the FWS.

7.2 ENVIRONMENTAL RESOURCES AND EFFECTS

7.2.1 ENVIRONMENTAL SURVEY

Prior to beginning site activities, USA's SUXOS and UXOSO, along with a representative of the Refuge Manager for FWS and the USACE OE Safety Specialist, will conduct a joint environmental survey, and develop a layout plan of the operating area on each MRS to document conditions of areas in and adjacent to the site of the work, storage areas, and access routes. The following items shall also be identified on the layout plan: wetlands endangered and protected species or habitats, and cultural or historical resource areas.

7.2.2 ENVIRONMENTAL SURVEY RECORDS

USA will record the results of environmental surveys both photographically and in writing. During the survey, photographs of each site and the surrounding area will be taken to document conditions prior to work activities. This includes taking generally representative photographs of the site and photographs of areas that will be used for administrative support, storage, and/or stockpiles. During the survey USA will prepare environmental analysis worksheets that identify the nature and cause of the environmental impact, and the procedures, equipment, and training required to mitigate/eliminate the adverse impact.

7.2.3 ENDANGERED /THREATENED SPECIES

Federally endangered and threatened species found on Culebra and surrounding cays are listed in Tables 7-1 and 7-2.

Table 7-1: Rare and Endangered Terrestrial and Amphibious Wildlife, Puerto Rico

Species	Common Name	Status
<i>Sphaerodactylus roosevelti</i> * ^o	Littoral Lizard	Rare
<i>Epicrates monensis granti</i>	Virgin Island Tree Boa	Endangered
<i>Anolis roosevelti</i>	Culebra Giant Anole	Endangered
<i>Anolis cuvieri</i> * ^o	Puerto Rican Giant Anole	Rare or Extinct
<i>Mabuya sloanii</i> * ^o	Slippery Black Skink	Rare or Extinct
<i>Typhlops</i> ^o	Worm Snake	Rare
<i>Alsophis antillensis</i> ^o	Ground Snake	Rare or Extinct
<i>Psejudemys rtejnegeri</i> * ^o	Antillean Painted Turtle	Rare
<i>Chelonia mydas</i> ^{#o}	Green Sea Turtle	Endangered
<i>Dermochelys coriacea</i> ^{#o}	Leatherback (Sea Turtle)	Endangered
<i>Caretta caretta</i> ^{#o}	Loggerhead (Sea Turtle)	Endangered
<i>Eretmochelys imbricata</i> ^{#o}	Hawkbill (Sea Turtle)	Endangered
<i>Trimeresurus</i>	Fer-De-Lance	Rare or Extinct
<p>* = Endangered in Puerto Rico [#] = Federally classified endangered species ^o = Not observed during study Source: Ecology and Environment, Inc., 1978</p>		

Table 7-2: Rare and Endangered Terrestrial Plant Species

Name	Growth Form	Habitat
<i>Amaranthaceae Celiosia virgata</i>	Herb	Upland Forest
<i>Bignoniaceae Enallagma latifolia</i>	Tree	Lowland Forest
<i>Bromeliaceae Tillandsia lineatispica</i>	Epiphyte	Lowland Forest
<i>Witmackia lingulata</i>	Epiphyte	Lowland Forest
<i>Caesalpiniaceae Caesalpinia bunduc</i>	Tree	Beach Scrub
<i>Stahlia monosperma</i> *	Tree	Lowland Forest
<i>Capparidaceae Morisonia americana</i>	Tree	Upland Forest
<i>Celastraceae Maytenus cymosa</i>	Shrub	Lowland Forest
<i>Compositae Baccharis dioica</i>	Sedge	Evergreen Scrub
<i>Cyperaceae Bulbostylis pauciflora</i>	Sedge	Pastures
<i>Cyperus urbani</i>	Tree	Pastures
<i>Flacourtiaceae Prockia cruiz</i>	Tree	Upland Forest
<i>Leptocereus grantianus</i>	Cacti	Varies
<i>Malpighiaceae Malpighia fucata</i> *	Tree	Beach Scrub
<i>M. infectissima</i>	Tree	Beach Scrub
<i>M. linearis</i> *	Tree	Beach Scrub
<i>M. shaferi</i>	Tree	Lowland Forest
<i>Tetrapteris inaequalis</i>	Woody Vine	Beach Scrub
<i>Myrtaceae Calypttranthes thomasiana</i>	Tree	Upland Forest
<i>Olcaceae Schoepfia schreberi</i>	Tree	Upland Forest
<i>Orchidaceae Epidendrum bifidum</i>	Epiphyte	Evergreen Scrub
<i>Papilionaceae Sophora tomentosa</i>	Scrub	Beach Scrub
<i>Pereomia wheeleri</i>	Ground Herb	Upland Forest
<i>Piperaceae Peperomia myrtifolia</i>	Herb	Upland Forest
<i>Polypodiaceae Adiantum villosum</i>	Fern	Gallery Forest
<i>Solanaceae Brunfelsia americana</i>	Tree	Upland Forest
<i>Urticaceae Pouzolzia occidentalis</i>	Shrub	Upland Forest
<i>Zygophyllaceae Guaiacum officinale</i>	Tree	Beach Scrub
Source: Wodbury, Roy, et al.1975, Rare and Endangered Plants of Puerto Rico, a Committee Report, U.S. Department of Agriculture, Soil Conservation Service. *Observed during Environmental Impact Study (Tamsand Ecology and Environment, Inc., 1980)		

The USACE document Standard Operating Procedures for Endangered Species Conservation and their Habitat on *DERP-FUDS Project No. 102PR006802.Culebra, Puerto Rico* (Appendix M) provides a series of SOPs to avoid or minimize impacts to threatened and endangered species during DERP-FUDS work at locations on Culebra Island and adjacent cays and in surrounding waters that serve as habitat for these species. These SOPs



Figure 7-1: Hawksbill Sea Turtle

“are in accordance with on-going communication with staff from the U.S. Fish and Wildlife Service (FWS), the National Marine Fisheries Service (NMFS) and the Puerto Rico Department of Natural and Environmental Resources (DNER), as well as pursuant to the Interim Guidelines provided by FWS to work on lands of Culebra National Wildlife Refuge, with the U.S. Army Corps of Engineers (USACE) Regulations and Environmental Operating Principles”. Species specifically referenced in the SOP include the endangered hawksbill (*Eretmochelys imbricata*) and leatherback (*Dermochelys coriacea*) sea turtles, the threatened green sea turtle (*Chelonia mydas*) and its designated critical habitat 3 nautical miles around Culebra and its surrounding islands and cays, the threatened elkhorn (*Acropora palmata*) and staghorn corals (*Acropora cervicornis*), the West Indian manatee (*Trichechus manatus*), and avian species.



Figure 7-2: Leatherback Turtle

The document provides information on the nesting habits and nesting seasons for the *endangered* hawksbill and leatherback sea turtles and the *threatened* green sea turtle and proscribes specific measures to be taken to avoid or minimize possible impacts resulting from munitions clearance and detonation activities, specifically addressing vegetation removal, beach monitoring for turtle nesting activities, and designation of beach zones based on sea turtle nesting data, and site inspections to ensure sea turtle nest protection during vegetation removal and munitions detonation activities.

The document also includes Vessel Strike Avoidance Measures and Reporting for National Marine Fisheries Service (NMFS) protected species, specifically addressing recommended training in identification of protected species, vessel strike avoidance procedures, and reporting requirements for injured or dead protected species.



Figure 7-3: Green Sea Turtle

7.2.3.1 Mitigation Measures
7.2.3.1.1 Beach Monitoring

Prior to commencement of clearance activities, including vegetation removal and removal of unexploded ordnance, on Culebra, Cayo Norte and Cayo Luis Peña USA will contract with a fully qualified and independent Project Biologist (biologist) to conduct beach monitoring surveys. The biologist's qualifications will be submitted in advance to the contracting officer and the FWS for approval. All beach clearance activities, including vegetation removal and removal or detonation of MEC, will be closely coordinated with FWS. The biologist will perform morning beach surveys prior to and during the nesting season, before crews commence daily activities, to determine whether sea turtle nesting has occurred and to ensure that activities may be accommodated in a window of time when no nests are present.

If sea turtle nests are found on beaches being cleared of MEC, the biologist, the UXO supervisor, and/or monitoring personnel will communicate daily with the FWS Boqueron Endangered Species Specialist and the Culebra Islands NWR Refuge Manager as to whether new nests have been located, and their locations within the work area. If agreed upon by FWS, nest locations will be clearly marked to ensure clearance personnel avoid nests and no clearance activities will take place in the area until the hatchlings emerge and vacate the nest. Otherwise, nests will be relocated to a safe beach within 6-12 hours following nesting. The relocation program will be carried out by the biologist and experienced personnel with the required DNER endangered species permits. This approach has been utilized by DNER personnel on Vieques from 1990-2000 to protect sea turtle nests from military operations with a hatching success of relocated nests of over 80%.

The biologist will provide training to beach clearance crews prior to the initiation of clearance activities regarding the importance of endangered species, in particular the status of sea turtles at this location; the potential penalties associated with violations of the ESA, measures for crawl and nest identification, and sea turtle biology.

7.2.3.1.2 Designation of Beach Zones for Vegetation Removal and Munitions Detonation

The information contained in this section was provided by the USFWS based on zones established during clearing activities for a Navy-led project in Vieques. The designation of zones based on number of nests, restrictions within the zones, etc. must be developed in coordination with the FWS to be specific to Culebra. USA, through the biologist, will establish three work zones, based on sea turtle nesting data, and site inspections to ensure sea turtle nest protection during vegetation removal, anomaly investigations, and munitions detonation activities. The biologist will obtain specific nesting data for the beach areas planned for work. USA understands that this data can be obtained from the FWS Ecological Services Office in Cabo Rojo or the DNER office on Culebra or Fajardo. The proposed work zones and supporting rationales used in Vieques, are described below. USA will follow these same zone delineations and associated restrictions to the maximum extent practicable, consistent with safe execution of operations.

Zone 1 No Restrictions. **Sea turtle nesting is not expected** within the area (rocky shore, no sand, etc).

Zone 2 Minor Restrictions. **Low historical sea turtle nesting events** (fewer than 4 nests per year have occurred within the zone). Zone 2, beaches will be surveyed twice a week, 75 days prior to the activity by experienced and qualified personnel. Surveys should cover both the open sand and the area below the vegetation. No driving on the beach will occur. If no nests are found, cutting of trees smaller than 3 inches in diameter may occur. Manual cutting using machetes is the preferred alternative to allow for re-growth. If power tools such as chain saws are required, the FWS recommended pruning low branches instead of removing the trees (except for mesquite trees). Both techniques would allow for re-growth of suitable habitat. Mechanized removal of vegetation using mowers or vehicles should not be used near beach areas. When nests are found, a protection or exclusion zone of 8m should be designated around the nest and marked with flagging tape. Vegetation removal outside of the exclusion zone may occur if conducted manually. Vegetation removal within the nest area should be postponed until 5 days after

hatching is documented, unless UXO is found in the vicinity of the nest. Vegetation removal within the hawksbill sea turtle nesting habitat should not occur from June to mid December (peak of the nesting season). Hawksbill sea turtle nesting habitat varies from 10 m to 25m from the edge of the woody vegetation.

Zone 3: Major Restrictions. **Four or more historical sea turtle nesting events** have occurred within the zone. Zone 3 beaches will be surveyed every morning by a qualified biologist utilizing pedestrian surveys beginning 75 days prior to the scheduled start date of the project and until ordnance or vegetation removal actions are completed. Minimizing the amount of woody vegetation such as sea grape cleared would help minimize impacts to nesting hawksbill sea turtles. The rest of the conditions are the same as Zone 2. When no nests are found on Zone 3 beaches, vegetation cutting may be conducted outside of the peak nesting season of the hawksbill sea turtle. A protection zone of 10 meters (measured landward from the edge of the woody vegetation) should be established to protect leatherback and green sea turtle nesting habitat. If leatherback and/or green sea turtle nests are left in situ (in place), vegetation removal activities should not occur within 10 meters of the landward edge of the nest track. The preferred alternative for cutting the vegetation, if nests are in situ, is hand cutting using machetes or power tools.

The document *Standard Operating Procedures for Endangered Species Conservation and their Habitat on DERP-FUDS Project No. 102PR006802.Culebra, Puerto Rico* (Appendix M) also included the following decision tree prepared by the FWS to provide further guidance on the sequence of events during ground-intrusive beach work applicable to work in zones 2 and 3. Minor discrepancies between zone restrictions and the decision tree are exist regarding required beach monitoring times prior to ground intrusive activities and the protective radius around nests. USA will follow the more restrictive requirement in either case.

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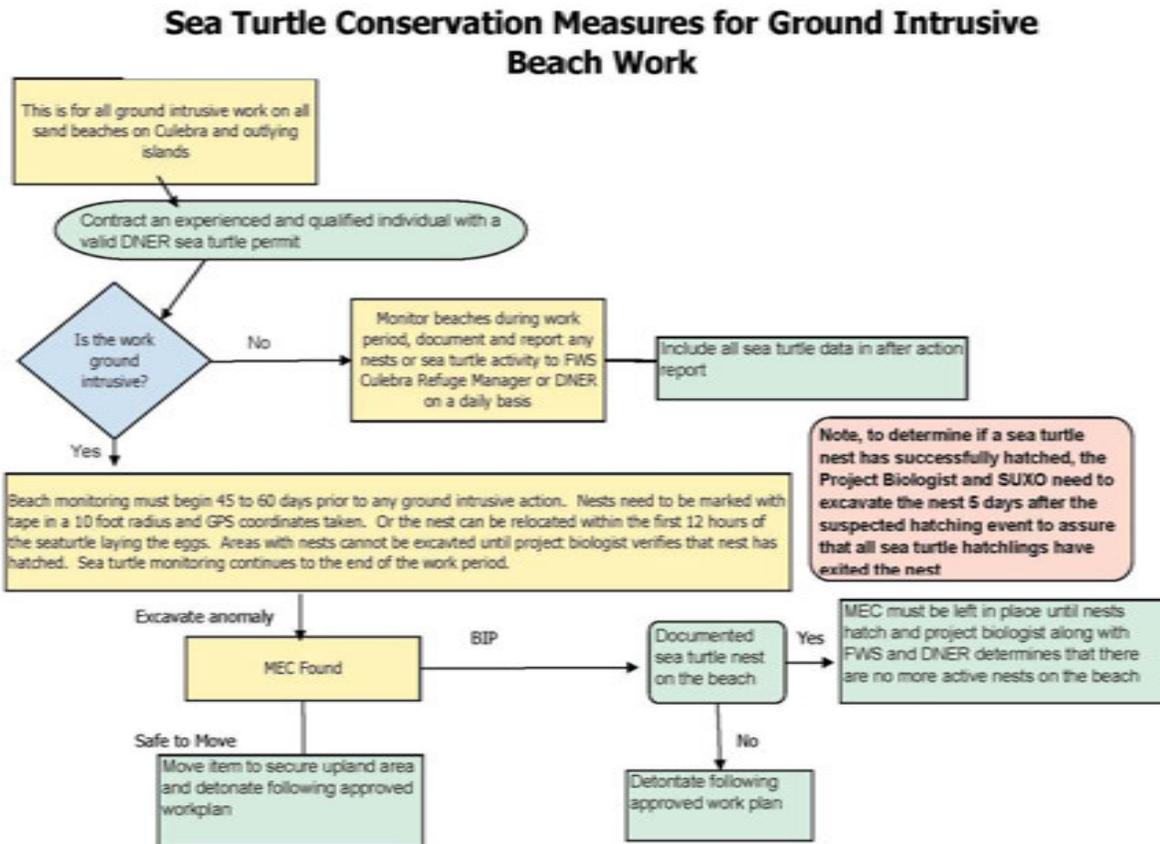


Figure 7-4: Sea Turtle Conservation Measures for Ground Intrusive Beach Work

To the maximum extent practicable, USA will not schedule detonation activities during sea turtle nesting season or when hatchlings are present on the beaches. To the maximum extent practicable, USA will not schedule ground intrusive activities, including detonation, to occur during the peak nesting season from March to November.

The following are specific issues concerning habitat, sea turtle nesting, and jurisdiction of the beaches on Culebra and surrounding cays.

- Beaches on Culebra and Cayo Norte provide nesting habitat for threatened or endangered sea turtles. The Endangered Species Act speaks particularly about adverse modification of Critical Habitat.

- Sea turtle nesting beaches are under the jurisdiction of the FWS.
- The waters around Culebra out to three nautical miles (from mean high water line) are Federally Designated Critical Habitat for sea turtles.
- Two coral species are listed as threatened: the Elkhorn and Staghorn coral. They are shallow water species and are found in the shallow waters around Culebra beaches and the surrounding cays; boat moorings and beach landings must take into consideration the location of the coral and avoidance and training of personnel.



Figure 7-5: Staghorn Coral

Cayo Luis Pena is a National Wildlife Refuge and access needs to be coordinated with the Refuge Manager. The beaches are relatively narrow, with scrub/shrub vegetation. There are always sea turtles in the bay and the beach is used by sea turtles for nesting. Access is by boat only and the area is a well-known weekend spot for local boaters. Establishing an EZ here will require the cooperation of local government.



The primary means of reducing impact on any species will be avoidance, if at all possible. When avoidance is not possible, MEC operations will be conducted, giving as much consideration to non-disturbance as is consistent with safely accomplishing the objectives of the project. USA establishes work zones around beaches to ensure sea turtle nest avoidance during vegetation removal and munitions detonations. USA will request a site inspection by the FWS to prepare beach-specific comments for each beach area.

Figure 7-6: Elkhorn Coral

- USA plans monitoring of the beaches with the designation of an EZ (protection zone) during vegetation removal and MEC activities to minimize possible adverse effects to sea turtle species. USA will minimize the amount of sea grape cleared to help curtail possible effects on the hawksbill sea turtle.
- During intrusive investigations of beach areas the use of vehicles and or equipment may be necessary. USA plans to minimize the amount of driving required to the minimum for intrusive operations.
- USA will coordinate directly with FWS when operations, e.g., DGM or Disposal of MEC, will be conducted in areas near known sea turtle nests. The requirement for BIP of MEC near sea turtle nests may require the FWS to relocate the nest to allow the disposal to be performed. The Engineering Evaluation/Cost Analysis (EE/CA) Former Culebra Island Naval Facility Culebra Island, Puerto Rico, Site Number: I02PR006802, dated 27 June 2006, stated in paragraph 7.5.1.4, Short Term Effectiveness, that, "In the event that MEC is discovered and detonation is the preferred disposal option, the area may be affected by noise and ground shock. Environmental impacts from clearance should be minimal."
- The USA PM will coordinate through the USACE OE Safety Specialist, the local agencies, FWS, and the Corps of Engineers USAESCH Office, whenever cutting of trees or vegetation is required or intrusive work is necessary in or near pools, ponds, or wetlands. This coordination should be initiated by the USA PM enough in advance to allow for the formulation and implementation of any specific impact reduction measures necessary.
- If excavation is required in an area of endangered plants, animals or vernal pools, excavation will proceed only after approval is obtained from the local agencies, Corps of Engineers USAESCH, and the USACE OE Safety Specialist. Should excavation of anomalies not be allowed, the area will be so annotated. Likewise, if the Investigation team is not allowed into a section, that section will be annotated.

7.2.3.1.3 Vessel Strike Avoidance Measures

Collisions with vessels can injure or kill protected species (e.g., endangered and threatened species, and marine mammals). The Standard Operating Procedures for Endangered Species Conservation and their Habitat on DERP-FUDS Project No. I02PR006802.Culebra, Puerto Rico (Appendix M) provides measures to be implemented to reduce the risk associated with vessel strikes or disturbance of these protected species. Based on this SOP document, USA and its supporting boat subcontractor will implement the measures described below, when consistent with safe navigation:

1. Vessel operators and crews will maintain a vigilant watch for marine mammals and sea turtles to avoid striking sighted protected species.
2. When whales are sighted, maintain a distance of 100 yards or greater between the whale and the vessel.
3. When sea turtles or small cetaceans are sighted, attempt to maintain a distance of 50 yards or greater between the animal and the vessel whenever possible.
4. When small cetaceans are sighted while a vessel is underway (e.g., bow-riding), attempt to remain parallel to the animal's course. Avoid excessive speed or abrupt changes in direction until the cetacean has left the area.
5. Reduce vessel speed to 10 knots or less when mother/calf pairs, groups, or large assemblages of cetaceans are observed near an underway vessel, when safety permits. A single cetacean at the surface may indicate the presence of submerged animals in the vicinity; therefore, prudent precautionary measures should always be exercised. The vessel should attempt to route around the animals, maintaining a minimum distance of 100 yards whenever possible.
6. Whales may surface in unpredictable locations or approach slowly moving vessels. When an animal is sighted in the vessel's path or in close proximity to a moving vessel and when safety permits, reduce speed and shift the engine to neutral. Do not engage the engines until the animals are clear of the area.

Vessel crews will report sightings of any injured or dead protected species to the USA site manager, who will then report the sighting as follows:

Marine Mammal:	Southeast U.S. Stranding Hotline: 877-433-8299
Sea turtle:	NMFS Southeast Regional Office: 727-824-5312

In the event that an injury or death of a marine mammal is caused by collision with a USA support vessel, the crew will immediately notify the USA site manager and be made available to assist the respective salvage and stranding network as needed. The USA site manager will immediately notify the NMFS Southeast Regional Office by email (takereport.nmfsser@noaa.gov).

7.2.3.1.4 Avoidance of Birds, Reptiles and Manatees

USA and its subcontractors will avoid contact with any bird or reptile found injured or otherwise in the way of the cleanup activities, until adequate coordination is done with FWS and DNER. To the maximum extent practicable, consistent with safety concerns, detonation of UXO on cays will not be conducted during seabird nesting season. In the event an item needs to be detonated near nests, the birds will be captured and held, prior to the blow-in-place detonation. This effort will be coordinated with the biologist, FWS and DNER. In the event of a manatee sighting in the vicinity of a work area, USA work will stop until the animal(s) are at a safe distance.

7.2.3.1.5 Site-Specific Training

USA will provide site specific training on identification and recognition of protected species (plant and animal), as well as mitigation measures to prevent disturbance, injury or death to protected animal species and habitats. Particular emphasis will be placed on the status of sea turtles on Culebra; the potential penalties associated with violations of the ESA, measures for crawl and nest identification, and sea turtle biology. This will include a review of pertinent laws and acts, guidelines to reduce impact, and points of contact to report encounters with protected or endangered species. Applicable aspects of this training will be correlated with the Accident Prevention Plan and Site Safety and Health Plan (Appendix D). This training will be provided by the biologist prior to the initiation of clearance activities.

Site specific training will also be provided to vessel crews, emphasizing identification of protected species that might be encountered in the waters surrounding Culebra and the cays, vessel strike avoidance measures, migratory routes and seasonal abundance, and recent sightings of protected species.

7.2.3.2 Wetlands and Riparian Areas

No on-site wetlands are expected to be impacted by the project. In the event that wetlands are to be impacted, the FWS Refuge Manager will be contacted. In such a case, mitigation measures will be taken to reduce the impact on the wetland ecosystem.

7.2.3.3 Cultural or Historical Resources

Based on available data, the probability that significant cultural or archaeological resources are located within the project area appears low. Because of the nature of the proposed work, any cultural or archaeological resources that may exist within the project area are not expected to be impacted. If any cultural or archaeological materials or resources are discovered within the project area, USA's SUXOS will immediately report the find to the on-site USACE OE Safety Specialist so a qualified archaeologist can be notified and will provide guidance on performing further work in the area. Site work will be suspended and will resume only after obtaining approval from USAESCH. Cultural and archaeological issues will be addressed by contacting the State Historic Preservation Office (SHPO) at 787-721-3737. A review/training of potential archeological items that may be present will be conducted for all personnel to assist with identifying items if encountered.

7.2.3.4 Water Resources

Based on available aerial photography, no water resources appear to be located within the project area, except for the Caribbean Sea to the north, south, west, and east and several lagoons spread along the coast. No inland water resources are expected to be impacted by the project.

7.2.3.5 Coastal Zones

Narrow beach areas of varying widths and lengths exist along the coastal zones of each MRS site. DGM and intrusive investigations will be performed in selected areas. For MRS 13, Cayo Luis Pena, preliminary locations for DGM and intrusive investigations have been selected (see Figures B-9, 10 and 11, Appendix B). Potential beach areas for DGM and intrusive investigations at the optional MRS sites have not been determined.

USA will perform some vegetation clearance and DGM on access routes to these beaches which will impact the areas landward of the shoreline.

7.2.3.6 Trees and Shrubs

During the On Board Review for the previous N-TCRA on Culebra and Culebrita, it was decided that a Botanist would be on site and approve any vegetation that was required to be trimmed to allow DGM survey of the beach areas. USA assumes the same will apply to this RI/FS action and that the FWS or USACE will provide the botanist.

Any vegetation clearance required will consist of hand clearing to the extent necessary to facilitate investigation operations. The removal of trees will be avoided. If it is decided that a tree must be removed, advance justification will be provided to the FWS or other appropriate agencies monitoring the site. Commonwealth, FWS or DNER must then provide *written* permission before the field crew can remove the tree.

The proposed work will involve trimming of shrubs, undergrowth, and small trees within the project area. The vegetation will be removed only on an as-needed basis.

7.2.3.7 Existing Waste Disposal Sites

There are no known waste disposal sites at the project area.

7.2.3.8 Compliance with ARARs

No ARAR's have been identified.

7.3 SITE DISTURBANCE MITIGATION PROCEDURES

All soil disturbance activities will be accomplished as specified in the WP. Any deviations from this plan will be performed only upon authorization from the on-site USACE OE Safety Specialist.

Prior to initiation of the proposed work, the USA PM will coordinate with the FWS to provide instructions to field personnel regarding the protection of on-site environmental resources. Such protective measures will include, but are not limited to, the following:

- Avoid contact with any specimen of the *Cobana negra (Stahlia monosperma)* tree or any other federally protected plant that is found within the project area. Flag specimens within the project area for easy identification.
- Avoid any sea turtles or sea turtle nests that are encountered. All sea turtle nests that are located during the project will be marked by flagging and an EZ will be set up around the nests in accordance with the SOP for Endangered Species Conservation and their Habitat (Appendix M) to prevent potential impacts. All sea turtle tracks sighted within the project area will be reported to the PM.
- Any MEC found within or near a wetland will be identified and removed, if deemed safe to do so, without impacts to wetland soil, vegetation, or hydrology.
- If any cultural or archaeological material/resource is discovered within the project area, a qualified archaeologist will be notified to provide guidance on performing further work in the area.
- MEC found in the immediate vicinity of a water body will be identified and removed, if deemed safe to do so, without impacts to the water resource.
- MEC found near the coastal zone will be identified and removed, if deemed safe to do so, without impacts to the coastal environment.

The PM will seek the guidance of the FWS to determine appropriate mitigation measures in the event that the performed work activities result in impacts to any environmental resource.

7.3.1 MEC INTRUSIVE INVESTIGATION AND BIP APPROACH TO MINIMIZE IMPACTS TO SEA TURTLES AND NESTING AREAS

The primary approach to conducting intrusive investigations and BIP actions at the beach areas identified as sea turtle nesting areas will require that a FWS biologist be consulted and the location of the proposed activity be examined by the U.S. FWS biologist to determine whether impacts to sea turtles and/or nests are imminent. If it is determined that no impacts will occur, the activities will be carried out in consultation with the U.S. FWS biologist.

If MEC are discovered in active nesting areas and the MEC presents a hazard requiring immediate disposal, a U.S. FWS biologist will be consulted and it will be determined if relocating the sea turtle nest is necessary. In cases where the sea turtle nests are required to be relocated, the Puerto Rico Department of Natural and Environmental Resources will be procured to perform the nest relocation.

It is anticipated that after consultation with U.S. FWS biologists, intrusive and/or BIP operations, if necessary, will be able to be carried out in these locations without impacts to sea turtles or nests during the appropriate time of the year.

7.3.2 ALL WASTE DISPOSAL

All detected metal that has been cleared as other waste materials that are generated by the clearance action will be inspected and classified before being sent to a commercial or municipal landfill for proper disposal. These wastes will consist primarily of waste paper, food and beverage containers, and expendables such as uncontaminated but used protective clothing.

7.3.3 ALL BURNING ACTIVITIES

Burning activities will be limited to the open detonation of MEC. All detonations will be performed in conformance with the safety measures presented in Chapter 3 and USA SOPs (Appendix K). Holes in the soil that result from detonations will be filled in and the ground restored to its previous condition. Open fires such as campfires or fires to dispose of cut brush will not be permitted during the performance of this project. Smoking will be restricted to within closed automobiles or other designated areas. Smoking areas will be designated by the UXOSO.

In all cases, cigarette butts and matches *must* be disposed either in an automobile ashtray or in a metal butt can. Cigarette butts and matches may not be tossed from car windows or discarded onto the ground surface.

7.3.4 DUST AND EMISSION CONTROL

Dust sources during operations may result from vehicular traffic on dirt roads, and dust from the detonation of UXO. Dust control measures will include the following.

- To the maximum practical extent, travel will be performed on paved roads. To minimize dust generation on dirt roads, speeds will be restricted to the speed limit.
- Best management practices for the control of dust generation will be observed during the detonation of UXO. These practices are described in Chapter 3.
- Emissions sources will include vehicles, including automobiles used to travel within the FUDS. All vehicles and equipment will be in good working order and will meet applicable vehicle emissions requirements.

7.3.5 SPILL CONTROL AND PREVENTION

All fueling and maintenance of vehicles will be performed offsite at appropriate commercial or private facilities. If a severe leak of fuel or other fluids such as antifreeze or transmission fluid occurs in the field because of a tank puncture or a ruptured line, the following procedures should be implemented.

- Promptly berm the site with dirt so that the fuel or fluid does not spread along the ground surface.
- Apply oil-absorbing material such as sawdust or kitty litter to the spill.

- Report the spill to appropriate state and local agencies and follow their instructions for cleanup. It is anticipated that this cleanup usually will involve digging up and drumming contaminated soil, and subsequently disposing of it in an approved landfill. Spills of 204 lb (32 gallons) of gasoline will be reported to the EPA or State EPA through approved channels.
- The fuel tank will not be filled to more than about three-quarters full to prevent overflowing in the field.

7.3.6 ALL STORAGE AREAS

No storage areas are anticipated within any of the MRS.

7.3.7 ACCESS ROUTES

USA crews entering and exiting the work sites will use existing roads and easements. Off-road vehicle travel will be kept to a minimum, and prior to establishing any off-road routes necessary to gain access to sites, consideration will be given to the possible consequences resulting from the channeling of run-off water in ruts. Additionally, local agencies, FWS, and the USACE OE Safety Specialist will be notified and approval from proper authority will be obtained prior to initiating off-road travel or operations. In such cases, the following measures will be taken to minimize the environmental effects.

- Personnel will remain at the off-road site until investigations there are completed for the day. For example, field crews will not start work at an off-road site, leave for a lunch break, and subsequently return to finish the job.
- Any ruts or new roads or tracks that are created by field activities will be restored. The ruts will be filled in and leveled.
- In a situation where the area is wet and rut damage to the environment is certain, the crews should drive on roads and paths to a point as close to the site as possible, and then walk the remaining distance to the site.

7.3.8 TREES AND SHRUBS PROTECTION AND RESTORATION

Protection of trees and shrubs is described in Section 7.2.3.6. It is unlikely that any trees will be removed during the MEC Investigation. Therefore, no provisions for tree restoration are required.

Brush clearing will be restricted to the minimum necessary to effectively investigate and identify anomalies. Demolition and excavation holes will be backfilled.

7.3.9 CONTROL OF WATER RUN-ON AND RUN-OFF

Vegetation clearance may alter drainage patterns. The use of berms, dikes, and barriers with plastic sheeting may be employed as needed to control water run-on/run-off and sediment or siltation migration. All sediment and erosion control measures will be monitored and properly maintained as long as their need exists.

7.3.10 MANIFESTING AND TRANSPORTATION OF WASTES

Wastes that could require transportation potentially include MEC and scrap metal. Any off-site transportation of UXO will be performed by USA in accordance with EPA and DOT regulations. Transportation of scrap metal does not require manifesting.

7.3.11 TEMPORARY FACILITIES

USA will not establish a site trailer command post. Trash will be collected and dumpsters will be dumped or removed, as appropriate.

7.3.12 DECONTAMINATION AND DISPOSAL OF EQUIPMENT

Except for MEC, this project does not involve any hazardous materials or hazardous wastes. Any MEC that is found will be disposed of by detonation. Mitigation will involve filling in any holes resulting from detonation and restoring the disturbed area. Disposal of non-hazardous materials and equipment is described in paragraph 7.3.2 and will not require decontamination or mitigation.

7.3.13 MINIMIZING AREAS OF DISTURBANCE

Procedures for minimizing areas of disturbance are described throughout this environmental protection plan and include such measures as:

- Driving on roads as much as possible and limiting off-road travel
- Complying with the SOP in Appendix M
- Performing minimum necessary vegetation clearance and excavation in wetlands and riparian areas
- Replacing soil into holes that result from the detonation of UXO.

7.4 PROCEDURES FOR POST-ACTIVITY CLEANUP

All wastes will be removed from each site immediately upon completion of each day's field activities. Therefore, no post-activity cleanup will be required.

7.5 AIR MONITORING PLAN

Air monitoring is not being performed during this investigation. USA work procedures are designed to minimize vapors, gases, and particulate emissions. Control of fugitive emissions will involve measures such as watering down dry or barren areas, roadways and soil disturbance areas; and covering of spoils piles and stockpiled soil with plastic/tarp. Throughout operations, the UXOSO and UXOTIII will continually monitor the production of dust which, if produced in significant quantities, will dictate the donning of protective masks by on-site personnel.

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8.0 PROPERTY MANAGEMENT PLAN

NOT APPLICABLE

This plan is required only when government property is used. USA will not use government property in the execution of this Task Order.

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**9.0 INTERIM HOLDING FACILITY SITING PLAN FOR RECOVERED CHEMICAL WARFARE
MATERIEL**

NOT APPLICABLE

Not authorized by the Performance Work Statement.

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10.0 PHYSICAL SECURITY PLAN FOR RECOVERED CHEMICAL WARFARE MATERIEL SITES

NOT APPLICABLE

Not authorized by the Performance Work Statement.

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11.0 REFERENCES

The following are references applicable to this project. USA will comply with applicable Federal, State, and local requirements. Following all applicable requirements and regulations listed in the following publications will ensure the safety and health of onsite personnel and the local community.

11.1 U.S. ARMY CORPS OF ENGINEER REPORTS

- DERP FUDS Culebra, Puerto Rico, Property No. I02PR0068, Inventory Project Report (INPR), CULEBRA, PUERTO RICO, PROPERTY NO. I02PR0068, MAY 1991.
- DERP FUDS Culebra, Puerto Rico, Property No. I02PR0068, Inventory Project Report (INPR), Revised July 2005 (Final).
- Archives Search Report, Findings, Ordnance and Explosive Waste, Culebra Island National Wildlife Refuge, Culebra, Puerto Rico, February 1995.
- Archives Search Report Supplement, Findings, Ordnance and Explosive Waste, Culebra Island National Wildlife Refuge, Culebra, Puerto Rico, 2004.
- Supplemental Archives Search Report, Culebra, Puerto Rico, Property Number I02PR0068, dated September 2005.
- Final Engineering Evaluation/Cost Analysis, Culebra, Puerto Rico, Environmental Science & Engineering, 1996.
- Site-Specific Final Report, UXO Construction Support, Culebra Island Wildlife Refuge, Culebra Island, Puerto Rico, Ellis Environmental Group, 2004.
- Site Inspections Project, Final Site Inspection Report, Culebra Island, Puerto Rico, FUDS Project No. I02PR006802, Parsons Infrastructure & Technology, 2007.

11.2 U.S. ARMY CORPS OF ENGINEER GUIDANCE DOCUMENTS

- EM 200-1-4. Environmental Quality - Risk Assessment Handbook, 1999.
- EM 1110-1-1002. Engineering and Design - Survey Markers and Monumentation, 1990.
- EM 1110-1-4009. Engineering and Design - Military Munitions Response Actions, 2007.
- EM-1110-1-100 Engineering and Design – Conceptual Site Models for Ordnance and Explosives (OE) and Hazardous, Toxic, and Radioactive Wastes (HTRW) Projects, 2003.
- EM 385-1-97 Explosives Safety and Health Requirements Manual
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- EP 75-1-4. Recurring Reviews on Ordnance and Explosives (OE) Response Actions, 2003.

11.3 U.S ARMY DOCUMENTS

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- TM 60A 1-1-31, Explosive Ordnance Disposal Procedures, 1994.
- AR 385-64, Ammunition and Explosives Safety Standards, 1999.
- AR 190-11, Physical Security of Arms, Ammunition and Explosives, 2006.

11.4 DEPARTMENT OF DEFENSE DOCUMENTS

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- DOD 4145.26-M, *Contractor's Safety Manual for Ammunition and Explosives*
- DOD 4160-21-M, *Defense Demilitarization Manual*
- DDESB TP-18, *Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel*

11.5 OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

Occupational Safety and Health Administration (OSHA) 1994 *General Industry Standards*, 29 CFR 1910 and *Construction Industry Standards*, 29 CFR 1926; especially 1910.120/29CFR 1926.65-*Hazardous Waste Site Operations and Emergency Response*.

11.6 U.S. ENVIRONMENTAL PROTECTION AGENCY

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11.7 FEDERAL REGULATION

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 - 33 CFR 320 Wetlands Protection Act
 - 40 CFR 300.430 National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 1993.
 - 40 CFR Part 261.23 Resource Conservation and Recovery Act.
 - 49 CFR Parts 100-199 Transportation.
 - 62 Federal Register 6622, 1997 Military Munitions Rule.
- Fish and Wildlife Coordination Act 16 U.S.C. 661 et seq.
- Endangered Species Act 16 U.S.C. 1531-154.
- Migratory Bird Treaty Act 16 U.S.C. 703-712.
- National Historic Preservation Act 16 U.S.C. 1470.
- Clean Water Act 33 U.S.C. 1151 et seq., 1251 et seq., 40 U.S.C. 3906 et seq.
- Comprehensive Environmental Response, Compensation, and Liability Act 42 U.S.C. 9601-11050.
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- Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) Publication 5400.7, Federal Explosives Laws and Regulations
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11.8 OTHER DOCUMENTATION/SURVEYS AND STUDIES

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