FINAL
WORK PLAN

Environmental Baseline Survey
Culebra Water Ranges – Flamenco Bay Water Area (MRS 03) and Luis Peña Channel (MRS 12)

Culebra, Puerto Rico

November 16, 2012

Prepared under:

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Prepared for:

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ABBREVIATIONS AND ACRONYMS

AP	armor piercing
APP	Accident Prevention Plan
ARAR	applicable or relevant and appropriate requirement
ARPA	Archaeological Resources Protection Act
ASR	Archives Search Report
BIP	blow-in-place
BTM	Benthic Terrain Modeler
CADD	computer-aided design and drafting
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CESAJ	Corps of Engineers Jacksonville District
CFR	Code of Federal Regulations
CHIRP	Compressed High Intensity Radar Pulse
CSM	conceptual site model
CTD	conductivity, temperature and depth
DERP	Defense Environmental Restoration Program
DGM	digital geophysical mapping
DID	Data Item Description
DNER	Department of Natural and Environmental Resources
DoD	Department of Defense
DR	Daily Report
DTM	digital terrain model
EBS	environmental baseline survey
EE/CA	Engineering Evaluation and Cost Analysis
EEG	Ellis Environmental Group, Inc.
EFH	essential fish habitat
EM	Engineer Manual
EOD	explosive ordnance disposal
EPP	Environmental Protection Plan
ESA	Endangered Species Act
FAR	Federal Acquisitions Regulations
FOL	field operations lead
FTP	file transfer protocol
FUDS	Formerly Used Defense Site
GAMS	GPS azimuth measurement subsystem
GeoTIFF	geo-referenced Tagged Image File Format
GIS	geographic information system

ABBREVIATIONS AND ACRONYMS
(Continued)

GPS	global positioning system
HE	high explosives
HIPS	Hydrograph Information Processing System
Hz	hertz
IHO	International Hydrographic Organization
IMU	inertial motion unit
INPR	Inventory Project Report
kHz	kilohertz
MBE	multibeam echosounder
MC	munitions constituent
MD	munitions debris
MEC	munitions and explosives of concern
MGA	Marine Gradiometer Array
MLLW	mean lower low water
mm	millimeter
MMRP	Military Munitions Response Program
MPPEH	material potentially presenting an explosive hazard
MRS	Munitions Response Site
NAD83	North American Datum 1983
Navy	Department of the Navy
NHA	National Heritage Area
NHL	National Historic Landmarks Program
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	National Oceanic and Atmospheric Administration Fisheries Service
NRIS	National Register Information System
OPUS	Online Positioning User Service
PESM	Program Environmental Safety Manager
PHINS	Photonic Inertial Navigation System
PjM	Project Manager (TtEC)
PM	Project Manager (USACE)
PPE	personal protective equipment
PREQB	Puerto Rico Environmental Quality Board
PWS	Performance Work Statement

ABBREVIATIONS AND ACRONYMS
(Continued)

QA	quality assurance
QC	quality control
QCM	quality control manager
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
ROV	remotely operated vehicle
RTK	real-time kinematic
SHPO	State Historic Preservation Office
SIPS	Sidescan Image Processing System
SOP	Standard Operating Procedure
SSHO	Site Safety and Health Officer
SSS	sidescan sonar
SUXOS	Senior Unexploded Ordnance Supervisor
SVP	sound velocity profile
T&E	threatened and endangered
T&M	time and materials
TBC	To Be Considered
TMP	Technical Management Plan
TPP	Technical Project Planning
TtEC	Tetra Tech EC, Inc.
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center, Huntsville
USC	U.S. Code
USFWS	U.S. Fish and Wildlife Service
UTC	Coordinated Universal Time
UXO	unexploded ordnance
VCF	vessel configuration file
VHF	very high frequency

1.0 INTRODUCTION

1.1 PROJECT AUTHORIZATION

1.1.01 Tetra Tech EC, Inc. (TtEC) is the prime contractor to the U.S. Army Engineering and Support Center, Huntsville (USAESCH) under Contract W912DY-10-D-0015, Task Order 0003. This Task Order was established to perform a munitions and explosives of concern (MEC) Remedial Investigation/Feasibility Study (RI/FS) of the Culebra Water Ranges, located in Culebra, Puerto Rico. A copy of the Performance Work Statement (PWS) is included as Appendix A.

1.1.02 This project falls under the Defense Environmental Restoration Program (DERP) for Formerly Used Defense Sites (FUDS). The work conducted for this project will be performed in a manner consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Sections 104 and 121; Executive Order 12580; and the National Oil and Hazardous Substances Pollution Contingency Plan. All activities involving work in areas potentially containing material potentially presenting an explosive hazard (MPPEH) will be conducted in full compliance with USAESCH, Department of Defense (DoD), Department of Army, U.S. Army Corps of Engineers (USACE), and local requirements regarding personnel, equipment, and procedures. Activities under this PWS fall under the applicable provisions of 29 Code of Federal Regulations (CFR) 1910.120.

1.2 PROJECT PURPOSE AND SCOPE

1.2.01 The purpose of this phase of the project is to conduct an environmental baseline survey (EBS) for two underwater Munitions Response Sites (MRSs). MRS 03 and MRS 12 are located offshore east and west-southwest, respectively, of the Northwest Peninsula of Culebra, Puerto Rico. MRS 03, also known as the Flamenco Bay Water Area (FUDS Project No. I02PR006803M01), and MRS 12, also known as the Luis Peña Channel Water Area (FUDS Project No. I02PR006812M01), will be referred to herein as Flamenco Bay and the Luis Peña Channel, for consistency. The primary field activities performed during the EBS will include multibeam echosounder (MBE) bathymetry, sidescan sonar (SSS), and underwater video surveys to conduct a benthic terrain and habitat assessment prior to the RI/FS. This work plan addresses activities that will be performed for the EBS, the first phase of the RI. Additional work plans will be developed for subsequent phases of the RI.

1.3 WORK PLAN ORGANIZATION

1.3.01 This work plan has been developed for the EBS and has been prepared in accordance with Data Item Description (DID) WERS-001.01 (Work Plans) and Engineer Manual (EM) 1110-1-4009 Chapter 4 – Work Plans. Additional work plans will be developed for subsequent phases of the RI. The sections that comprise the EBS Work Plan are discussed below.

- Section 1, Introduction, of this Work Plan details the overall scope and objective of the

project, presents the organization of the work plan, and presents an overview of the site and its history.

- Section 2, Technical Management Plan, details the organizational structure, lines of authority, and communication of the project team.
- Section 3, Field Investigation Plan, describes the approaches to be taken for the procedures that will be implemented to complete the required field work.
- Section 4, Quality Control (QC) Plan, describes TtEC's procedures for controlling and measuring the quality of work performed, including the organization, responsibilities, and policies to be implemented.
- Section 5, Explosives Management Plan, describes details for management of explosives used to destroy MEC recovered during the project, including acquisition receipt, storage, transportation, and inventory. This plan is not included in this Work Plan for the EBS but will serve as a placeholder section.
- Section 6 describes the Environmental Protection Plan (EPP), which provides general information and lists applicable requirements.
- Section 7, Property Management Plan, describes how property management will be performed.
- Section 8, Interim Holding Facility Siting Plan for Recovered Chemical Warfare Materiel (RCWM) Projects, is not applicable to this project and will serve as a placeholder section only.
- Section 9, Physical Security Plan for RCWM Project Sites, is not applicable to the project and will serve as a placeholder section only.
- Section 10, References, includes a list of references used in the preparation of this Work Plan.

1.3.02 Additional information and plans are attached to this Work Plan as appendices:

- Task Order Scope of Work: The PWS is included as Appendix A.
- Standard Operating Procedures (SOPs): The SOPs were prepared by USACE and are included as Appendix B.
- Points of Contact: Various points of contact are listed in Appendix C to this Work Plan.
- Accident Prevention Plan (APP): The APP is attached as Appendix D of this Work Plan. The APP describes the health and safety procedures, personal protection standards, and environmental health hazards applicable to this project.
- Snorkeling Safety Plan: A Snorkeling Safety Plan is included in Appendix E.

- Contractor Forms: Relevant forms and templates are provided in Appendix F.
- Contractor Personnel Qualifications Certifications Letter: Qualification certifications of key personnel are included in Appendix G.
- Technical Project Planning (TPP) Work Sheets and Documentation: Appendix H contains the TPP Work Sheets, conceptual site models (CSMs) for MEC and MC, and minutes from the TPP meetings.

1.4 PROJECT PROPERTY DESCRIPTION

1.4.01 Culebra Island is located approximately 17 miles east of the island of Puerto Rico and is approximately 9 miles from the Island of Vieques (Figure 1-1).

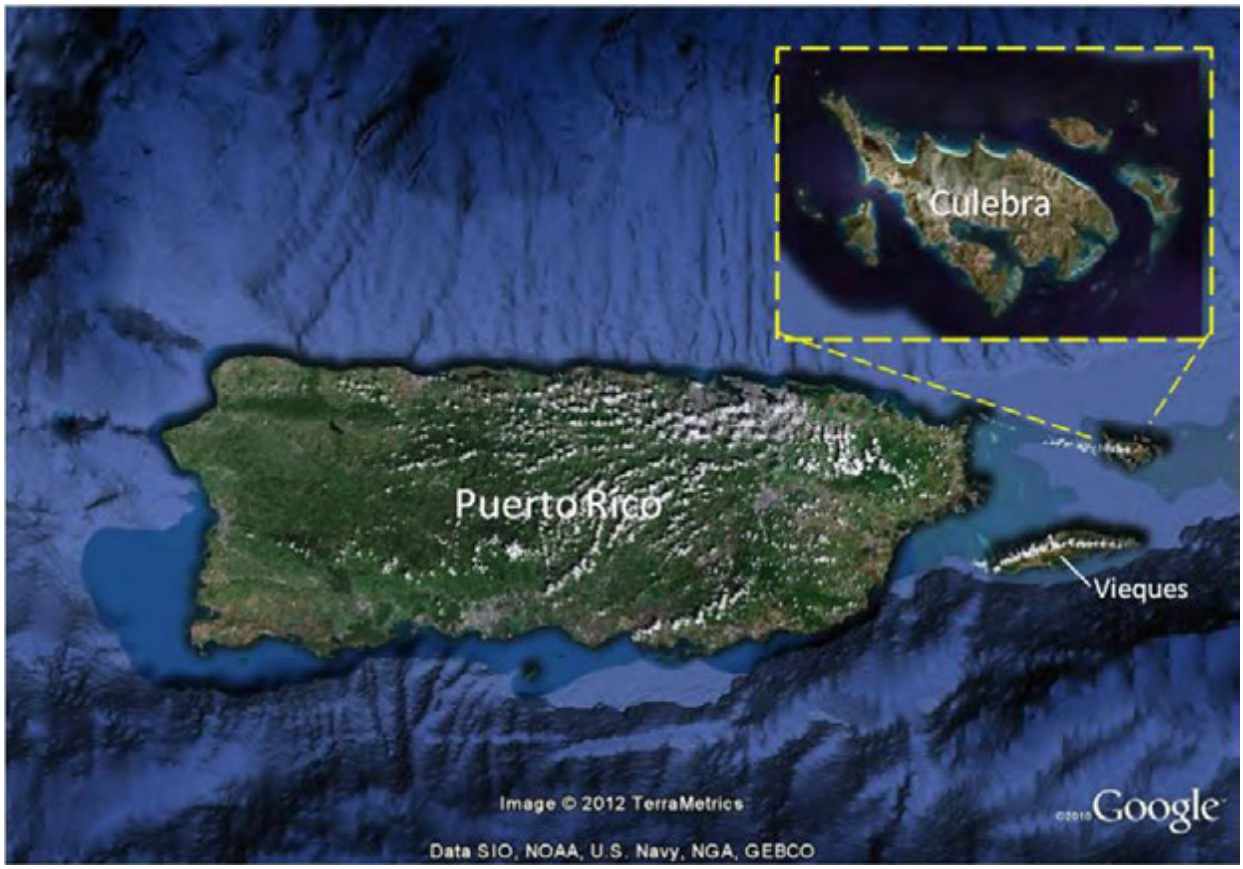


Figure 1-1. Location Map of Culebra

1.5 PROJECT HISTORY

1.5.01 The Culebra Island Archipelago (including the Northwest Peninsula of Culebra and these two water range MRSs) was used as an impact range for aerial bombs and rockets, missiles, mortars, and naval projectiles from 1903 until 1975. The southern portion of the Northwest Peninsula of Culebra lies between the two water range MRSs. This peninsula was used as a target for aerial bombing, aerial rockets, strafing, and naval gunfire from roughly 1941 until

1975. Most of the gunfire was indicated to have been fired from ships in the water east of the peninsula and directed at targets on its eastern beach and ridges and plateaus. The upland targets included white painted drums, Sherman tanks, trucks, panels, and circular targets painted on the ground. A movable cable target system was constructed in this area and used for a short time.

1.5.02 The areas between the ridges on the peninsula were used as impact areas for conventional and napalm-laden bombs. Landing practice operations also took place on the beach areas of Flamenco Bay. Some of these exercises were accompanied by the firing of illuminating flares and white phosphorus rounds. Floating target structures may also have been towed off-shore into Flamenco Bay or the waters of Luis Peña Channel and used for training. Most of the munitions discovered to date on the Northwest Peninsula appear to have resulted from naval gunfire, illumination flares, and practice bombs. Since relatively flat trajectory projectiles were typically fired from the ships, it appears unlikely that many rounds fired from the northeast would have impacted on the western slope of the peninsula ridge. However, there may have been overshoots resulting in the potential for MEC in the Luis Peña Channel.

1.5.03 No confirming evidence has been discovered that upland targets were ever placed on the steep western slopes of the peninsula or shoreline areas to the south. The steepness and inaccessibility of these slopes would have made the placement and maintenance of upland targets very difficult. It is also not known with certainty whether floating targets were ever used on the western side of the Northwest Peninsula in the Luis Peña Channel. Naval firing from the west is believed to have been less likely because of the relatively shallow water in many areas and restrictive reefs and small cays. In consideration of these factors, prior MEC investigations in the upland areas of the Northwest Peninsula have focused primarily on its eastern side and northern portion (including the beach and shoreline areas of Flamenco Bay) where evidence of upland targets has been found. The Archives Search Report stated that the TtEC biological dive team observed munitions at Flamenco Beach. This was the only report of MEC or munitions debris (MD) in the water of Flamenco Bay. The Archives Search Report also documented a local scuba dive instructor who said he spotted many underwater ordnance items around Culebra, with the highest concentration in the Luis Peña Channel and water west of Flamenco Peninsula. It was not indicated whether these items were MEC or MD.

1.6 CURRENT AND PROJECTED LAND USE

1.6.01 In 1901, Culebra's public land was placed under Department of the Navy (Navy) control. The Island and adjacent cays were used as impact areas and firing ranges for aerial bombs and rockets, missiles, mortars, small arms, artillery rounds, and naval projectiles by the Navy and U.S. Marine Corps from 1903 until 1975. In 1978, part of the public land was transferred to the Commonwealth of Puerto Rico and the rest to the U.S. Fish and Wildlife Service (USFWS). Lands were transferred to the Commonwealth through a Quitclaim Deed and a Cooperative

Management Agreement signed by the Government of Puerto Rico and the Department of the Interior in 1982.

1.6.02 The Finding and Determination of Eligibility, dated December 24, 1991, qualified 2,660 acres of Culebra Island and adjacent cays as eligible for consideration under the DERP-FUDS. However, upon subsequent review of historical material from the National Archives, it was determined that all of Culebra Island and the adjacent cays should be considered a FUDS except the Northwest Peninsula, which is not eligible under the 1982 Quitclaim Deed and Public Law 93-166, and the tract that was controlled by the Navy after 1986. The revised area covered by the DERP-FUDS projects for Culebra Island and adjacent cays consists of approximately 8,430 acres. Figure 1-2 shows the DERP-FUDS project for Culebra.

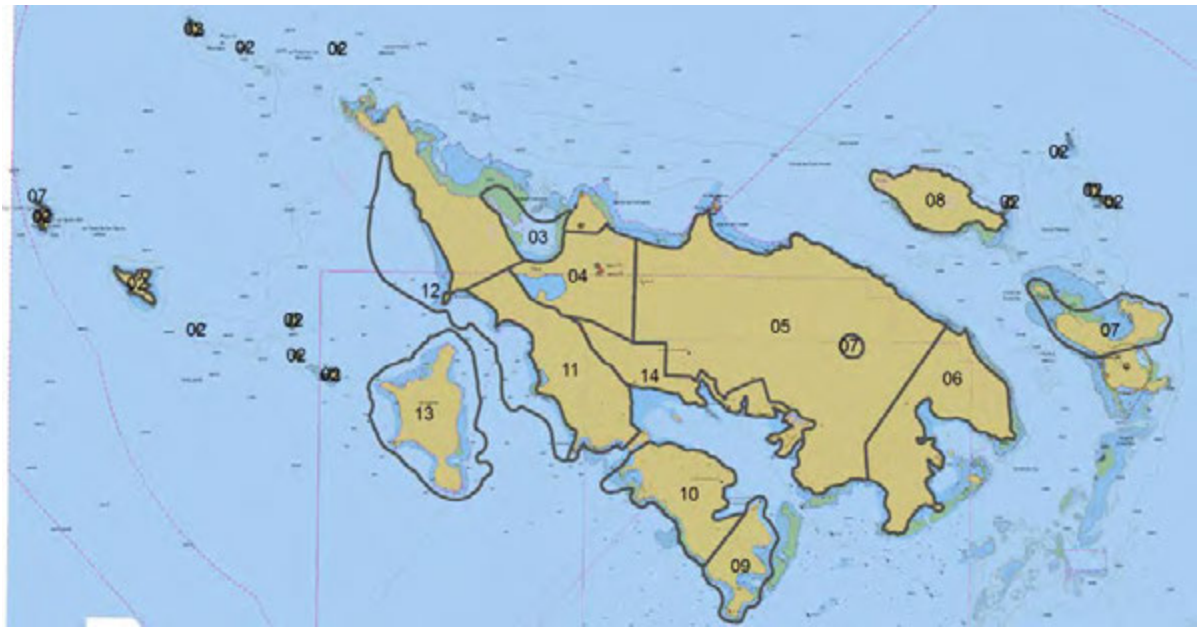


Figure 1-2. DERP-FUDS Projects for Culebra

1.6.03 The objective of DERP-FUDS projects are to reduce risk to human health and the environment and reduce the hazards to public safety presented by military munitions through implementation of effective, legally compliant, and cost-effective response actions. The TPP Team, comprising federal and Commonwealth of Puerto Rico agencies, agreed to conduct underwater water investigations in an effort to gather information that would help to determine the nature and extent of munitions constituent (MC) or MEC contamination on Culebra Island. Tetra Tech will conduct underwater investigations in MRS 03 and MRS 12 to: a) characterize and map benthic habitats within investigation areas; b) determine, identify, and map endangered or threatened species, in particular coral colonies; c) gather the necessary information to determine potential effects (e.g., location of species versus location of suspected MEC) on endangered or threatened species during remedial investigations and cleanup activities; d) determine presence or absence of MC and MEC; e) characterize the nature and extent of MC and

MEC presence; and f) determine if the MC or MEC pose an unacceptable risk to human health and the environment, which would require further considerations or a response action. The first phase, the EBS (the subject of this Work Plan), will address "a" and "b" above. Subsequent work plans will be developed for the following phases to address the additional objections upon completion of the EBS.

1.7 PREVIOUS INVESTIGATIONS

1.7.01 This section summarizes previous investigations conducted at Culebra. The following sections are taken from the Final Site Inspection Report (Parsons 2007) and information provided by the USAESCH.

1.7.1 1991 Inventory Project Report

1.7.1.01 An Inventory Project Report (INPR) was signed on December 24, 1991, establishing the Culebra Island site as a FUDS, defining a site boundary, and assigning the FUDS Project No. I02PR006800 (USACE 1991). The Findings and Determination of Eligibility 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)."

1.7.2 1995 Archives Search Report

1.7.2.01 The Archives Search Report (ASR) was completed by the USACE Rock Island District in February 1995 (USACE 1995) after reviewing available records, photographs, and reports that documented the history of the site. As part of the ASR, a site visit was conducted in October 1994, during which the team identified 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.

1.7.3 1995 Interim Remedial Action

1.7.3.01 In 1995 MTA, Inc. completed an interim remedial action on 3.66 acres of the Flamenco Bay Campground (MRS 02) near Flamenco Beach to dispose of unexploded ordnance (UXO) within 2 feet of the ground surface at the campground (MTA 1995). Work was conducted on the site between May 12 and May 26, 1995. MTA found 11 items of UXO and munitions-related scrap.

1.7.4 1997 Final Engineering Evaluation/Cost Analysis

1.7.4.01 In March 1997, Environmental Science and Engineering, Inc. submitted the *Final Engineering Evaluation and Cost Analysis (EE/CA) for the Former Culebra Island Naval Facility, Culebra Island, Puerto Rico* (ESE 1997). The EE/CA investigation included surface and subsurface sample grids on Flamenco Peninsula, Isla Culebrita, Cayo Botella, Cayo del Agua, Cayo Lobo, and Cerro Balco, where only ordnance-related scrap was identified. Items

found included 20 millimeter (mm) high explosive (HE) incendiary devices, Mk76 practice bombs, Mk50s, 37-mm projectiles, 5-inch rockets, 76-mm projectiles, 3- to 6-inch naval projectiles, 81-mm mortars, and a grenade.

1.7.5 2004 UXO Construction Support

1.7.5.01 In June 2004, Ellis Environmental Group, LC (EEG) submitted the *Site-Specific Final Report, UXO Construction Support, Culebra Island Wildlife Refuge, Culebra Island, Puerto Rico* (EEG 2004). The report documented clearance efforts conducted by EEG on the Northwest Peninsula. Ellis performed four phases of clearance from January 2001 to February 2004. Phase I consisted of clearance support by clearing roadways, a wind generator foundation, and a desalination plant foundation, as well as re-grading the site. Phase II of the construction support was not exercised due to a stop in funding for the construction project. 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.

1.7.5.02 During UXO Construction Support project, Ellis excavated 6,121 holes and recovered 15,479 pounds of scrap metal and 249 UXO items. Fifteen (15) of the 249 UXO items were found within the boundary of the southern portion of the Northwest Peninsula principal area of interest.

1.7.6 2004 Archives Search Report Supplement

1.7.6.01 The ASR Supplement was completed by the USACE Rock Island District as an addition to the 1995 ASR (USACE 2004). This report provides details of aerial training conducted by the Navy between 1935 and 1975 and identifies range/sub-range areas. Of the identified areas, boundaries of the following sub-ranges encompass areas within or adjacent to MRSs 03 and 12:

- Water West: Part of this area in 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.
- Naval Gunfire Target Area: This range was a naval gunfire and air-to-ground range with its target located on Northwest Peninsula. Munitions included general small arms, .50-caliber small arms ammunition, 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.

- 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 Mk80 series general purpose bombs and 2.75-inch rockets.
- Air-to Ground North: This target was located at the northern tip of Northwest Peninsula. Munitions used include general small arms, .50-caliber small arms ammunition, 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. Munitions used include general small arms, .50-caliber small arms ammunition, Mk82 500-pound general purpose bombs, 2.75-inch rockets, and 11.75-inch Tiny Tim rockets.

1.7.6.02 No site visit was conducted in support of the ASR Supplement.

1.7.7 2005 Revised Inventory Project Report

1.7.7.01 A Revised INPR was completed in June 2005 (USACE 2005a). The Revised INPR further clarified 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 project was identified and assigned the number 00, and 13 MMRP project areas were identified and assigned Risk Assessment Code scores. MRSs 03 and 12 were each assigned as Risk Assessment Code 1.

1.7.8 2005 Supplemental Archives Search Report

1.7.8.01 The Supplemental ASR was completed by the USACE St. Louis District in 2005 as an addition to the 1995 ASR (USACE 2005b). 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 2007 site inspection. This document provided a detailed summary of military activities conducted on Culebra Island and the surrounding cays. The document summarizes planned and/or executed maneuvers and training conducted at the site, including specific time periods, locations, and munitions used.

1.7.9 Cultural and Archeological Resources

1.7.9.01 The following is taken from the Final Site Inspection Report (Parsons 2007):

> "According to the National Register Information System (NRIS), National Historic landmarks (NHL) list, national Heritage Areas (NHA) list, and national park Service (NPS), there is only one registered cultural resource within the boundaries of the Culebra Island site. On the Isla Culebrita is an historic lighthouse called Faro Isla de Culebritas. The lighthouse is not open to the public due to building deterioration. According to the Puerto Rica State Historic Preservation Office (SHPO), there are no known architectural resources within the boundaries of the Culebra Island site; however, an architectural survey has not yet been conducted for Culebra. An archeological survey performed at

Lower Camp in 1992 found evidence of prehistoric and historic inhabitants distributed over a half-acre area within the Lower Camp site."

1.7.10 2006 and 2007 Underwater Investigations

1.7.10.01 Between 2006 and 2007, several underwater investigations and surveys were performed around Culebra. In 2006, the USACE performed a feasibility study of geophysical methods for offshore military munitions response surveys in the vicinity of Culebra Island. In addition, preliminary underwater video surveys were conducted by USA Environmental in support of their ongoing RI/FS task order to investigate the water areas around MRS 09 (Soldado Point) and MRS 13 (Luis Pena). USA Environmental has teamed with Parsons, another contractor, to perform the underwater investigation around Culebrita (MRS 07) and adjacent cayos (MRS 02). In 2007, Science Applications International Corporation (or SAIC) performed a marine towed array survey, running a series of transect surveys of various bays on the southwest side of Culebra and on all sides of the much smaller island Cayo de Louis Peña.

1.8 INITIAL SUMMARY OF MEC RISK

1.8.01 MEC is a safety hazard and, as such, may constitute an imminent and substantial endangerment to the general public, on-site personnel, and the environment. Numerous MEC and MD items have previously been recovered from Culebra (see Section 1.6), and there is potential for additional items to be present. Members of the public have access to Flamenco Bay and Luis Peña Channel; consequently, there is potential for public access to MEC if present.

1.8.02 Potential MEC at the Flamenco Bay and Luis Peña Channel sites consists of both munitions known or suspected to have been used and the types of MEC and MD that have previously been recovered or observed. Types of munitions anticipated based on the ASR and EE/CA findings include:

- Small arms ammunition;
- Rockets;
- Grenades;
- Projectiles;
- Artillery;
- Mortars;
- Mines; and
- Various fuzes associated with the above munitions.

1.8.03 All field personnel will be given recognition training on the types of munitions known or suspected to be present prior to commencing any field activities. The EBS includes no intrusive activities, but in the event MEC is encountered, all personnel will be instructed to avoid any physical contact with the item or surrounding terrain, to record its location and associated sensor

or imagery data, and provide this information in the report. There is a possibility MC may also be present at the site, although there are currently no data available to make this determination. In certain concentrations and site conditions MC may pose risks to human health or the environment.

1.9 INITIAL CONCEPTUAL SITE MODEL

1.9.01 A CSM is a description of a site and its environment that can be used to summarize potential contamination and the possible human and environmental receptors, and also to focus the investigation. The CSM is a 'living document' based on existing knowledge and updated throughout the course of the project as more data become available.

1.9.02 For the purposes of this RI/FS, initial CSMs have been developed for MEC and MC in accordance with EM 1110-1-1200. Each of these CSMs is presented as a flow chart and shows the potential MEC and MC contamination as well as the receptors that may come into contact with any potential contamination via various media and migration pathways. A CSM summary table has also been prepared to summarize the key information for each MRS, including acreage, potential munitions present and depths, land use, and findings of historical photograph analyses. The CSM summary table and CSMs will be revised based on investigation results and USAESCH, Corps of Engineers Jacksonville District (CESAJ), and stakeholder feedback. As more data are gathered, revised versions will be submitted in subsequent submittals such as the RI and FS reports. The preliminary CSM flow chart and summary table are presented in Figure 1-3 and Table 1-1, respectively, and are included with the TPP documentation in Appendix H of this Work Plan. The CSMs will be presented to the stakeholders during the TPP meetings in support of the RI/FS project.

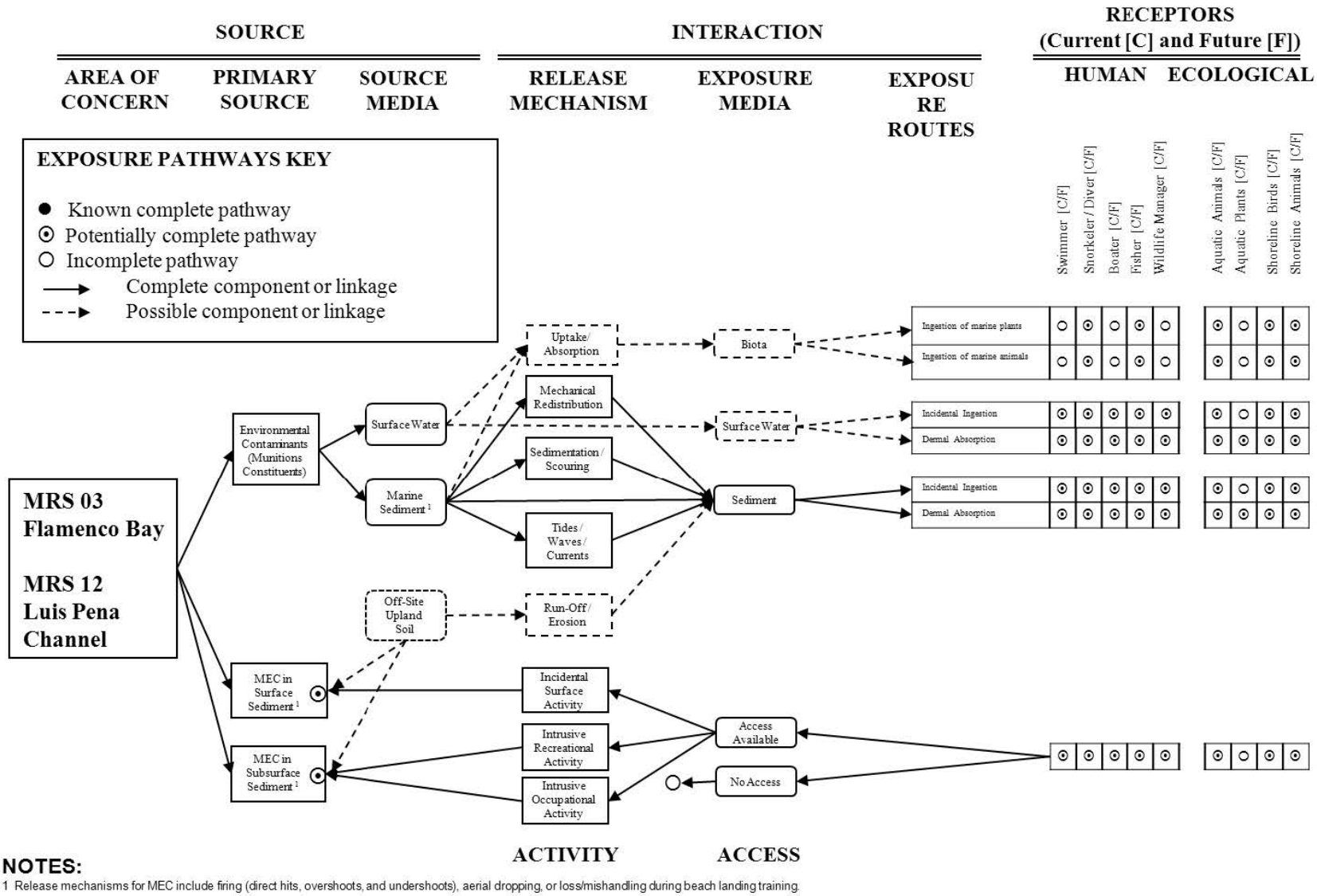


Figure 1-3. Preliminary CSM for Potential Exposure to MEC and MC at the Culebra Water Ranges MRS 03 and MRS 12

Table 1-1. CSM Summary Table

Site	Acres	Site Type	Past DoD Activities	OE-related Items Found Since Closure	Post-DoD Land Use and Current Land Use	PRP Involvement	TPP Recommendations	
							Geophysical Investigations	MEC
MRS 3 – Flamenco Bay	195	OE	Marine amphibious and other training exercises area. Located immediately adjacent to a former Navy gunfire and bombardment area in use from 1934-1975. UXO: Projectiles, Bombs and explosives (20 mm and larger)	Numerous reports or ordnance found since closure. Sources include interviews with local residents, camping ground employees, and government officials.	Recreational. However, residential and commercial areas within 2 miles of the site.	Managed by DNER as a Camping Ground and Public Beach.		
MRS 12 – Luis Peña Channel	835	OE	Located immediately adjacent to the Northwest Peninsula bombardment and impact area. Also Marines fired mortars from higher grounds to the beach. Portions of the site were also used as an impact area for barrage mortar firing from boats. UXO: Projectiles, Bombs and explosives (20 mm and larger)	Numerous reports or ordnance found since closure, specifically in the ocean floor. Sources include interviews with local residents and government officials.	Recreational. However, residential and commercial areas within 2 miles of the site.	Managed by DNER as a Natural Marine Reserve.		

Notes:
DNER – Department of Natural and Environmental Resources
DoD – Department of Defense
MEC – munitions and explosives of concern
OE – ordnance and explosives
TPP – Technical Project Planning
UXO – unexploded ordnance

2.0 TECHNICAL MANAGEMENT PLAN

2.1 INTRODUCTION

2.1.01 The purpose of the Technical Management Plan (TMP) is to provide the approach and procedures that will be used to execute the tasks required to meet the project objectives. This Work Plan has been developed for the EBS phase of the overall project. Field procedures for this phase of the project include non-invasive marine geophysical surveys. The TMP focuses on project objectives, organization, personnel, communication and reporting, deliverables, schedule, billing, public relations, duties and responsibilities, as well as the functional relationship between the different organizations. For this phase of the project, the applicable elements of the TMP will be presented and discussed. Additional and remaining elements of the TMP will be addressed in subsequent work plans for the follow on phases of work.

2.2 OBJECTIVES

2.2.01 The purpose of the EBS is to provide information to help characterize the nature and extent of sensitive marine habitats and species within the boundaries of MRS 03 Flamenco Bay and MRS 12 Luis Peña Channel. The objective of the EBS is to identify areas of sensitive habitat and to determine where towed operations and sampling can be safely conducted. Underwater investigation activities to be conducted as part of the EBS consist of visual observations, boating and snorkeling operations, and remote sensing surveys. No intrusive investigation will be conducted during the EBS phase of the project. This work plan has been developed to describe these underwater EBS activities. The TPP Team will develop and coordinate further investigations based on the EBS results.

2.3 EBS ORGANIZATION

2.3.01 The EBS project organization consists of representatives from TtEC as depicted in Figure 2-1. Appendix C lists the key points of contact for the Task Order under the EBS phase of work. The roles of each of the Project Delivery Team members are described below.

2.4 TETRA TECH EC PERSONNEL

2.4.01 The EBS will be conducted by the personnel outlined below.

2.4.1 Program Management

2.4.1.01 TtEC program management is provided by following individuals:

- The program manager is Kent Weingardt. The program manager is responsible for ensuring contract requirements are met during the performance of the Task Order.
- The program safety manager is Roger Margotto.
- The munitions response program and diving safety manager is Steve Neill.
- The program QC manager is Mark Dollar.
- The lead hydrographer/geophysicist QC manager is Burr Bridge.

2.4.2 Project Manager

2.4.2.01 The Project Manager (PjM), Scot Wilson, is responsible for the strategic and tactical leadership, management, and administration of the Task Order and is supported at the corporate level with health and safety, project controls, quality, finance, procurement, engineering, and environmental and regulatory compliance. The PjM is responsible for the day-to-day management of project activities, monitoring the project budget, updating the status the project schedule, and ensuring project compliance.

2.4.3 Field Investigation Coordinator

2.4.3.01 Fernando Pagés will serve as the Field Investigation Coordinator for the EBS. Fernando is based in Puerto Rico with knowledge of the personnel and resources for effective implementation of the project. The Field Investigation Coordinator is responsible for coordinating EBS resources on-site to support the project field investigation.

2.4.4 Underwater Lead

2.4.4.01 The underwater lead, Robert Feldpausch, will oversee the technical management of the field program. The underwater lead ensures timely resolution of project-related technical, quality, and safety questions associated with in-water survey operations; coordinates and oversees in-water hydrographic and geophysical work performed by TtEC field and office technical staff, including data collection and interpretation; and coordinates preparation and review of hydrographic and geophysical deliverables.

2.4.5 Field Operations Lead / Quality Control Manager

2.4.5.01 The field operations lead (FOL), Richard Funk, is responsible for implementation of the field program. In addition to Richard Funk, the FOL role may alternatively be fulfilled by Cory Graves or Brent Johnston. The FOL oversees day-to-day field operations for hydrographic studies and in-water geophysical mapping and ensures that proper staffing and resources are available on-site, that personnel have reviewed and understand their responsibilities, and that data collection activities are conducted in accordance with the approved plan and cited standards. For the EBS, the FOL will also serve as the field QC manager (QCM) and is responsible for all aspects of data quality. This individual must ensure that data collection procedures and data processing and interpretation procedures are observed and that the resulting data meet the performance specifications in the approved plan.

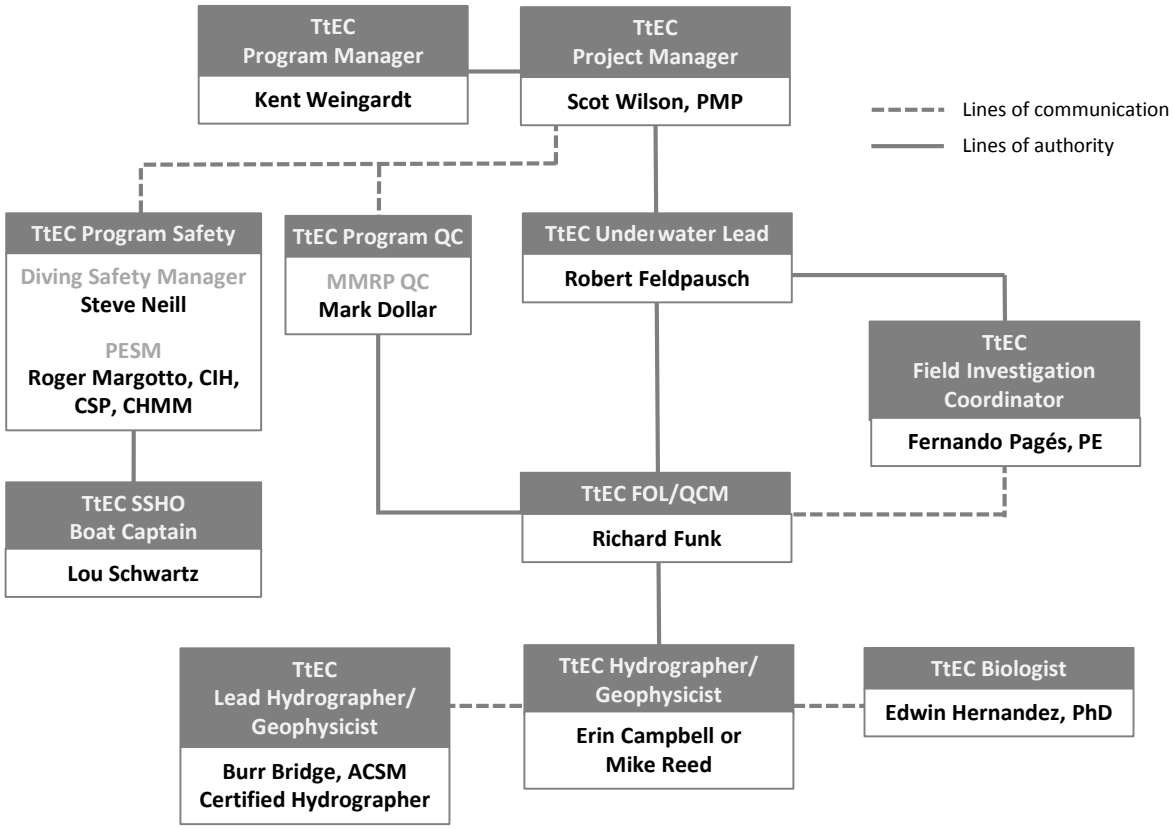
2.4.6 Hydrographers and Geophysicists

2.4.6.01 The lead hydrographer and geophysicist for this project is Burr Bridge, who will primarily perform quality control and data review offsite. Onsite hydrographer/geophysics duties will be performed by Erin Campbell or Mike Reed under the supervision of the FOL/QCM. Alternate personnel who may perform field hydrography and geophysics tasks include Cory Graves, Brent Johnston, Joanna Hobson, Brian Donahue, and/or Kyle Enright.

Hydrographers and geophysicists are responsible for reviewing and understanding their responsibilities as assigned and for general safety at the project site. They will carry out the daily field activities, which include deployment and operation of survey equipment and acquisition of high-quality survey data under the supervision of the FOL.

2.4.7 Biologists

2.4.7.01 Each team performing underwater investigation work will be accompanied on the boat, but not necessarily in the water, by qualified, trained, and experienced personnel (e.g., biologist, marine biologist, environmental scientist, among others) in order to identify the presence or absence of threatened or endangered species. The primary TtEC field biologist will be Edwin Hernandez-Delgado, Ph.D, with support from Edwin Rodriguez-Class, Ph.D. Both individuals have extensive experience and academic qualifications for observing sea turtles, other marine mammals, and coral and seagrass habitat; they also meet the National Marine Fisheries Service (NMFS) and USFWS requirements for observers and are qualified to provide the endangered species briefings to project personnel. In addition, TtEC has identified a qualified environmental scientist with experience in marine mammal observation, Ms. Maylene Pérez Robles. Training and briefing of project personnel by the project biologist will be completed prior to performing any in-water work.



TtEC FOL/QCM alternates: Brent Johnston, Cory Graves
TtEC Hydrographer/Geophysicist alternates: Cory Graves, Brent Johnston, Joanna Hobson, Brian Donahue, Kyle Enright

Figure 2-1. Environmental Baseline Survey Organization

2.5 COMMUNICATION AND REPORTING

2.5.1 Recordkeeping

2.5.1.01 All aspects of administering the Task Order must be substantiated by permanent records, such as written correspondence, notes, and photographs. It is essential to summarize important non-written communications with notes covering conferences, telephone calls, and discussions, giving the date, location, parties involved, and important topics discussed. Written correspondence is the most deliberate, as well as the most important, of the three general types of contractual communication (i.e., person to person, telephone calls, and written correspondence). Office Communications and Reporting

2.5.1.02 The TtEC Project Manager is responsible for issuing the following documents throughout the duration of the Task Order:

- Meeting minutes (due 5 business days after a meeting);
- Record of telephone conversations (due with the Project Status Report); and
- Project Status Reports (in accordance with DID WERS-016).

2.5.2 Field Communications and Reporting

2.5.2.01 The following communications will be documented in a chronological communications log maintained by the on-site FOL:

- Each and every occasion MEC is encountered;
- When and why work is stopped for safety reasons;
- Health and safety violations;
- Personnel changes and reason for changes; and
- Any deviations from the approved Work Plan that occur in the field (for example, equipment changes, analysis, or problems encountered).

2.5.2.02 During field work, Daily Reports (DRs) will be completed to detail the personnel on-site, production, equipment, lessons learned, and summaries of safety and QC tasks. During the EBS, the DR will include, at a minimum, weather information at the time of survey, field instrument measurements and calibrations (if applicable), any problems encountered, and any Government personnel directives.

2.6 DELIVERABLES

2.6.01 Project deliverables will meet the schedule requirements of the project and will be prepared in accordance with the applicable DID format referenced in the PWS. Deliverables will undergo internal TtEC technical and QC reviews prior to submittal to other organizations. The primary deliverables for associated with the EBS are:

- Work Plan
- Snorkel Plan
- Environmental Baseline Survey Report

2.6.02 The EBS Report will include items presented in Table 2-1 and summarized in the sections below.

Table 2-1. Summary of Data Deliverables

Version	Product	Format
Draft	Report	Electronic (.pdf)
Draft Final	Report	Electronic (.pdf)
Final	Report	Electronic (.pdf) Paper
	Bathymetry	ArcASCII Grid Fledermaus (.scene)
	Bathymetric Imagery	GeoTIFF
	Benthic Terrain Model Results	GeoTIFF
	Sidescan Sonar	GeoTIFF mosaics, 0.25m (.tif)
	Underwater Video	MPEG (1 copy on DVD[s] or hard drive[s])
	Target List	Shapefile

2.6.1 Environmental Baseline Survey Report

2.6.1.01 TtEC will provide a baseline survey report describing the methods, procedures, and quality checks used to perform the bathymetric, digital video, and habitat assessment portions of the survey. The report will be developed and delivered in advance of conducting the subsequent digital geophysical mapping (DGM). The DGM will be performed with a towfish, except for in very shallow water areas (i.e., depths of less than approximately 4 feet) and in areas where coral heads project within 4 feet of the surface. In many instances, the towfish will be used at the surface of the water. TtEC will evaluate environmental factors such as location, tides, water turbulence, and wave action as well as depth for making the determination for entry by vessel and transect coverage/towfish use to prevent damage to coral reefs or sensitive habitats and to prevent accidental groundings. The report will include the bathymetric survey results, including multibeam imagery, a digital elevation model of Flamenco Bay and the Luis Peña Channel, a Benthic Terrain Modeler (BTM; as described in Section 3.5), and a general description of the bottom and habitat types present in the area. The report text will be provided in Portable Document Format (.pdf) format, data products in the form of maps, and digital data in standard geographic information system formats.

2.6.2 MBE Deliverables

2.6.2.01 A combination of CARIS, Fledermaus Pro, ArcGIS, and TtEC-developed software will be used to generate final data products and to downsample the high-resolution multibeam data into a digital terrain model (DTM), which will be based on a 1-meter grid (or less). The minimum number of points required per grid will be one, ensuring that all data collected would be represented. Any grid cell without a sounding will be shown as a hole, or "holiday," in the data set (unless interpolation is requested). Charts displaying the site bathymetry and mapped features will be generated in the project datum at a scale that will be pertinent for site evaluation.

2.6.2.02 In addition to delivering the final bathymetry chart as described above, the bathymetry data will also be provided as a Fledermaus scene electronic file, with a viewer that allows the data to be viewed interactively in three dimensions.

2.6.2.03 The MBE bathymetry and imagery will be analyzed using ArcGIS BTM tools and other software to determine the boundaries of various bottom types within the survey area, and to help locate any discrete features, such as reefs or coral heads and seagrass beds that may represent protected habitat or listed species. The results of these analyses will be delivered in ArcGIS compatible formats (e.g., geo-referenced Tagged Image File Format [GeoTIFF]).

2.6.3 Sidescan Sonar Deliverables

2.6.3.01 Images acquired on adjacent transects will be merged to produce a geo-referenced mosaic.

2.6.3.02 The SSS data will be produced on a series of maps and as a composite image of the sediment surface (mosaic) in GeoTIFF.

2.6.3.03 All survey documentation will be included with the final delivery of the report.

2.6.4 Underwater Video Deliverables

2.6.4.01 To assist regulatory agencies anxious to review the video collected during the underwater video survey, a password-protected file transfer protocol (FTP) or SharePoint site to which to upload the video files will be established by TtEC as part of data processing and QC. If the USAESCH and USACE Jacksonville determine that providing the regulatory agencies access to the video files (prior to submittal of the baseline survey report) will ultimately benefit the task order, TtEC will create usernames and passwords for the specified regulatory agency representatives to view as authorized visitors to the FTP/SharePoint site and post video to the site as Internet connectivity allows.

2.6.4.02 Underwater video footage will be used to refine and ground-truth the bottom type map developed during analysis of the bathymetry and imagery data. In areas of interest, where for example features are present that could be sensitive habitat, the video will be reviewed and still images will be extracted and inserted into the baseline survey report. Additional video

collection, using a remotely operated vehicle (ROV), towed camera sled, and/or a diver using snorkeling equipment, as described in Section 3.3.3, may be necessary to verify bottom type interpretation or feature identification following analysis of the bathymetry and imagery.

2.6.5 Targets

2.6.5.01 While the EBS is not intended to detect munitions, targets of possible MEC identified during acquisition or routine processing of the baseline MBE and SSS data will be compiled into a shapefile with associated images, if appropriate. If a possible MEC target is identified in the video during investigation of sensitive habitat, it will be added to the target shapefile; however, the video will not be reviewed specifically for that purpose.

2.7 SCHEDULE

2.7.01 A project schedule for this phase of the project and associated tasks has been prepared for work planning purposes (Figure 2-2, placed at end of this section for convenience). This schedule will be updated, when necessary, and submitted to USAESCH with the associated progress report. The included schedule is based on the current Draft Work Plan and the anticipated time needed for stakeholder review, TtEC's response to comments and Draft Final and Final Work Plan preparation. Revisions to the project schedule will be included with the project status reports.

2.8 PERIODIC REPORTING

2.8.01 Over the course of the project, periodic reports such as weekly/monthly project status reports and DRs will be required to document project activities. TtEC will prepare these reports in accordance with the PWS, the applicable DIDs, and the project schedule. Specific reports associated with this EBS phase are discussed in Section 2.6 of this Work Plan.

2.9 COSTING AND BILLING

2.9.01 This Task Order was awarded to TtEC as a combination of firm fixed price tasks, fixed unit price tasks, and cost plus fixed fee tasks. The firm fixed price/fixed unit price tasks are billed based on work completed in accordance with the negotiated milestones or accepted unit rates. The cost plus fixed fee tasks are billed based on monthly progress. Milestones will be considered met or completed when the required QC documentation has been submitted, quality assurance (QA) completed, and the submittal is accepted. A milestone payment schedule has been established for this Task Order.

2.10 PROJECT PUBLIC RELATIONS SUPPORT

2.10.01 Site personnel will not disclose any data generated or reviewed during this and each phase of the Task Order and will refer all requests for information concerning site conditions to the CESAJ Project Manager (Tom Freeman) with copy furnished to USAESCH (Roland Belew

and Teresa Carpenter). Information gathered by this project is the property of the DoD and distribution to any other source is prohibited.

2.11 FIELD OPERATION MANAGEMENT PROCEDURES

2.11.01 This subsection lists the major field operation components of the EBS. Detailed descriptions and field procedures to be followed during each of these steps are presented in the subsequent chapters and appendices of this Work Plan. Field operations for the EBS are separated into the following primary steps:

- Mobilization
- Equipment setup and instrument validation
- Environmental Baseline Survey
- Demobilization

2.11.02 TtEC will manage and be responsible for all aspects of the field work during the EBS phase of the project. All work will be performed in accordance with the approved EBS Work Plan and project SOPs, adhering to the appropriate level of care and limitations based upon site-specific conditions and work locations (e.g., presence of endangered species, shallow depths, coral and seagrass habitat, beach activities, and turtle nesting activity) to ensure vessel use and entry, use of the towfish array, entry into areas by snorkelers, and staging of equipment on beaches do no harm to these species and resources. The on-site FOL will be responsible for the on-site operations, ensuring project goals are met in a safe and effective as well as environmentally protective manner. As required in this plan and the SOPs, TtEC will coordinate with USACE project management and natural resource agency personnel with NMFS/National Oceanic Atmospheric Administration (NOAA), Puerto Rico Environmental Quality Board (PREQB), USFWS, and Department of Natural and Environmental Resources (DNER) to schedule the work within the MRSs and sensitive habitats areas. TtEC will also coordinate with the USACE contractor USA Environmental who will be performing work in adjacent water areas and MRSs, to ensure there are no conflicts. The field investigation coordinator and the site geophysicist along with the QC manager will be responsible for the management of onsite field data as it is generated.

2.11.1 General Approach

2.11.1.01 The EBS will be conducted within the boundaries of MRS 03 and 12. Upon completion of the EBS and subsequent report, the project team will evaluate the results for use in developing additional project work plans for DGM and intrusive investigation activities. The intrusive investigation will characterize the nature and define the extent of MEC contamination. The results of these investigations will be used to focus the collection of media samples for the MC analysis.

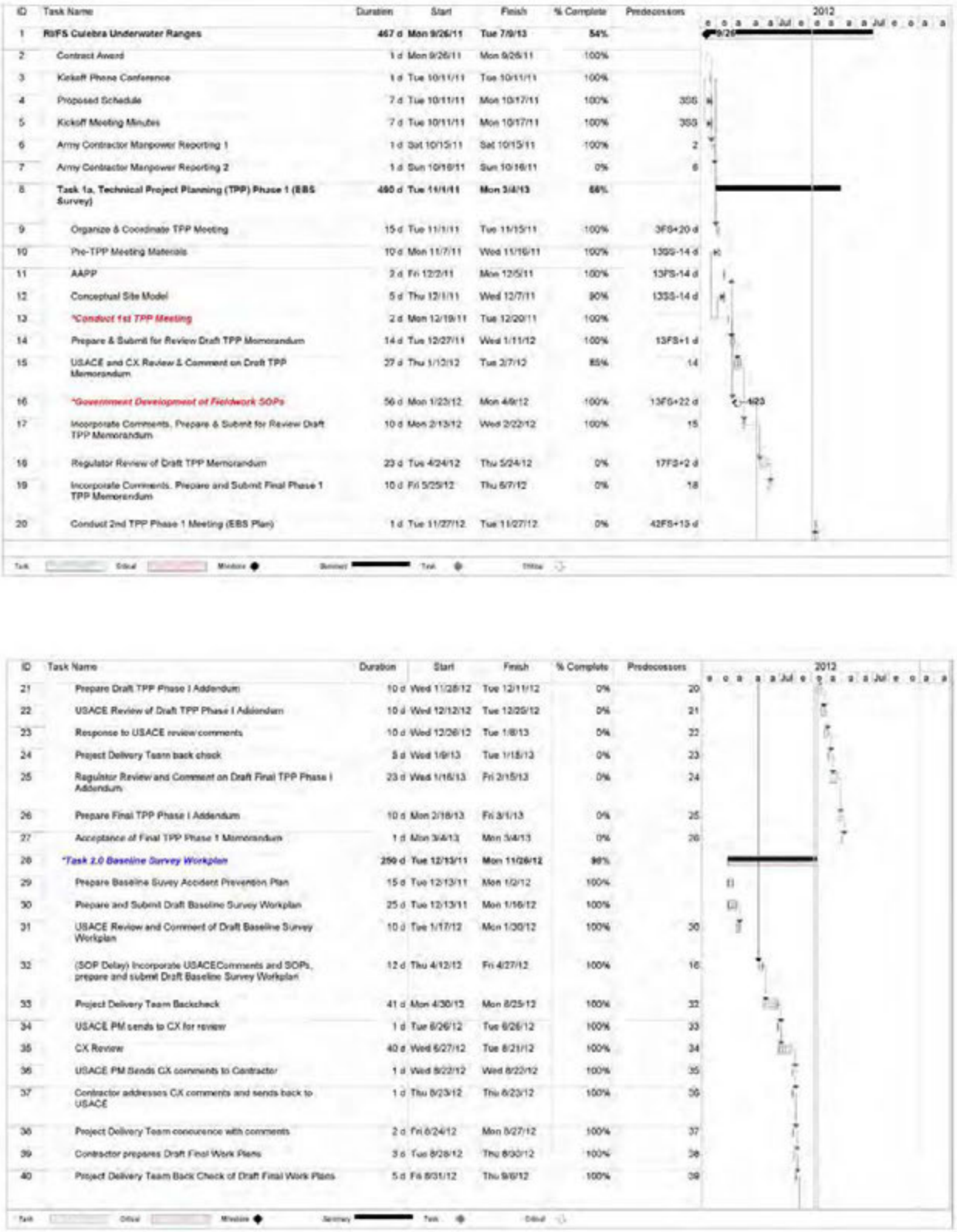
2.11.2 Mobilization

2.11.2.01 Preparation for mobilization will commence prior to receipt of the notice-to-proceed. Upon receipt of the notice to proceed, the field team will be notified, travel and lodging arrangements will be made, and the requisite copies of the applicable project and reference documents will be assembled.

2.11.2.02 Mobilization of the field team and equipment will be conducted based on the sequence of the field tasks. All field personnel will attend site-specific training upon mobilization. The survey team and support personnel will mobilize to the site and establish the field office and support facilities, receive equipment deliveries, and prepare equipment for use. Site preparation activities include establishing support facilities and establishing docking and marine access arrangements, and establishing survey coordinates and parameters. The field crew will complete the installation of survey equipment on the vessels and perform required equipment installations and test prior to the survey.

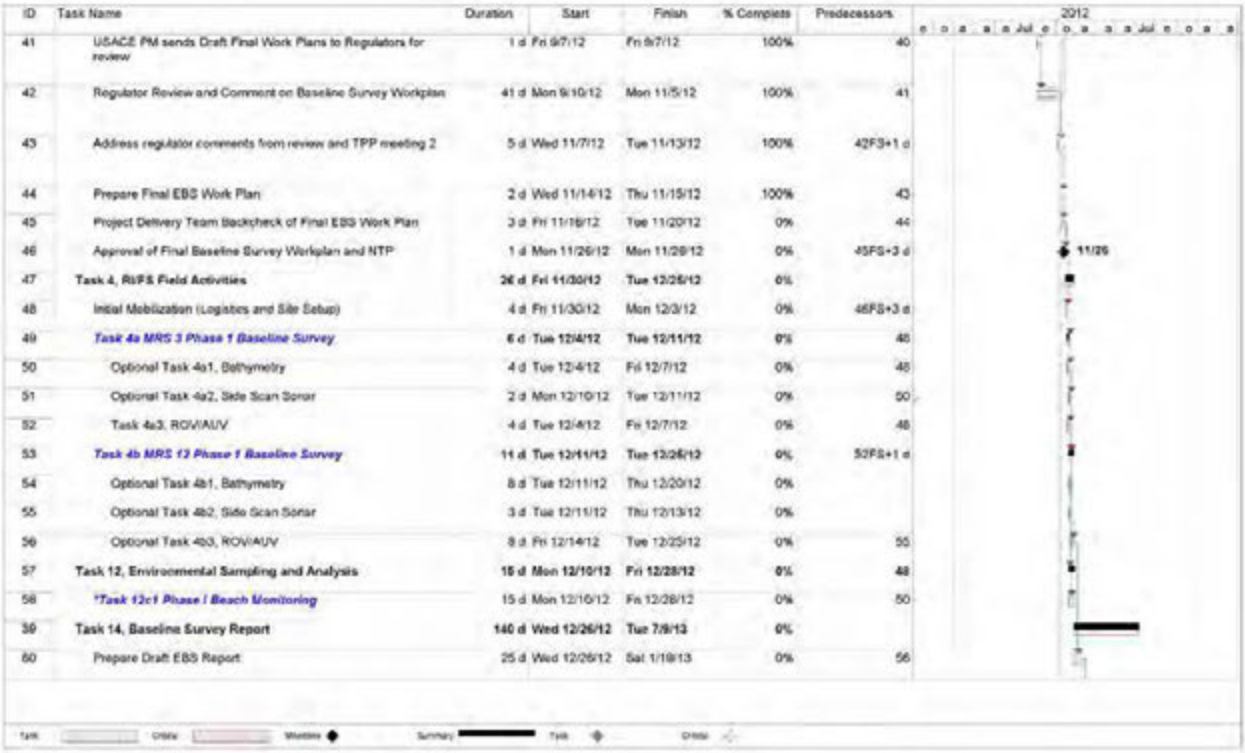
2.11.3 Environmental Baseline Survey

2.11.3.01 Non-invasive marine geophysical surveys will be conducted in Flamenco Bay and Luis Peña Channel extending from 4 feet mean lower low water (MLLW) to the offshore boundary of each site. The EBS will be conducted to evaluate the characteristics of the marine environment and identify endangered species and sensitive areas such as coral reefs that may not be adequately defined. The EBS will be conducted using surface vessel–mounted and/or near surface towed sensor systems and scientific snorkelers to delimit and ensure the preservation of sensitive marine habitats and flora/fauna prior to the use of towed sensors in the water column. A qualified marine biologist under the supervision of the project biologist will be used during the baseline survey to investigate shallow or sensitive habitat areas by swimming with mask, fins, and snorkel to observe and digitally record conditions with a video camera. The baseline survey will also use hull-mounted and towed sensors and video equipment to investigate and document deeper areas of interest. The marine geophysical surveys will include the following remote sensing systems: high-resolution MBE, SSS, and underwater video.

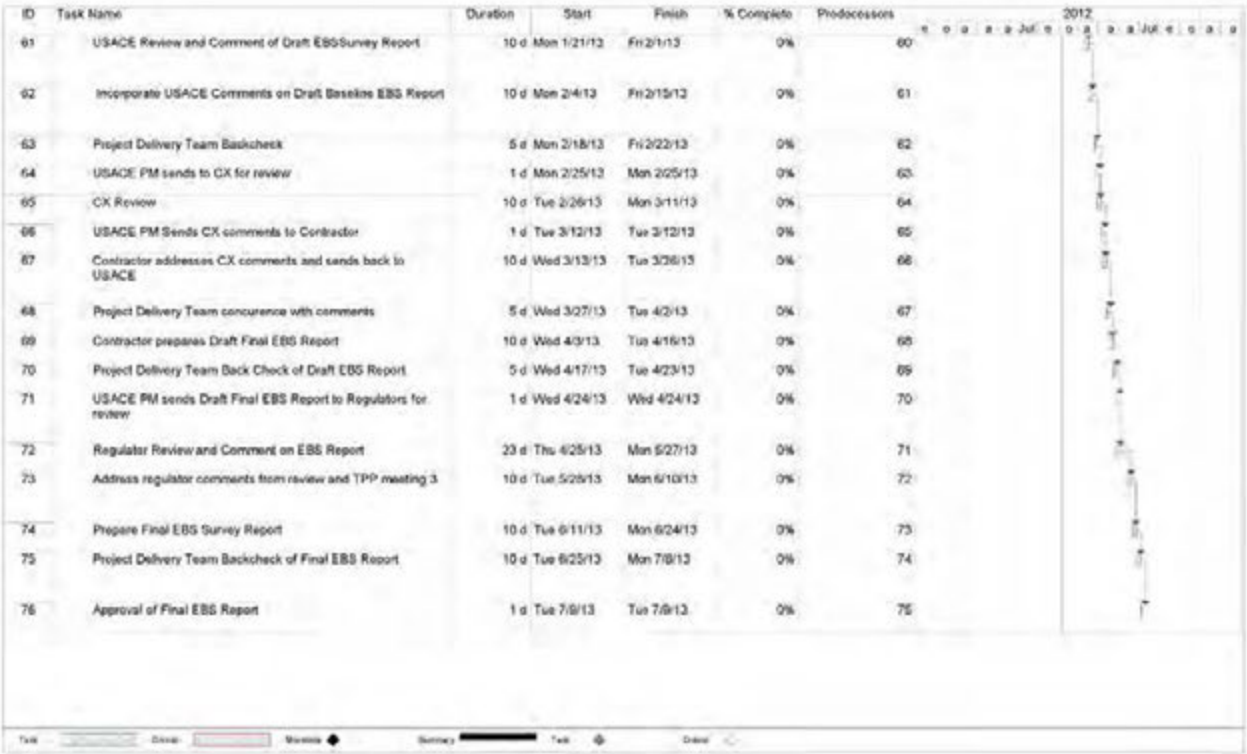


ID	Task Name	Duration	Start	Finish	% Complete	Predecessors
1	**RI/FS Culebra Underwater Ranges**	**467 d**	**Mon 9/26/11**	**Tue 7/9/13**	**54%**	
2	Contract Award	1 d	Mon 9/26/11	Mon 9/26/11	100%	
3	Kickoff Phone Conference	1 d	Tue 10/11/11	Tue 10/11/11	100%	
4	Proposed Schedule	7 d	Tue 10/11/11	Mon 10/17/11	100%	3SS
5	Kickoff Meeting Minutes	7 d	Tue 10/11/11	Mon 10/17/11	100%	3SS
6	Army Contractor Manpower Reporting 1	1 d	Sat 10/15/11	Sat 10/15/11	100%	2
7	Army Contractor Manpower Reporting 2	1 d	Sun 10/16/11	Sun 10/16/11	0%	6
8	**Task 1a, Technical Project Planning (TPP) Phase 1 (EBS Survey)**	**480 d**	**Tue 11/1/11**	**Mon 3/4/13**	**68%**	
9	Organize & Coordinate TPP Meeting	15 d	Tue 11/1/11	Tue 11/15/11	100%	3FS+20 d
10	Pre-TPP Meeting Materials	10 d	Mon 11/7/11	Wed 11/16/11	100%	13SS-14 d
11	AAPP	3 d	Fri 12/2/11	Mon 12/5/11	100%	13FS-14 d
12	Conceptual Site Model	5 d	Thu 12/1/11	Wed 12/7/11	90%	13SS-14 d
13	*Conduct 1st TPP Meeting	2 d	Mon 12/19/11	Tue 12/20/11	100%	
14	Prepare & Submit for Review Draft TPP Memorandum	14 d	Tue 12/27/11	Wed 1/11/12	100%	13FS+1 d
15	USACE and CX Review & Comment on Draft TPP Memorandum	27 d	Thu 1/12/12	Tue 2/7/12	85%	14
16	*Government Development of Fieldwork SOPs	56 d	Mon 1/23/12	Mon 4/9/12	100%	13FS+22 d
17	Incorporate Comments, Prepare & Submit for Review Draft TPP Memorandum	10 d	Mon 2/13/12	Wed 2/22/12	100%	15
18	Regulator Review of Draft TPP Memorandum	23 d	Tue 4/24/12	Thu 5/24/12	0%	17FS+2 d
19	Incorporate Comments, Prepare and Submit Final Phase 1 TPP Memorandum	10 d	Fri 5/25/12	Thu 6/7/12	0%	18
20	Conduct 2nd TPP Phase 1 Meeting (EBS Plan)	1 d	Tue 11/27/12	Tue 11/27/12	0%	42FS+13 d
21	Prepare Draft TPP Phase I Addendum	10 d	Wed 11/28/12	Tue 12/11/12	0%	20
22	USACE Review of Draft TPP Phase I Addendum	10 d	Wed 12/12/12	Tue 12/25/12	0%	21
23	Response to USACE review comments	10 d	Wed 12/26/12	Tue 1/8/13	0%	22
24	Project Delivery Team back check	8 d	Wed 1/9/13	Tue 1/15/13	0%	23
25	Regulator Review and Comment on Draft Final TPP Phase I Addendum	23 d	Wed 1/16/13	Fri 2/15/13	0%	24
26	Prepare Final TPP Phase I Addendum	10 d	Mon 2/18/13	Fri 3/1/13	0%	25
27	Acceptance of Final TPP Phase 1 Memorandum	1 d	Mon 3/4/13	Mon 3/4/13	0%	26
28	*Task 2.0 Baseline Survey Workplan	250 d	Tue 12/13/11	Mon 11/26/12	98%	
29	Prepare Baseline Survey Accident Prevention Plan	15 d	Tue 12/13/11	Mon 1/2/12	100%	
30	Prepare and Submit Draft Baseline Survey Workplan	25 d	Tue 12/13/11	Mon 1/16/12	100%	
31	USACE Review and Comment of Draft Baseline Survey Workplan	10 d	Tue 1/17/12	Mon 1/30/12	100%	30
32	(SOP Delay) Incorporate USACEComments and SOPs, prepare and submit Draft Baseline Survey Workplan	12 d	Thu 4/12/12	Fri 4/27/12	100%	16
33	Project Delivery Team Backcheck	41 d	Mon 4/30/12	Mon 6/25/12	100%	32
34	USACE PM sends to CX for review	1 d	Tue 6/26/12	Tue 6/26/12	100%	33
35	CX Review	40 d	Wed 6/27/12	Tue 8/21/12	100%	34
36	USACE PM Sends CX comments to Contractor	1 d	Wed 8/22/12	Wed 8/22/12	100%	35
37	Contractor addresses CX comments and sends back to USACE	1 d	Thu 8/23/12	Thu 8/23/12	100%	36
38	Project Delivery Team concurrence with comments	2 d	Fri 8/24/12	Mon 8/27/12	100%	37
39	Contractor prepares Draft Final Work Plans	3 d	Tue 8/28/12	Thu 8/30/12	100%	38
40	Project Delivery Team Back Check of Draft Final Work Plans	5 d	Fri 8/31/12	Thu 9/6/12	100%	39

Figure 2-2. Proposed EBS Schedule



ID	Task Name	Duration	Start	Finish	% Complete	Predecessors
41	USACE PM sends Draft Final Work Plans to Regulators for review	1 d	Fri 9/7/12	Fri 9/7/12	100%	40
42	Regulator Review and Comment on Baseline Survey Workplan	41 d	Mon 9/10/12	Mon 11/5/12	100%	41
43	Address regulator comments from review and TPP meeting 2	5 d	Wed 11/7/12	Tue 11/13/12	100%	42FS+1 d
44	Prepare Final EBS Work Plan	2 d	Wed 11/14/12	Thu 11/15/12	100%	43
45	Project Delivery Team Backcheck of Final EBS Work Plan	3 d	Fri 11/16/12	Tue 11/20/12	0%	44
46	Approval of Final Baseline Survey Workplan and NTP	1 d	Mon 11/26/12	Mon 11/26/12	0%	45FS+3 d
47	**Task 4, RI/FS Field Activities**	**26 d**	**Fri 11/30/12**	**Tue 12/25/12**	**0%**	
48	Initial Mobilization (Logistics and Site Setup)	4 d	Fri 11/30/12	Mon 12/3/12	0%	46FS+3 d
49	***Task 4a MRS 3 Phase 1 Baseline Survey***	**6 d**	**Tue 12/4/12**	**Tue 12/11/12**	**0%**	48
50	Optional Task 4a1, Bathymetry	4 d	Tue 12/4/12	Fri 12/7/12	0%	48
51	Optional Task 4a2, Side Scan Sonar	2 d	Mon 12/10/12	Tue 12/11/12	0%	50
52	Task 4a3, ROV/AUV	4 d	Tue 12/4/12	Fri 12/7/12	0%	48
53	***Task 4b MRS 12 Phase 1 Baseline Survey***	**11 d**	**Tue 12/11/12**	**Tue 12/26/12**	**0%**	52FS+1 d
54	Optional Task 4b1, Bathymetry	8 d	Tue 12/11/12	Thu 12/20/12	0%	
55	Optional Task 4b2, Side Scan Sonar	3 d	Tue 12/11/12	Thu 12/13/12	0%	
56	Optional Task 4b3, ROV/AUV	8 d	Fri 12/14/12	Tue 12/25/12	0%	55
57	**Task 12, Environmental Sampling and Analysis**	**15 d**	**Mon 12/10/12**	**Fri 12/28/12**	**0%**	48
58	***Task 12c1 Phase I Beach Monitoring***	15 d	Mon 12/10/12	Fri 12/28/12	0%	50
59	**Task 14, Baseline Survey Report**	**140 d**	**Wed 12/26/12**	**Tue 7/9/13**	**0%**	
60	Prepare Draft EBS Report	25 d	Wed 12/26/12	Sat 1/19/13	0%	56



ID	Task Name	Duration	Start	Finish	% Complete	Predecessors
61	USACE Review and Comment of Draft EBSSurvey Report	10 d	Mon 1/21/13	Fri 2/1/13	0%	60
62	Incorporate USACE Comments on Draft Baseline EBS Report	10 d	Mon 2/4/13	Fri 2/15/13	0%	61
63	Project Delivery Team Backcheck	5 d	Mon 2/18/13	Fri 2/22/13	0%	62
64	USACE PM sends to CX for review	1 d	Mon 2/25/13	Mon 2/25/13	0%	63
65	CX Review	10 d	Tue 2/26/13	Mon 3/11/13	0%	64
66	USACE PM Sends CX comments to Contractor	1 d	Tue 3/12/13	Tue 3/12/13	0%	65
67	Contractor addresses CX comments and sends back to USACE	10 d	Wed 3/13/13	Tue 3/26/13	0%	66
68	Project Delivery Team concurrence with comments	5 d	Wed 3/27/13	Tue 4/2/13	0%	67
69	Contractor prepares Draft Final EBS Report	10 d	Wed 4/3/13	Tue 4/16/13	0%	68
70	Project Delivery Team Back Check of Draft EBS Report	5 d	Wed 4/17/13	Tue 4/23/13	0%	69
71	USACE PM sends Draft Final EBS Report to Regulators for review	1 d	Wed 4/24/13	Wed 4/24/13	0%	70
72	Regulator Review and Comment on EBS Report	23 d	Thu 4/25/13	Mon 5/27/13	0%	71
73	Address regulator comments from review and TPP meeting 3	10 d	Tue 5/28/13	Mon 6/10/13	0%	72
74	Prepare Final EBS Survey Report	10 d	Tue 6/11/13	Mon 6/24/13	0%	73
75	Project Delivery Team Backcheck of Final EBS Report	10 d	Tue 6/25/13	Mon 7/8/13	0%	74
76	Approval of Final EBS Report	1 d	Tue 7/9/13	Tue 7/9/13	0%	75

Figure 2-2. Proposed EBS Schedule (continued)

3.0 FIELD INVESTIGATION PLAN

3.0.01 This section describes tasks that will be performed during the EBS. These tasks will be completed prior to performing the geophysical surveys, which require the use of towed sensors and sediment sampling. The objectives of these tasks are to identify areas of sensitive habitat and to determine where towed operations and sampling can be safely conducted.

3.0.02 The collection of high-resolution bathymetry data in both MRS areas is critical to the success of the subsequent DGM effort that will be conducted as part of the RI/FS. Magnetometer/gradiometer and electromagnetic sensors inherently have very short detection ranges for anything but the largest MEC items. In a marine environment, with a sensor that must be flown on or very close to the bottom to provide useful data, it is absolutely imperative to have a very accurate three-dimensional model of the bottom to avoid damage to the equipment and sensitive marine life, such as corals, during survey operations. Currently, high-resolution multibeam bathymetry is the best available technology that will provide the necessary accuracy and resolution to build this model.

3.0.03 The field investigation will be conducted in three phases: Phase 1, the EBS, to develop basemaps to guide the following phases; Phase 2, the DGM, to provide an assessment of the distribution and density of metallic items and debris fields that may be MEC; and Phase 3, which will be an intrusive investigation. This document describes the plan of work for Phase 1 EBS activities.

3.1 OVERALL APPROACH TO EBS ACTIVITIES

3.1.1 Site Characterization Processes

3.1.1.01 The EBS will be conducted prior to the DGM and intrusive investigations to identify areas of endangered corals/sensitive habitat and to determine where the magnetometer/electromagnetic system can be safely deployed. The EBS will include the following components:

- Bathymetric and bottom type mapping, including acquisition and interpretation of high-resolution MBE bathymetry and imagery.
- SSS data collected to provide high-quality imagery and to augment the MBE and underwater video imagery for bottom type characterization and target identification.
- Underwater video collected concurrently with the MBE and SSS data will aid project geologists, biologists, and MEC specialists with bottom type classification, identification of sensitive habitat, and potential identification of MEC.
- Benthic terrain modeling conducted on the MBE bathymetry using the National Oceanic and Atmospheric Administration's (NOAA's) BTM.

- If necessary, following analysis of the MBE bathymetry and imagery, additional video or visual inspection may be conducted using an ROV, towed video sled, drop camera deployment, and/or diver equipped with snorkeling gear and handheld camera.
- No environmental sampling will be conducted as part of Phase 1.

3.1.2 Measurement Quality Objectives

3.1.2.01 Application of measurement quality objectives developed as part of Phase 1 will ensure high-quality data will be obtained. Table 3-1 provides the measurement quality metrics that will be achieved to ensure project objectives are met.

Table 3-1. Measurement Quality Metrics

Technology Type	Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
Hydrographic Survey – Multibeam	Precision/ Repeatability	Cross line data	Data points common to both main survey lines and QC cross lines will have x,y,z coordinates that are repeatable within specified USACE Hydrographic Survey standards (refer to Appendix B of the standard, Table 1 [USACE 2002]). Hydrographic Survey data shall meet or exceed Special Order standards.	Minimum 4% of total line plan
	Completeness	Visual evaluation of data real-time for verification that intended coverage goals are met	Real-time coverage plots (i.e., matrix fill) will be utilized to monitor coverage completeness. Along-track coverage, which is a function of vessel speed and ping rate, will be evaluated by calculating the percentage of data obtained at less than 6 knots (i.e., 95% of MBE data were obtained at < 6 kts).	Continuous visual monitoring during data collection
	Sensitivity	Real-time monitoring and use of gains and gate filters, software quality flags	Data collection depth range is optimized to reduce anomalous reflections and provide optimum data, gains are set to provide appropriate bottom tracking. The data acquisition software is used conduct internal testing to check the validity of each ping based on colinearity and brightness and ensure each ping is tagged with a quality flag of 0-3 based on the these tests. During processing, the pings are filtered based on the quality flags to eliminate all but the data with a quality of 3 unless conditions warrant accepting lower quality pings (e.g., where there are topography discontinuities such as wrecks or piles).	Continuous visual monitoring during data collection, sonar system quality flags

Table 3-1. Measurement Quality Metrics (continued)

Technology Type	Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
Geodetic Equipment	Functionality/ Accuracy	1. GPS Positioning – Survey crew will check selected terrestrial control points with RTK GPS rover.	1. RTK GPS measurements will match published position to within 0.1 meters x, y and z.	1. Daily
		2. Water level check – Use RTK GPS rover or temporary bench mark at vessel dock to check water surface elevation. Compare to survey system navigation reported tide level.	2. RTK GPS water level and survey system tide level will match to within 0.1 meters.	2. Daily
		3. Bar check and/or lead line check vs. water surface relative depth from sonar.	3. Nadir bathymetry depths relative to surface, corrected for draft and attitude matches to within 0.06 meters.	3. At the start of survey
Sidescan Sonar Survey	Completeness	Visual evaluation of data real-time for verification that intended coverage goals are met.	Real-time coverage plots will be used to monitor coverage completeness.	Continuous visual monitoring during data collection
Sidescan Sonar Positioning	Accuracy	Visual evaluation following collection of first lines.	A feature detected in adjacent lines run in opposite directions will be compared to each other and to the location of the feature in the MBE data to determine towfish positioning accuracy.	At start of survey

Table 3-1. Measurement Quality Metrics (continued)

Technology Type	Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
Sidescan Sonar Survey	Data Quality/Safety	Maximize data quality while monitoring safety of environment.	To minimize the risk of physical contact with, or potential damage to sensitive habitats, the SSS system will be mounted on the bow of the vessel or towed near the surface just aft of the survey vessel. Existing bathymetry and imagery in the area will be assessed prior to deployment of the SSS system. In deeper water where the towfish will be towed at depth, towfish flight altitude and water depth will be continuously monitored during survey operation. To the extent possible, the towfish will be flown at a constant altitude approximately 10-20 percent of range, unless a risk to habitat or equipment, such as irregular or steep terrain, has been determined. To the extent possible, sonar range will be kept constant at 50 meters.	Continuous
Underwater Video Camera	Functionality	Visual Inspection	Test the camera prior to deployment to ensure that the unit is working correctly.	Daily

Notes:
MBE – multibeam echosounder
QC – quality control
RTK GPS – real-time kinematic global positioning system
USACE – U.S. Army Corps of Engineers

3.2 IDENTIFICATION OF AREAS OF CONCERN

3.2.01 The areas to be surveyed include Flamenco Bay (MRS 03) and the Luis Peña Channel (MRS 12) (Figure 3-1). The TtEC team, which includes local scientists and biologists, have consulted high-resolution aerial imagery and local knowledge sources to delineate known ordnance items and areas of sensitive habitat to minimize risk of impact from survey operations. The maps in Figures 3-2 and 3-3 have been marked with the anticipated survey tracts that will be performed, and project biologists with local knowledge of the MRSs have marked the locations of sensitive habitats, including areas where coral reefs are known to exist.

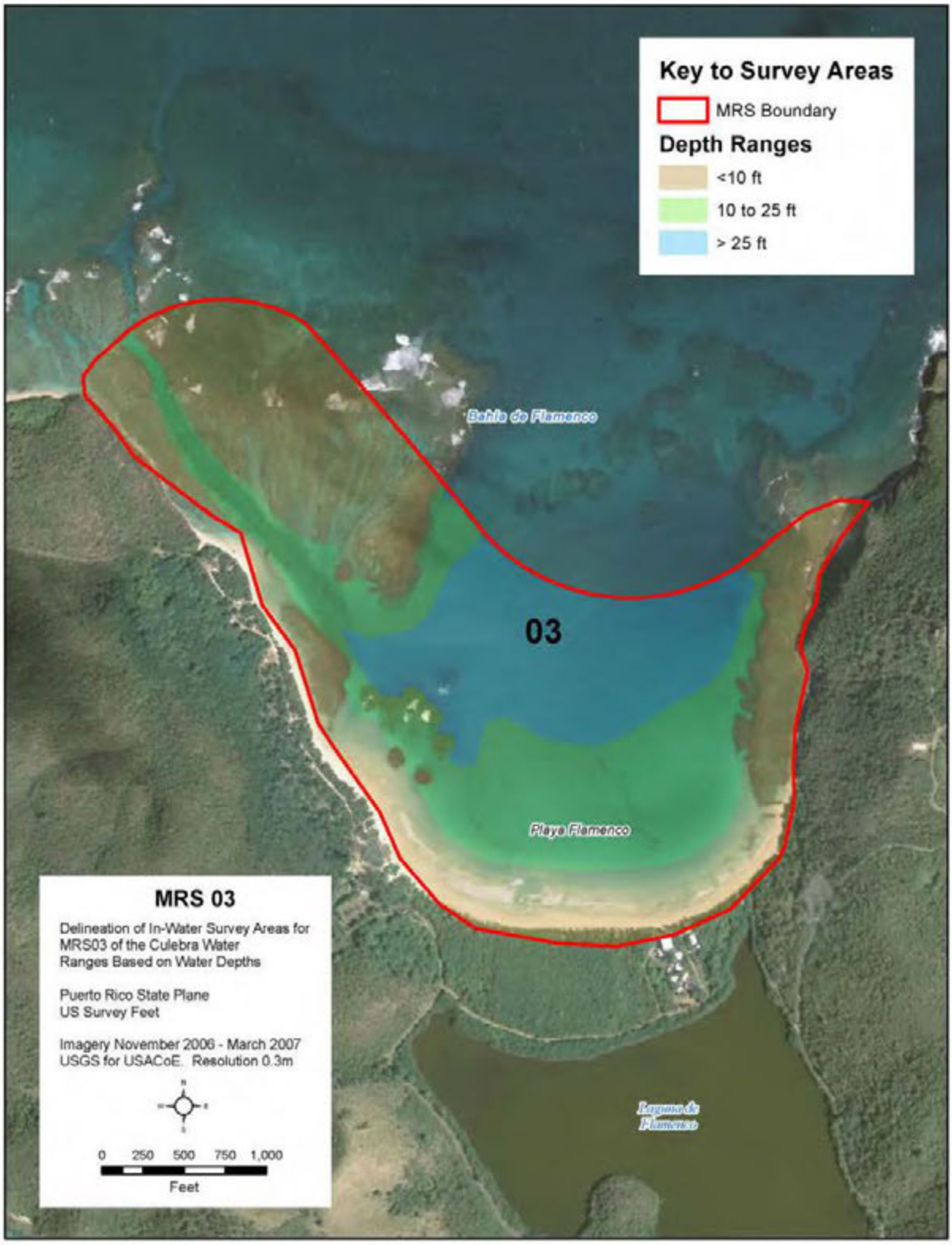


Figure 3-1a. Flamenco Bay Survey Area

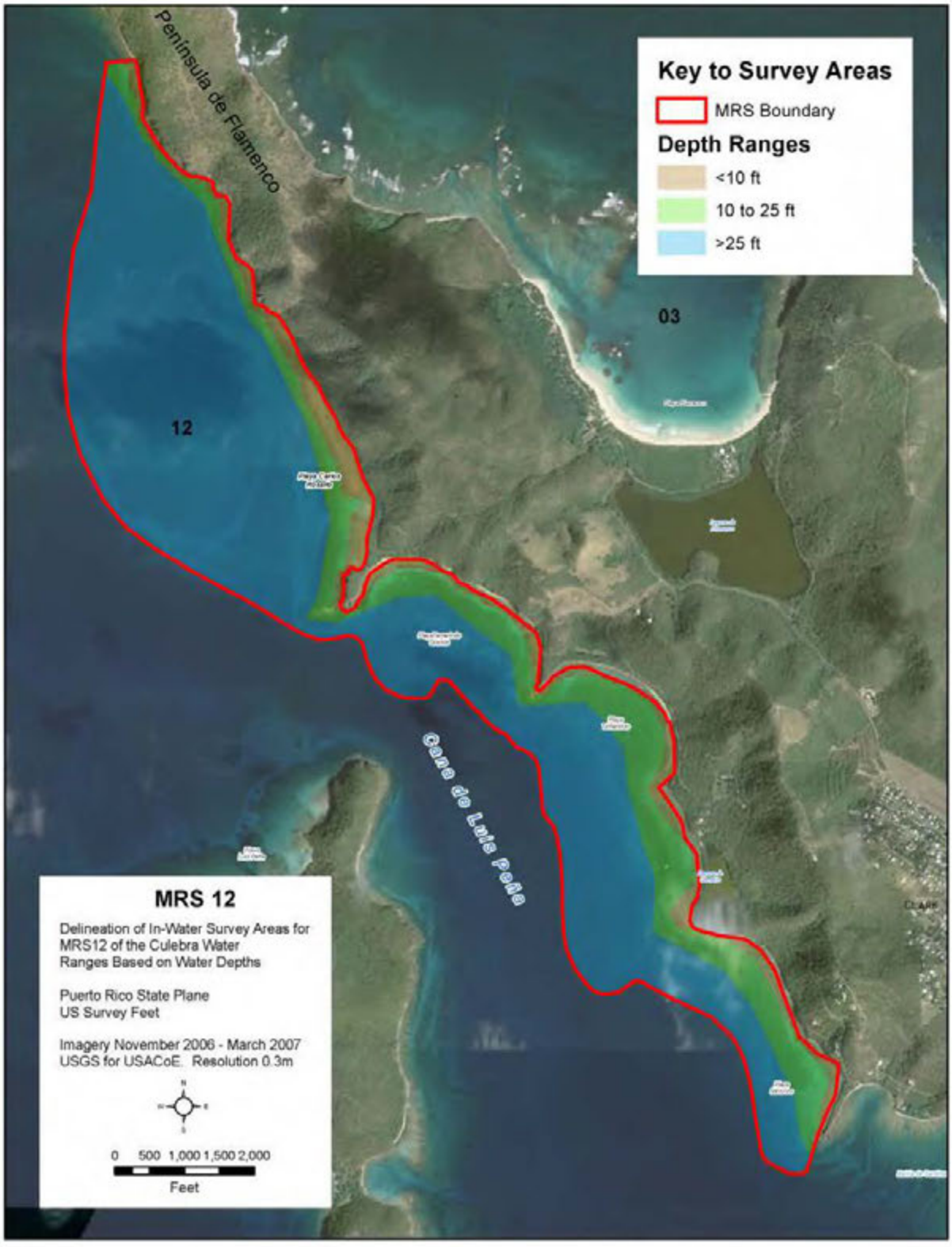


Figure 3-1b. Luis Peña Channel Survey Area

3.2.02 The TtEC team will then perform non-invasive marine geophysical surveys from approximately the 4-foot (~1.2 meter) shallow water limit for vessel operations stated in the SOPs in Appendix B and this Work Plan to the offshore boundary of each site, taking extra care to avoid high-risk areas determined during the existing data review and delineate areas that should be marked for avoidance during the follow-on RI investigations.

3.3 LOCATION SURVEYS AND MAPPING PLAN

3.3.1 Bathymetry Survey

3.3.1.01 The primary objective of the MBE survey is to provide high-resolution bathymetry for the EBS and to guide planning for Phase 2 and 3 operations. High-resolution bathymetric mapping will be conducted to:

- Provide an accurate topographic model to support all subsequent survey and sediment sampling efforts (ensuring review of proposed sample locations by the project biologist so that no coral critical habitat areas are proposed for sampling during the RI);
- Locate potential hazards to the marine towed sensors and survey/sampling vessels;
- Map or delineate features of interest, such as areas of potential sensitive habitat or listed corals, possible debris, areas of sand ripples, and rocky outcrops; and
- Provide detailed bathymetric and depth information to support dive planning.

3.3.1.02 Bathymetry systems will be mounted on surface vessels, minimizing the risk of physical contact with, or potential damage to, sensitive habitats. MBE imagery data will be collected to assist with classification of bottom types and items of interest. Bottom type classification methods from MBE imagery are discussed further in Section 3.6.10.

3.3.1.03 Specific calibrations for the MBE and data collection systems are detailed in Section 4 of this Work Plan and in the quality assurance project plan. Performance standards and acceptance criteria for the calibrations and tests are consistent with the USACE Hydrographic Survey manual (EM 1110-2-1003; USACE 2002) and industry standards will be implemented.

3.3.1.04 Since there have been no previous high-resolution bathymetric surveys of these areas, operational procedures will be employed to ensure that the survey vessel(s) do not run aground and damage sensitive habitats. The bottom of the boat (and its draft), as well as any towfish array or other equipment projecting below the bottom of the boat, will stay a minimum of 4 feet from the top of the coral and the bottom of the channel or bay.

- When approaching shallow waters, the vessel crew will make use of the wide swath of the multibeam sonar to help identify and avoid potential grounding sites by surveying from deeper to shallower areas, and keeping the boat within areas that have adequate depths for safe passage.

- When operating in shallow areas, one of the crew will act as a bow watch, visually checking for shoal areas and communicating with the vessel captain to avoid grounding or hitting coral.

3.3.2 Sidescan Sonar Survey

3.3.2.01 High-quality seabed imagery will be collected concurrently with the MBE and video imagery within the survey areas to aid in bottom type characterization and identification of bottom features of interest detected in the bathymetric and underwater video data.

3.3.2.02 In shallower areas, the SSS system will be pole-mounted or towed near/at the surface to minimize risk to coral heads or sensitive habitats. The decision on depth of deployment of this system will also be based on site-specific MRS characteristics such as tide cycles, high wave action, low visibility, or known proximity to sensitive habitats. In deeper areas and areas that do not have projecting coral reefs, the towfish will be actively flown in the water column to get better quality imagery, but the tow altitude will be kept well above the bottom and/or tops of coral heads (more than 4 feet [~1.2 meters]) as defined by available existing bathymetry data for the area or biologist direction based on observations. The sidescan data, which provide information on towfish altitude, will also be monitored to minimize the risk of physical contact with, or potential damage to, sensitive habitats. To the extent possible, the range setting will be maintained at 50 meters and target altitude will be kept approximately 20 percent of the range.

3.3.2.03 Sidescan range settings will be selected to provide overlap of adjacent track lines to provide full coverage of the survey area. Survey lines were planned based on a range setting of 50 meters; the range will be kept constant to the extent possible.

3.3.3 Underwater Video Survey

3.3.3.01 TtEC will conduct underwater video acquisition as part of the EBS. A video camera system will be mounted on the survey vessel and will collect video of the seabed concurrently with the MBE/SSS. Once the MBE bathymetry and MBE/SSS imagery have been processed, the vessel-mounted underwater video imagery will be used to ground-truth and support bathymetry and imagery derived and developed bottom type classification, and will be used by project biologists to identify specific species of interest within the survey area. If necessary, additional underwater video acquisition or observation/investigation by diver using a mask, snorkel, and handheld camera may be performed to support bottom type classification. Video imagery may be required in areas of deeper water where video imagery may be unclear or where specific features identified in the MBE data need to be further explored. Additional video may be acquired using a camera mounted on the vessel's hull, ROV, a towed camera sled, or by a diver using snorkeling equipment with a hand-held underwater video or digital still camera. Digital video will be used to refine classification derived from the bathymetry terrain, multibeam sonar imagery, and/or aerial photography.

3.3.3.02 The digital video will be geo-referenced using the vessel and/or subsurface navigation systems. Geo-referencing will be achieved using time synchronization with global positioning system (GPS) and/or overlay of GPS data on the video image.

3.3.4 Data Spatial Density

3.3.4.01 Full bottom coverage with the MBE and SSS will be acquired in accessible areas to sufficiently show surface sediment structures and bedforms as well as detect and provide detailed information on the size and shape of significant features such as coral reefs, rock outcrops, debris, or wrecks that may be present. MBE and SSS data will be collected at the site to the shallow water limit of the equipment and survey vessel or to a minimum of 4 feet below the MBE.

3.3.4.02 The site will be surveyed with the MBE and SSS using a line plan that is dependent on water depth and other site constraints. The line spacing will be designed to provide full bottom coverage with both MBE and SSS except in areas not accessible with the survey vessel or equipment; the SSS range will be set to optimize resolution while providing complete coverage, and changes to the sonar settings will be minimized to the extent possible. SSS coverage may be limited by factors such as shallow water or obstructions that are determined to pose a risk to the towed system or environment.

3.3.4.03 While it is anticipated that video data will be collected simultaneously with MBE survey lines, the spacing of these lines will vary with water depth and other site constraints (e.g., presence of coral heads at or near surface, identification of listed coral species). Therefore, the precise density of video data cannot be specified. However, transect spacing for the underwater video survey, if not obtained during the MBE survey, will be adjusted to be not less than approximately 100 feet, water depths and site conditions permitting.

3.3.5 Survey Data Collection Areas and Line Plans

The MRS 3 and 12 survey areas contain zones too shallow and/or dangerous to survey due to the presence of shoals and/or coral. The anticipated areas excluded from vessel operations were determined by both water depth (Figures 3-1a and 3-1b), and by the presence of coral colonies as determined by TtEC field biologist Edwin Hernandez-Delgado, Ph.D., (Figure 3-2).

These anticipated exclusion areas are shown in Figure 3-3 along with a simplified example line plan for the areas. The actual line plan will be developed based on field conditions and the results of the survey as it progresses. Survey operations will generally progress from deeper water into shallower water. The MBE and SSS both provide wide coverage swaths both directly under the survey vessel and to port and starboard (MBE approximately 3 times water depth) and as a result, the survey team is able to plan subsequent survey lines in shallower water to avoid exclusion areas (those areas with water depths too shallow or coral too close to the surface) using data acquired in preceding lines.

Figure 3-2. MRS 3 and 12 Preliminary Coral Delineations

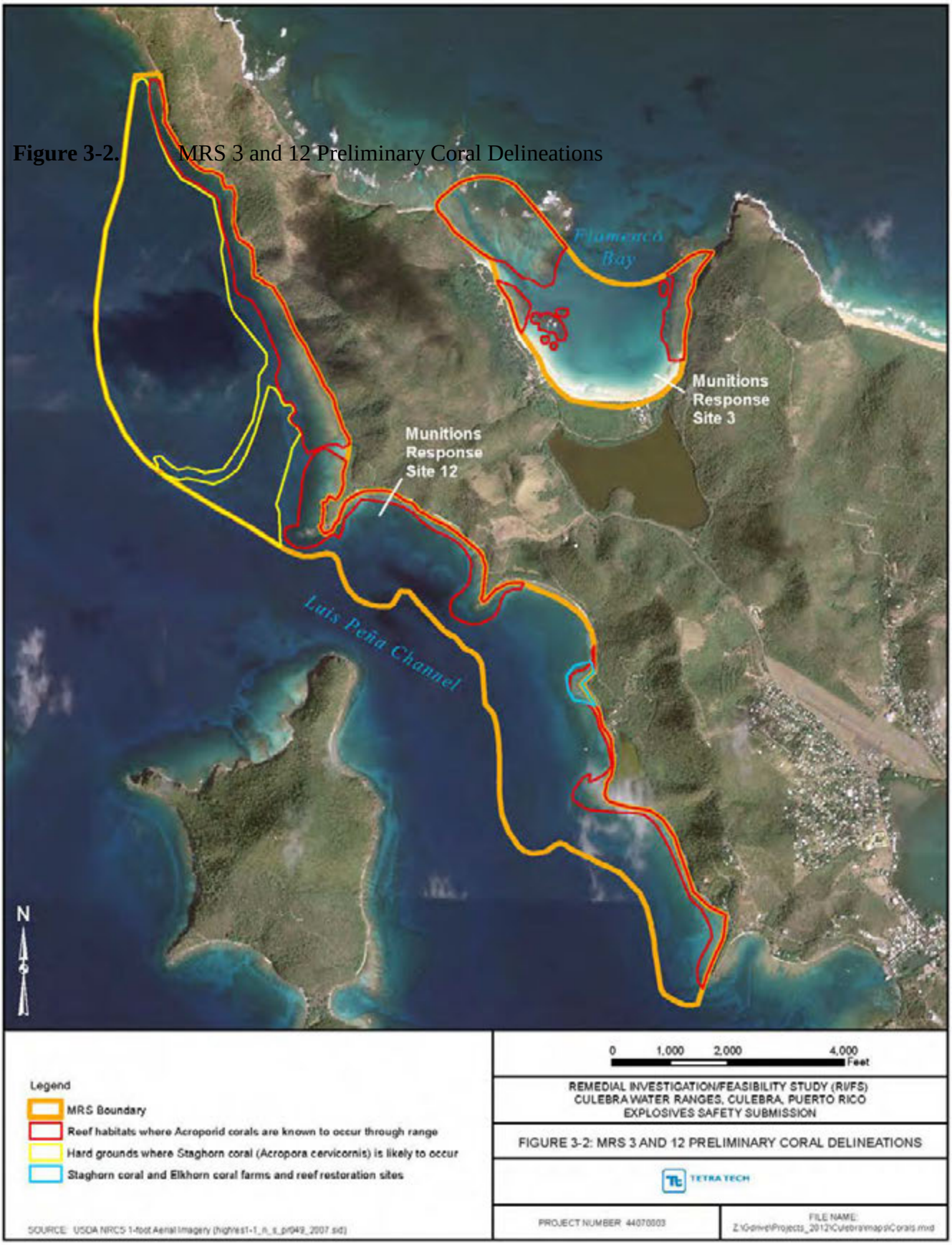
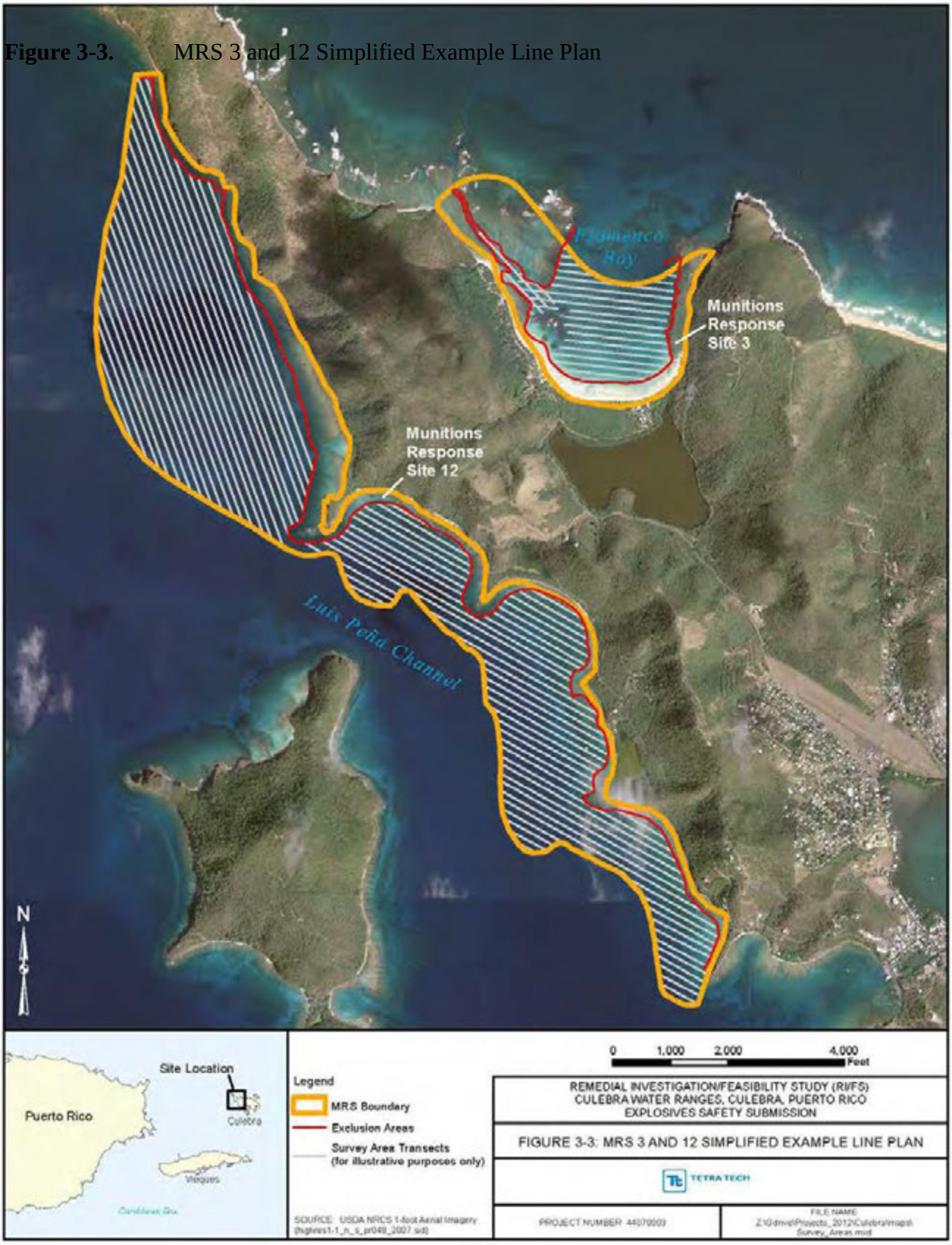


Figure 3-3. MRS 3 and 12 Simplified Example Line Plan



The example and simplified transects shown are based on SSS with a range of 50 meters. The spacing of the simplified transects is 40 meters. This allows for the coverage of the nadir region of adjacent lines.

3.3.6 Equipment Specifications

3.3.5.01 A high-resolution MBE, SSS, and an underwater video system or ROV will be deployed during the EBS to develop a detailed terrain and imagery derived map to guide the subsequent RI efforts, to aid in bottom type classification, and to identify areas of potentially sensitive habitat.

3.3.5.02 Table 3-2 contains a summary of the various systems that will be used and the purpose or value of their use. The systems are described in detail in the following sections.

Table 3-2. Summary of Technologies

Technology	Purpose/Value
MBE (multibeam echosounder)	Map site bathymetry in high resolution. Identify debris fields and items and features of interest as well as items or shoals that may damage the magnetometer/electromagnetic sensors or survey vessel during subsequent investigations.
SSS (sidescan sonar)	Provide photo-like imagery of seabed. Uses low grazing angle beams which create shadows used to better identify smaller items and better define larger items on or proud of the bottom. Increases the quality of the bottom image.
Underwater Video	Underwater video cameras will be used during MBE operations to aid in classification of the seabed and to potentially help identify areas of sensitive habitat.
Positioning Equipment	Used to track the instrument locations and the vessel motion, and geo-reference features identified in the sonar and video data.

3.3.6.1 Multibeam Echosounder

3.3.5.1.01 The RESON SeaBat 7125 MBE, one of the highest resolution MBE systems commercially available, will be augmented with real-time kinematic global positioning system (RTK GPS) and an inertial motion sensor with RTK corrections capable of achieving 0.01 degree roll and pitch accuracy. Multibeam sonars transmit acoustic pulses (sound waves) in a fan-shaped pattern. These pulses reflect back from the seafloor and/or items on the seafloor and the returns are measured from different angles across the swath with a large number of narrow receiver beams. The signal strength (amplitude), angles, and travel time of the pulses in each beam can be used to determine the size/shape of features/objects on the seafloor and the distance to those features/objects. When the sonar beams are very narrow and the ping rate high relative to the speed of motion of the survey vessel, the MBE data can be used to generate a very detailed, full coverage, bathymetry map of the seafloor and objects on the bottom. Figure 3-4 shows an example of the type of terrain model and feature detail that can be created using data from a high-resolution MBE system.

3.3.5.1.02 The MBE will provide a total angular coverage of approximately 130 degrees across track. The RESON sonar system specified utilizes 256 or 512 (user selectable), focused 0.5 x 1.0 degree beams at 400 kilohertz (kHz). The MBE system will be operated to collect

sample points at up to the maximum rate of 50 hertz (Hz). This corresponds to 50 pulses per second in very shallow water; however, the pulse rate decreases with depth as the pulses require longer increments of time to reach the seafloor and return. The system incorporates an Applanix POS MV roll, pitch, heave, heading, and position sensor (or equivalent), a Sea-Bird SBE-19 or YSI Castaway conductivity, temperature and depth profiler (CTD), and a Sea-Bird 37 MicroCat CTD (or equivalent) sound speed sensor. Data from these systems are used to convert the sonar data from sensor relative to geo-referenced soundings on the earth, corrected for vessel attitude, heading and position, and to correct for the effects of changing sound speeds at the sonar head and through the water column.

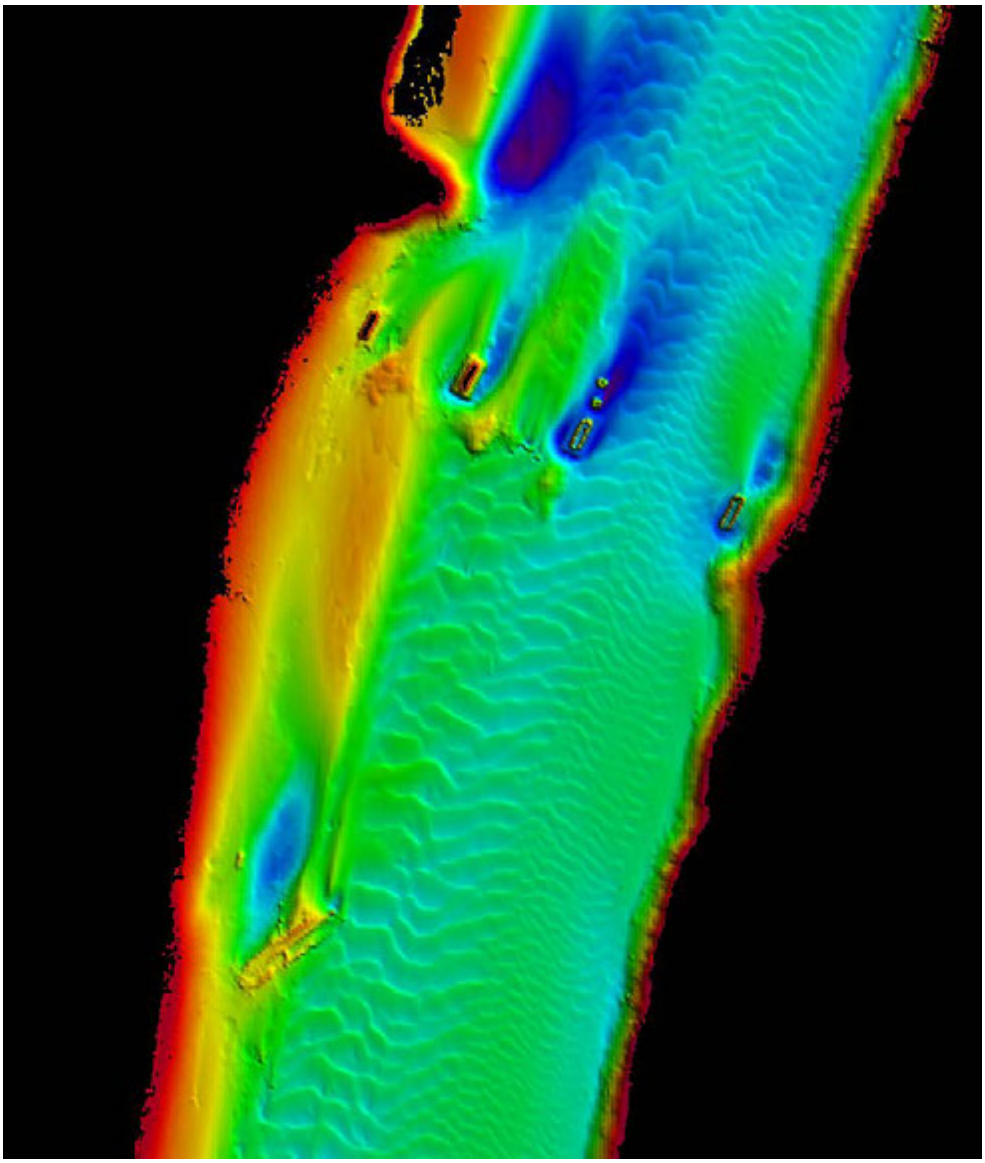


Figure 3-4. Example MBE Terrain Model

3.3.5.1.03 Reflected signal strength is a function of the physical properties of the seafloor and can therefore also provide data to characterize physical/geological features of the study area. Materials such as metals, boulders, gravel, or recently extruded volcanic rock are very efficient at reflecting acoustic pulses. Finer sediments like clay and silt do not reflect sound as well. Strong reflectors create strong echoes, while weak reflectors create weaker echoes. The project team will use this information to develop a better understanding of the site and to evaluate the physical and geologic properties of the seafloor and the objects present on it.

3.3.5.1.04 The MBE is mounted on a rigid pole attached directly to the hull of the survey vessel and thus is subject to the same physical influences as the vessel itself. The MBE will be combined with inertial navigation and a vessel heading and attitude sensor to compensate for these influences. Position (x, y) and water height (z) data will be provided using a RTK GPS with corrections from either a base station provided and set up by TtEC or a local RTK network, if available.

3.3.5.1.05 Using the RTK GPS for vessel elevation, together with appropriate data quality checks, will provide positional accuracy (x, y, and z) of approximately 0.1 meter and will be used to:

- Provide highly accurate vessel position,
- Correct for changing tide levels,
- Eliminate the vertical uncertainties inherent with modeling vessel settlement and squat as a function of speed through the water, and
- Automatically compensate for changes in the vessel draft due to crew and material loading.

3.3.5.1.06 Heading will be obtained from a gyrocompass and/or an integrated inertial system (Applanix POS MV, IXSEA PHINS, or equivalent). This high performance system will also measure vessel pitch, roll, and heave, which will be used by the acquisition and processing software (HYPACK / HYSWEEP and CARIS) to compensate the bathymetry data for vessel motion induced by wave action and other vessel dynamics.

3.3.5.1.07 A water column profiler, such as a Sea-Bird SBE-19 or YSI Castaway, and a sound speed sensor, such as a SBE 37 MicroCat mounted adjacent to the multibeam sonar array, will be used to measure changes in conductivity and temperature with depth and provide information to the sonar to aid in accurate beam forming. Differentials in these parameters along the water column influence the path and speed of the pulses created by the MBE. Data from the CTD profiler will be input to HYSWEEP and CARIS software to model the refraction and path length effects of any changes in the water column properties with depth and to apply the appropriate corrections in calculating the positions of the soundings on the seafloor. The frequency and location of the CTD casts to be used in processing the data will be determined by the local water conditions at the survey site.

3.3.6.2 Sidescan Sonar

3.3.5.2.01 To provide high-quality imagery, SSS data will be collected with a CHIRP sidescan system with an operating frequency of 600 kHz, or equivalent. Range settings on the SSS will be set at the beginning of the survey to optimize resolution and to a range longer than the spacing between adjacent track lines to provide full coverage. The range setting will be reduced in shallower areas where the track line spacing is narrower. Changes to the settings will be minimized to the extent possible, to minimize variability in the imagery due to settings changes.

3.3.5.2.02 Sidescan sonars transmit a narrow fan-shaped acoustic pulse (ping) perpendicular to the direction of travel. As the pulse travels outward from the sonar unit, the seafloor and other objects will reflect some of the sound energy back in the direction of the unit (backscatter). The signal strength (amplitude) and travel time are analyzed to provide data on the form and nature of the seafloor. One advantage of the SSS is the low grazing angle of the transmitted beam(s) over the seafloor. This results in distinctive shadows being cast behind objects on the seafloor making smaller objects more visible and providing greater detail on larger objects.

3.3.5.2.03 While SSS imagery does not measure the depths of features it can provide a reasonable size estimate and can often provide a sufficiently high resolution image to enable identification of many features (Figure 3-5). These characteristics make it a very good complement to MBEs and magnetometers, helping discriminate features of interest from background clutter.

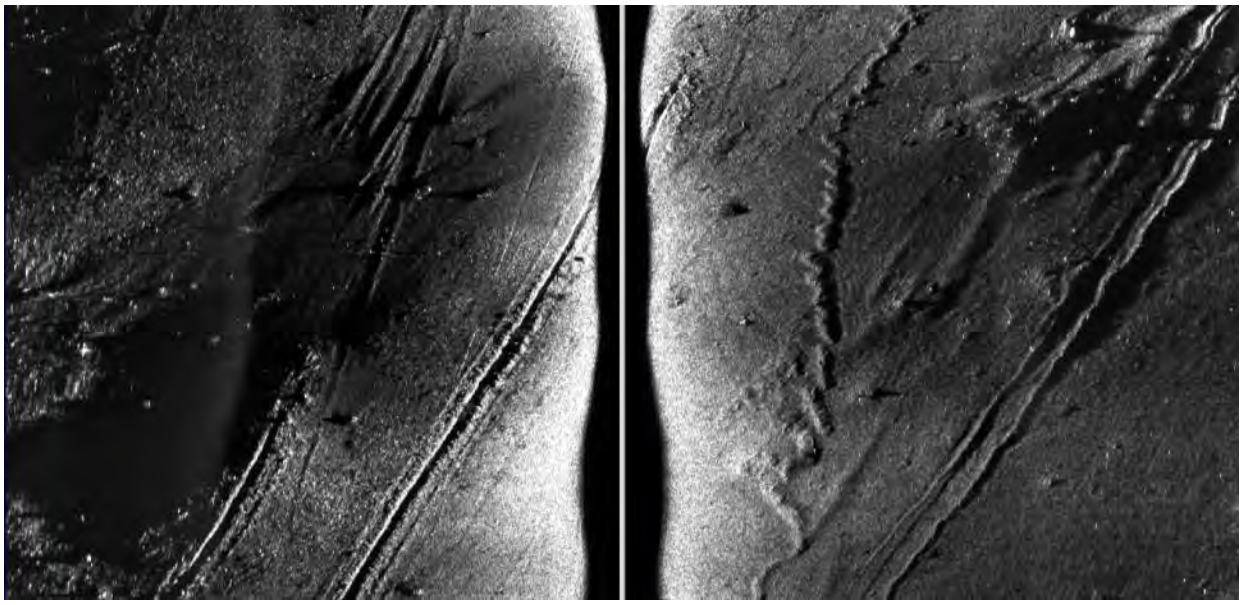


Figure 3-5. Example 600-kHz Sidescan Imagery for Feature Detection and Location

3.3.6.3 Underwater Video

3.3.5.3.01 An underwater video camera system mounted on the vessel will be used for the shallower portions of the survey. In areas where additional video coverage is needed, for

example in areas of deeper water or to further investigate features of interest, the camera system will be mounted on an ROV, a towfish, or be deployed as a drop camera. Alternatively, video and photo coverage may be acquired using a diver equipped with snorkeling equipment. The digital images/video from these systems will be geo-referenced using the vessel and/or subsurface navigation systems and time correlation with a common clock, typically GPS Coordinated Universal Time (UTC) time, or in the case of snorkeling operations, locations will be estimated based on surrounding features. A video overlay showing GPS position and time will be recorded on the video. Video cameras, such as Deep Sea Power & Lights's Wide-i SeaCam, provide high-quality imagery in low light conditions. Imagery will be reviewed in real time, allowing operators to identify targets that may require further investigation and to provide supplemental information for bottom type classification during post-processing and analysis of bathymetry terrain and imagery data. Additionally, this information will be reviewed, as needed, prior to and throughout the RI/FS process.

3.3.5.3.02 Snorkelers will only enter areas to survey where they (or their equipment) will not make contact with the coral. Generally, snorkelers will maintain a distance of at least 3 feet from the channel or bay bottom or the top of coral heads. Depth of consideration for entry by snorkelers will also include evaluation of the tides, wave action, and turbidity that may impact visibility. Snorkelers will wear positive buoyancy personal flotation devices, make sure their equipment is secure, practice good finning and body control to avoid accidental contact with coral or stirring up of the sediment, and follow other measures as noted in Section 4.5.5 of the SOP.

3.3.7 Survey Vessel

3.3.6.01 A TtEC-owned vessel, a vessel from the University of Puerto Rico, or a similar vessel will be mobilized to perform the EBS activities. These vessels are equipped for coastal shallow water surveys with all required U.S. Coast Guard equipment, positioning instrumentation, equipment racks with operator stations, equipment mounts, a hydraulic A-Frame and winch for deploying towed equipment. The TtEC 29.5-foot aluminum survey vessel has a variable draft of 24 to 43 inches, depending on out-drive position (Figure 3-6). To obtain bathymetry and/or video in areas where depth to sensitive habitat is approaching the 4-foot specified minimum water depth below the vessel and/or survey equipment, snorkelers may be deployed to collect survey data, video, or photos at the surface. TtEC will not bring the survey vessel or equipment into areas where the minimum water depth or depth to coral heads below the vessel and equipment (4 feet minimum) cannot be maintained to avoid potential damage to sensitive habitat or listed species. The bottom of the boat (its overall draft including propeller and other equipment as configured) and the towfish array will stay at a minimum of 4 feet from the top of coral or channel or bay bottom depth. TtEC also will consider other factors such as changing tides and wave action or ground swell in making vessel or towfish operational restrictions as these factors may cause potential depth fluctuations that could bring the vessel and its equipment closer than 4 feet. Depth will be adjusted conservatively based on site conditions to minimize the potential for accidental groundings or coming too close to coral heads.

Vessel Specifications
Hull Construction: Welded Aluminum
Overall Length: 29.5 ft. **Beam:** 9.5 ft.
Draft: Hull 13", Outdrive 24 to 43". **Gross Tons:** ~5
Propulsion: VolvoPenta KAD44 Turbo charged Diesel with duo prop outdrive
Electrical Generation: Honda 6500/3000 Watt
Safety Equipment: All required U.S. Coast Guard equipment
Bridge Equipment: DGPS, POS MV, RTK GPS, Ross Hypack Control, Radar, VHF
Survey Facilities: Equipment rack with operator stations and 2 to 6 LCD monitors
Transducer Mounts: RESON 8101/8125/7125/7101/NS 420/Benthos C3D/R2 Sonics 2024/Ross 825B/Innerspace 448, IXSEA GAPS USBL, customizable as needed
Hull Mounted Transducers: As required
A-Frame and Winches: Pullmaster PL-3 support by hydraulic A-frame

Figure 3-6. TtEC's 29.5-foot Aluminum Survey Vessel and Specifications

3.3.8 Survey Systems Schematic

3.3.7.01 Figure 3-7 provides an example graphic of the various sensor systems, with the exception of the Marine Gradiometer Array (MGA) magnetometer that will be used for the EBS, and Figure 3-8 shows an example configuration of the instrumentation (schematic).

It should be noted that various types of positioning systems may be utilized based upon site-specific conditions, and that other ancillary equipment may be added to enhance data quality and completeness. In addition, systems may not be configured as shown; for example, towed components may be hull- or pole-mounted to the survey vessel in the shallower portions of the survey area.

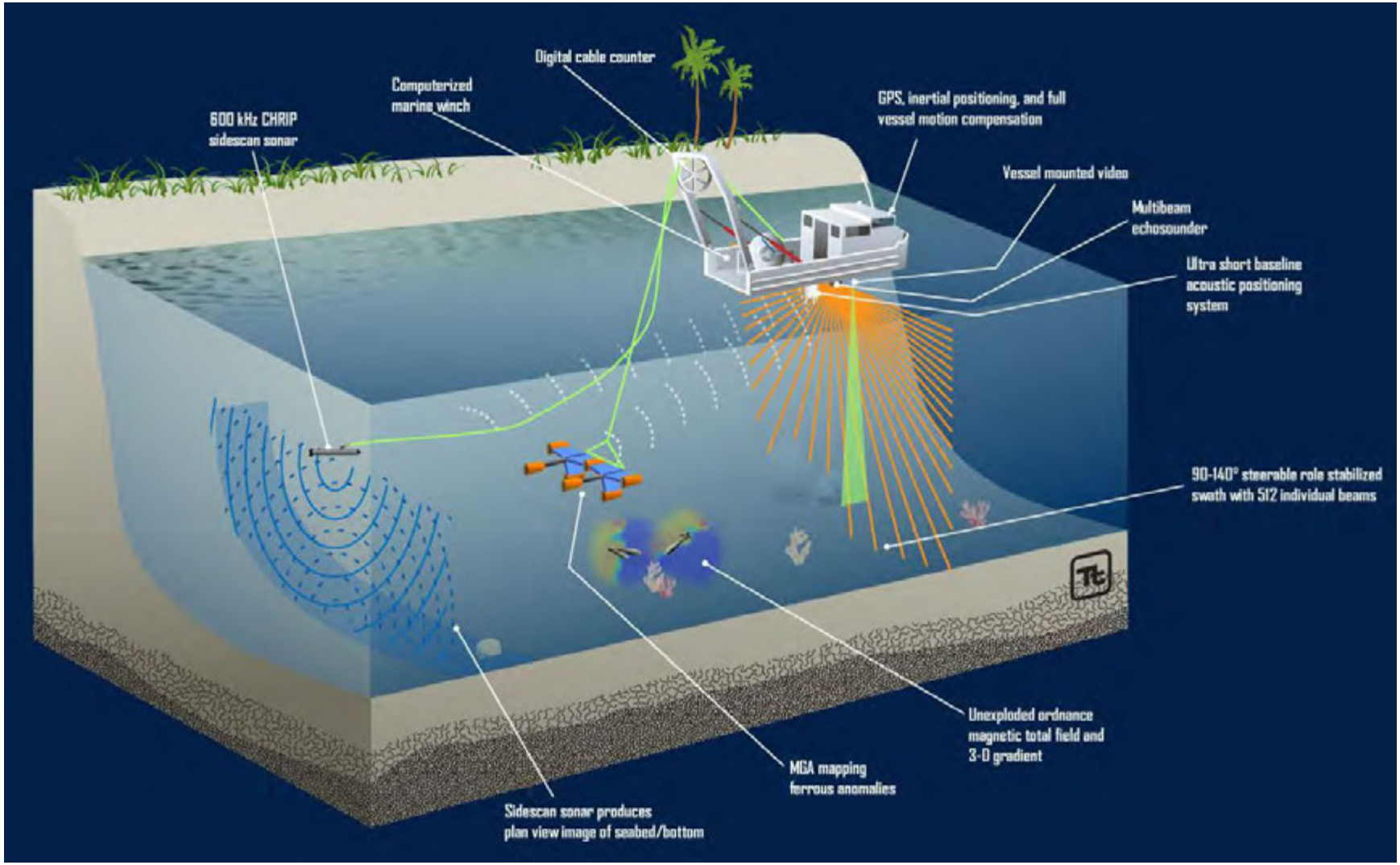


Figure 3-7. TtEC EBS and DGM Survey Systems

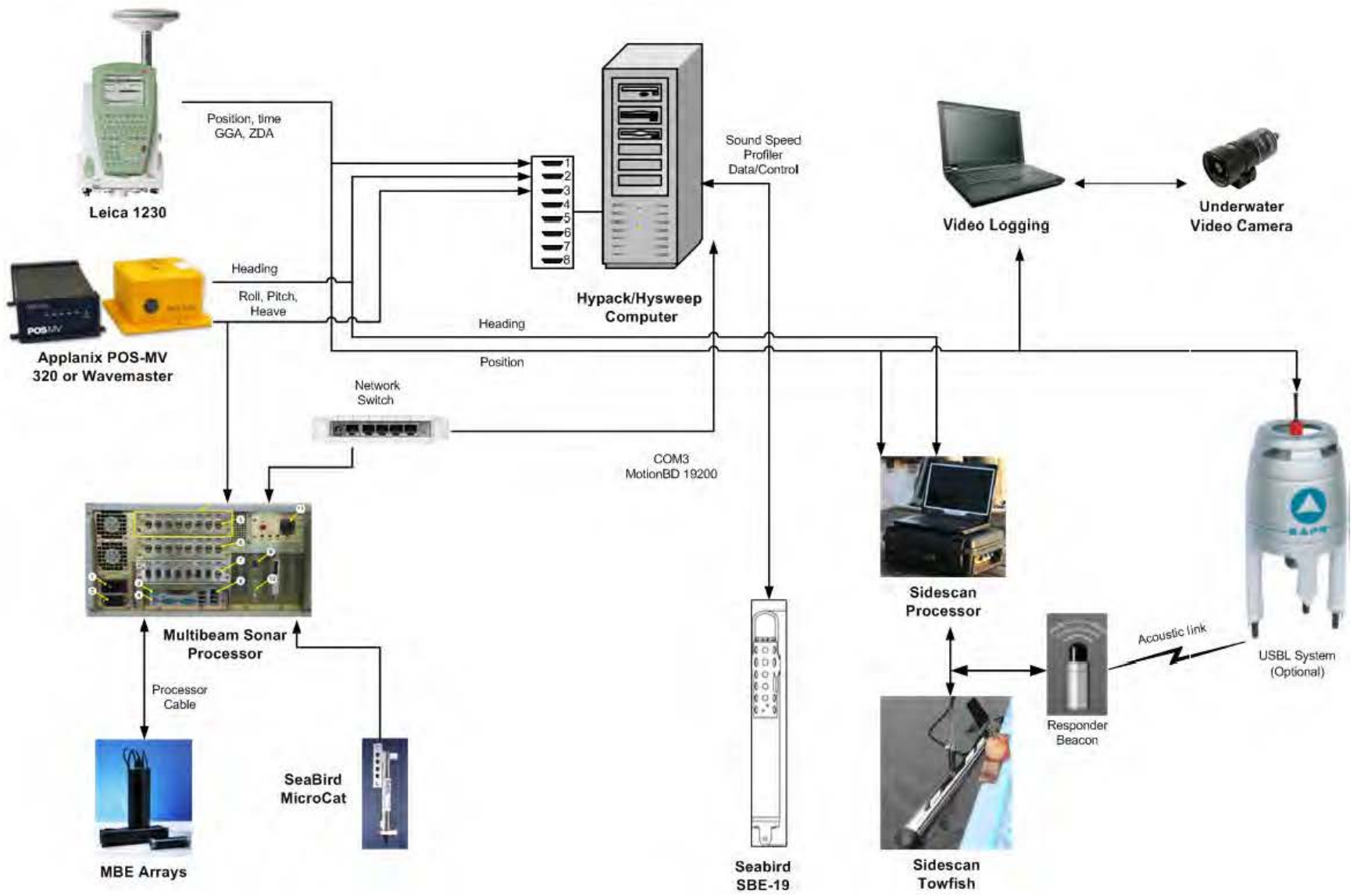


Figure 3-8. Environmental Baseline Survey System Configuration

3.4 GEOSPATIAL INFORMATION AND ELECTRONIC SUBMITTALS

3.4.01 This section presents the methods, equipment, and accuracy required for conducting location surveys and mapping, and managing geospatial information in support of the EBS. The section was prepared following EM 1110-1-4009 and provides details of the methods and equipment to be used to achieve accuracy requirements in performing location surveying and mapping.

3.4.1 Coordinates

3.4.1.01 All surveying will be performed using the North American Datum 1983 (NAD83) Puerto Rico 5200 State Plane coordinate system in units of meters. The vertical datum will be Puerto Rico Vertical Datum of 2002 (PRVD 02).

3.4.2 Control Points

3.4.2.01 The control points to be used for the surveys will be provided by the USACE prior to the commencement of field operations. If not provided by USACE, project control will be established by TtEC using conventional survey methods or the Online Positioning User Service (OPUS) network. Control will be verified by a professional land surveyor.

3.4.3 Accuracy

3.4.3.01 Each data type will be documented for associated position accuracies. The accuracy assessment will include the type and accuracy of the position sensor(s) used for the data and any other factors that could affect the data location accuracy. For example, the accuracy of the bathymetry sounding data from the MBE system is a function of the accuracies of the GPS used for vessel position; the sonar; the attitude sensor used to measure roll, pitch, and heave of the vessel; the sound speed profiler used to measure sound speed vs. depth in the water column; and the offset measurements of the sensors.

3.4.4 Map Requirements

3.4.4.01 The project maps shall be prepared in accordance with EM 1110-1-4009 and DID WERS-007.01 to accurately depict the marine habitat and to identify and delineate areas where corals are present, including listed species in MRS 03 and MRS 12. The maps will contain as much detail as can be ascertained from the information collected within the scope of the survey, survey method, and techniques. Means of coral identification may be ascertained by biologists from review of underwater video or photos, SSS or MBE survey data, identification and logging by scientific snorkelers, or known information based on prior studies of the MRSs. There may be limitations that preclude the ability of the team to identify species of coral, such as if visibility is poor or no video is recorded for an area, or in areas where snorkelers cannot make entry.

3.4.5 Monument Description

3.4.5.01 The monument descriptions for the control points to be used for the survey, or links to them, will be provided by the USACE prior to the commencement of field operations. If not provided by USACE, TtEC will describe monuments that will be used for project survey control.

3.4.6 Digital Format for Geographic Information System Data

3.4.6.01 A geographic information system (GIS) has been developed for the project to aid in the development of the CSM and maintain and manage all project and geospatial data. The GIS was developed in accordance with DID WERS-007.01, EM 200-1-2, EM 1110-1-4009, and applicable interim guidance documents.

3.4.6.02 The geospatial data for the EBS will include the following:

- A comprehensive CSM.
- All available existing applicable to the project will be consolidated into the geodatabase and analyzed to relay pertinent information to the Project Delivery Team. If an existing GIS database is available, it will be provided by the government.
- The analysis of data from the GIS will support all conclusions of the CSM.
- The pre-RI analysis will encompass social, environmental, and/or economic entities that will be or may be impacted by response-action activities.
- The post-RI and FS analysis will detail entities impacted by RI/FS activities and impacts of future response action activities (if applicable). The pre- and post-RI and FS analysis may detail the fieldwork strategies, areas of concern, survey requirements, environmental concerns, milestones, and/or other factors that affect product delivery and future action planning.
- Entities that may be affected by response actions include, but are not limited to, landowners, homeowners, rental tenants, schools, utilities, roads, businesses, recreational areas, air traffic, water bodies, and/or industries.
- The geodatabase will be a living repository that is refined throughout the life of the EBS and the entire project.
- Layers that overlay on maps of the site that identify physical features and areas of possible debris found during the EBS will be incorporated. Examples include streets, anomalies, MEC positively identified, identifiable MD, sampling location, cultural resources, and environmental, biological, and socio-economic variables.
- Archaeological site location(s) will not be released to the public without written permission from USACE.
- Locations for MEC items will not be released to the public or placed in documents without written permission from USACE.

- Civil surveys will be performed in accordance with EM 1110-1-4009 and DID WERS-007.01.
- Property owner privacy will be preserved. Property owner names will not be disseminated in any documents.

3.4.6.1 Sources and Standard

3.4.6.1.01 The project geospatial data will include all information from the Microsoft Access project database (EM 1110-1-4009). All digital GIS data will be created in an ArcView compatible format. All data will conform to the Spatial Data Transfer Standard (SDTS) and be ESRI-compliant (geodatabases). The standards are designed for computer assisted mapping methods that must interface with other surveying firms, government contractors and customers. Bathymetry derived digital elevation model (DEM) data will be provided as ArcGIS raster coverage and/or Arc ASCII grids, as required. Other raster data (geophysical color-contoured data, orthophotography, remote sensing imagery, etc.) will be provided in GeoTIFF. Supporting tabular data will be provided in ANSI SQL language compatible format, such as Microsoft Access. The GIS point, polyline and area vector data will be provided in ArcGIS format including geodatabases and .shp files and will include all appropriate metadata. The final electronic submittal will also include layout files for all plates, figures, and drawings conveyed in the report.

3.4.6.2 File Backup

3.4.6.2.01 The GIS data will be backed up daily and data processing progress will be documented on a data tracking spreadsheet.

3.4.7 Quality Control

3.4.7.01 QC checks will be completed periodically to confirm accurate data storage and backup. This process will be accomplished by reviewing survey logs and data processing logs. The FOL/QC manager will verify the performance of these QC activities.

3.5 DATA COLLECTION AND PROCESSING PROCEDURES

3.5.1 General Requirements and Procedures

3.5.1.01 The requirements in this section are applicable to all field activities including boating activities, marine bathymetric and geophysical mapping and data verification. Historical review, administrative activities, or training conducted off-site are not subject to the requirements in this section. SOPs for the activities have been provided by the USACE and are presented in Appendix B of this document.

3.5.1.1 Daily Briefings/Verification

3.5.1.1.01 At the beginning of each working day, the project FOL or designee will hold a daily briefing. At a minimum, the daily briefings will include:

1. Review of safety practices and emergency procedures

2. Review and testing of communications
3. Review of any site-specific or applicable task-specific hazards

3.5.1.1.02 Other topics that will be discussed, as necessary, include QC, changes to the work schedule, equipment maintenance, and any other issues that may affect the activities being performed that day or in the near future.

3.5.1.1.03 During the daily briefing, the FOL will also discuss selected work sites and/or tasks for the day. Each field team member will receive the instructions necessary to perform the assigned work. Attendance at the daily briefing will be documented in the FOL's field logbook and/or on daily briefing forms.

3.5.1.2 Tailgate Briefing

3.5.1.2.01 If the field team is divided into groups working in separate areas of the site or on separate tasks, a tailgate briefing may be required during which the team lead for that activity discusses specific safety hazards or mitigation measures specific to the assigned task or work area. The daily briefing at the site will fulfill the requirement for a tailgate briefing if all relevant information is presented regarding the hazards associated with all assigned work.

3.5.1.3 Equipment Testing and Maintenance

3.5.1.3.01 All equipment used by the field team will be verified to be working properly prior to use each day. The functionality of marine mapping instrumentation will be ensured by using the calibration and QC testing discussed in Sections 4.5 and 5.

3.5.1.3.02 All mapping equipment testing will be verified and documented in the field log book or on appropriate field forms by the FOL or designee. If any equipment requires repair or new equipment is brought on-site, it must be inspected and confirmed to be operational by the FOL or designee prior to use. The FOL or designee will also inspect any other equipment, including marine vessels and safety equipment, to be used each day to ensure that the equipment is in proper working order. Inspections will be documented in the filed log book or on appropriate forms.

3.5.2 Positioning

3.5.2.01 All positioning data for the survey will be based on RTK GPS or OmniSTAR-HP differential global satellite navigation system to provide sub-meter position accuracies both horizontally and vertically.

3.5.2.02 The vessels conducting MBE operations will be set up with the Applanix POS MV or IXSEA PHINS system (or equivalent), which provides position, heading, and vessel roll, pitch, and heave information to the MBE data collection systems. This positioning system includes two RTK GPS receivers that are used to discipline the inertial motion unit (IMU) and

aid in the determination of heading. RTK corrections will be provided from a base station via radio modem.

3.5.2.03 Towfish positioning will be provided using an ultra-short baseline acoustic positioning system. This GPS-aided inertial platform measures position, heading, roll, pitch, and heave so that it can independently determine its position and attitude. A cable counter will also be installed as backup. If a survey area is not of sufficient depth to utilize the acoustic tracking, the layback calculation may be used as the primary method for positioning the SSS towfish.

3.5.3 Site Control Network

3.5.3.01 Geodetic control at the site will be established for the hydrographic and underwater video surveys. Control point locations will facilitate GPS base station control for bathymetric mapping (areas with a sufficient view of the sky that are accessible for base station setup). All survey data and control will be referenced to the following, unless otherwise specified:

Horizontal Datum:	State Plane NAD83 Puerto Rico 5200 Meters
Vertical Datum:	Puerto Rico Vertical Datum of 2002 (PRVD 02) Meters

3.5.4 Multibeam Echosounder Survey

3.5.4.01 The MBE bathymetric survey will be conducted in general accordance with the most recent USACE Hydrographic Surveying Engineering Manual (USACE 2002) for an echosounder survey.

3.5.4.02 Accuracy standards for various types of survey are tabulated in Appendix B, Table 1 of USACE (2002) and Table 1 of the International Hydrographic Organization (IHO) Special Publication No. 44 (IHO 1998). Data from both of these publications are consolidated in Table 3-3 below. USACE and IHO special survey requirements will be fulfilled, with the acknowledgement that conforming to the full bottom coverage requirement in the identified survey area will be contingent upon unlimited access to areas with sufficient water depth and maneuvering, and that the survey will be conducted with a 400-kHz multibeam system. It is anticipated that there will be areas that are not covered in shoreline, shoal, and restricted areas. RTK GPS or OmniSTAR-HP positioning will be utilized, resulting in horizontal positioning accuracy of approximately 0.1 meter.

Table 3-3. Multibeam Echosounder Accuracy Standards

Order	Special	1	2	3
Examples of Typical Areas	Harbors, berthing areas, and associated critical channels with minimum under-keel clearances	Harbors, harbor approach channels, recommended tracks, and some coastal areas with depths up to 100m	Areas not described in Special Order and Order 1, or areas up to 200m water depth	Offshore areas not described in Special Order, and Orders 1 and 2
Horizontal Accuracy (95% Confidence Level)	2m	5m + 5% of depth	20m + 5% of depth	150m + 5% of depth
Depth Accuracy for Reduced Depths (95% Confidence Level) 1/,2a/	a = 0.25m b = 0.0075	a = 0.5m b = 0.013	a = 1.0m b = 0.023	Same as Order 2
100% Bottom Search 3/	Compulsory 2b/	Required in selected areas 2b/	May be required in selected areas	Not applicable
System Detection Capability	Cubic features > 1m	Cubic features > 2m in depths up to 40m; 10% of depth beyond 40m 3/	Same as Order 1	Not applicable
Maximum Line Spacing 4/	Not applicable, as 100% search compulsory	3 x average depth or 25m, whichever is greater	3 to 4 x average depth or 200m, whichever is greater	4 x average depth

Notes:
1/ To calculate the error limits for depth accuracy, the corresponding values of a and b listed in this table are introduced into the formula

$$\pm\sqrt{a^2 + (b*d)^2}$$

where,
a is the constant depth error, i.e., the sum of all constant errors,
b*d is the depth dependent error, i.e., the sum of all depth-dependent errors,
b is the factor of depth-dependent error and
d is depth.
2a/ The confidence level percentage is the probability that an error will not exceed the specified maximum value.
2b/ For safety of navigation purposes, the use of an accurately specified mechanical sweep to guarantee a minimum safe clearance depth throughout an area may be considered sufficient for Special Order and Order 1 surveys.
3/ A method of exploring the seabed which attempts to provide complete coverage of an area for the purpose of detection of all features addressed in this publication. The value of 40m has been chosen considering the maximum expected draught of vessels.
4/ The line spacing can be expanded if procedures for ensuring adequate sounding density are used.
Sources: USACE 2002; IHO 1998

3.5.5 Multibeam Echosounder Data Processing

3.5.5.01 The collected MBE sounding data will be processed using HYPACK and CARIS Hydrographic Information Processing System (HIPS) software, respectively, to generate the XYZ soundings in the survey coordinate system and units.

3.5.5.02 The MBE data cleaning will be performed in CARIS HIPS two-dimensional and three-dimensional editing software. A subsequent area-based cleaning, using the merged data from all the survey lines, will then be conducted on the MBE data using the CARIS HIPS subset editing tool. XYZ files of the individual soundings will then be exported out of the CARIS environment. Following initial post-processing the data will be imported and gridded in Fledermaus for further processing and format conversion. Sounding data collected in shallow

water will be interpolated to fill data gaps. Final data presentation materials will be generated using a combination of Fledermaus, HYPACK, and ArcGIS software.

3.5.6 Quality Assurance/Quality Control for Multibeam Echosounder Data

3.5.6.01 TtEC's data quality is established at the time of data collection through proper setup and operation of the survey systems, and cannot be enhanced during processing, other than to remove obviously invalid data. Survey, data processing, and QA procedures will comply with the applicable guidelines provided by the USACE.

3.5.6.02 Data quality can be assessed explicitly: a single data element is compared directly to a standard or known control. Alternatively, quality can be assessed implicitly: combinations of data elements are compared to members of their own set for internal consistency. Additionally, quality can be measured quantitatively (numerically) or qualitatively, requiring interpretation on the part of an operator.

3.5.6.03 For each step of the setup and operation of the survey system, a series of checks is run on the equipment and data collection software configuration. These checks will be documented in the survey collection logs and a dedicated QC electronic log and the results will be included in the EBS report. Where possible, a quantitative measurement of data quality is identified for each data type acquired. Procedures are constructed to measure this quantity as near as practicable to the point of acquisition. These measurements of quality are continually assessed throughout the acquisition and processing phases of the project. Where a quantitative measure of data quality cannot be developed, an interpretive or qualitative method is contrived to estimate data quality.

3.5.6.04 Data that fail to meet minimum quality standards will be discarded. A number of individual data elements are required to calculate a sounding. These include sounder data, vessel attitude, sound velocity profile (SVP), tide, draft, and position.

3.5.6.05 Field methods used for measuring data quality begin with position accuracy. Throughout the survey the echosounder operator reviews the positions of identifiable features in the online HYPACK/HYSWEEP coverage plots. This software allows the user to compare the results of the measured positions for consistency within the lines and against external references. Positions of well-defined features, mapped on overlapping lines, should agree to within a few decimeters.

3.5.6.06 Motion data are also scrutinized in HYSWEEP. These data are more difficult than vessel position to QC because there is only one system and it cannot be checked against itself. Consequently, the heave component of the motion data set is merged with the soundings from the vertical beam. A timing error in either of these systems will result in a residual oscillation in the measured depth. Amplitude errors in the heave record will have a similar effect.

3.5.6.07 Sounding data from the MBE are subject to interpretive and quantitative measurements of data quality. During acquisition, sonar operators monitor data quality on the MBE monitor and HYPACK/HYSWEEP acquisition screens. The general noise level of the soundings and useable swath width are visible on the echosounder's monitor. Custom screens in HYPACK and HYSWEEP allow the operator to view a DTM of average depths, waterfall displays, and individual profiles. These displays require interpretation and are used as the first quality check on multibeam data.

3.5.6.08 The data will be viewed again as they are cleaned (flagged for exclusion from the final data set) and edited. In HYPACK and CARIS HIPS, lines can be examined for obvious errors. By this time, however, the data are bundled with all their ancillary data elements: SVP, tide, static draft, squat and settlement, heave, pitch, and roll.

3.5.6.09 The final quality assessment for the data set is conducted with Fledermaus Pro software. Production line data are compared to a DTM created from a cross line. Differences between the soundings and the surface are tabulated for each beam and evaluated with respect to an accuracy standard, in this case, an IHO specification. Compliance with the specification must exceed 95 percent.

3.5.6.010 The visualization tools available in the processing software provide clear indications of any problems in the motion sensor data or in the time correlation of the echosounder and motion data. Any errors in these areas will result in identifiable data artifacts. Conducting at least preliminary processing of the bathymetry data on the vessel will allow any problems to be caught and corrected quickly, and will ensure that a full, high-quality data set is collected.

3.5.7 Sidescan Sonar Survey

3.5.7.01 Acoustic images of the seafloor in the survey area will be acquired with SSS. These data will be used to provide qualitative information on the nature of the bottom type. This characterization includes identifying zones of hard or soft bottom (rock or coral outcrops and fine- to coarse-grained sediment) and the presence of debris proud of the bottom.

3.5.7.02 During SSS operations, images will be displayed in real-time on a computer monitor that will be interfaced with the navigation system to provide geo-referencing for the data. The data will be digitally recorded.

3.5.7.03 The SSS towfish will be tracked with an acoustic tracking system; a cable counter will be employed as backup to calculate layback. In shallow areas, the SSS may be mounted off the bow with a fixed offset applied.

3.5.8 Sidescan Sonar Data Processing

3.5.8.01 SSS will be processed using Chesapeake Technology's SonarWiz.MAP software (or similar). Each data file will be bottom-tracked to remove the water column from the data to allow proper slant range and beam angle corrections to be applied.

3.5.8.02 Targets detected in the SSS data can be picked in real time or in post-processing and can be exported in a target report in shapefile and/or Microsoft Excel format directly from SonarWiz.MAP.

3.5.8.03 Sidescan data will be exported as a mosaic in GeoTIFF format to be used for delineation of habitat areas.

3.5.8.04 Final data presentation materials will be generated using a combination of SonarWiz.MAP and ArcGIS.

3.5.9 Quality Assurance/Quality Control for Sidescan Sonar Data

3.5.9.01 The SSS is factory calibrated and cannot be field calibrated or adjusted. QA/QC of the SSS data will be performed in real time by observing the quality of the data on the computer monitor used with the digital acquisition system. The digital data, along with the navigation, will be reviewed at the end of each survey day to verify the data quality and ensure that the requirements for coverage have been met.

3.5.9.02 A navigation check will be conducted on the SSS data by measuring the position offset of a target observed on two adjacent lines run in opposite directions. This check will be conducted at the beginning of the survey once a distinct target has been detected on adjacent lines and throughout the sidescan operations during post-processing.

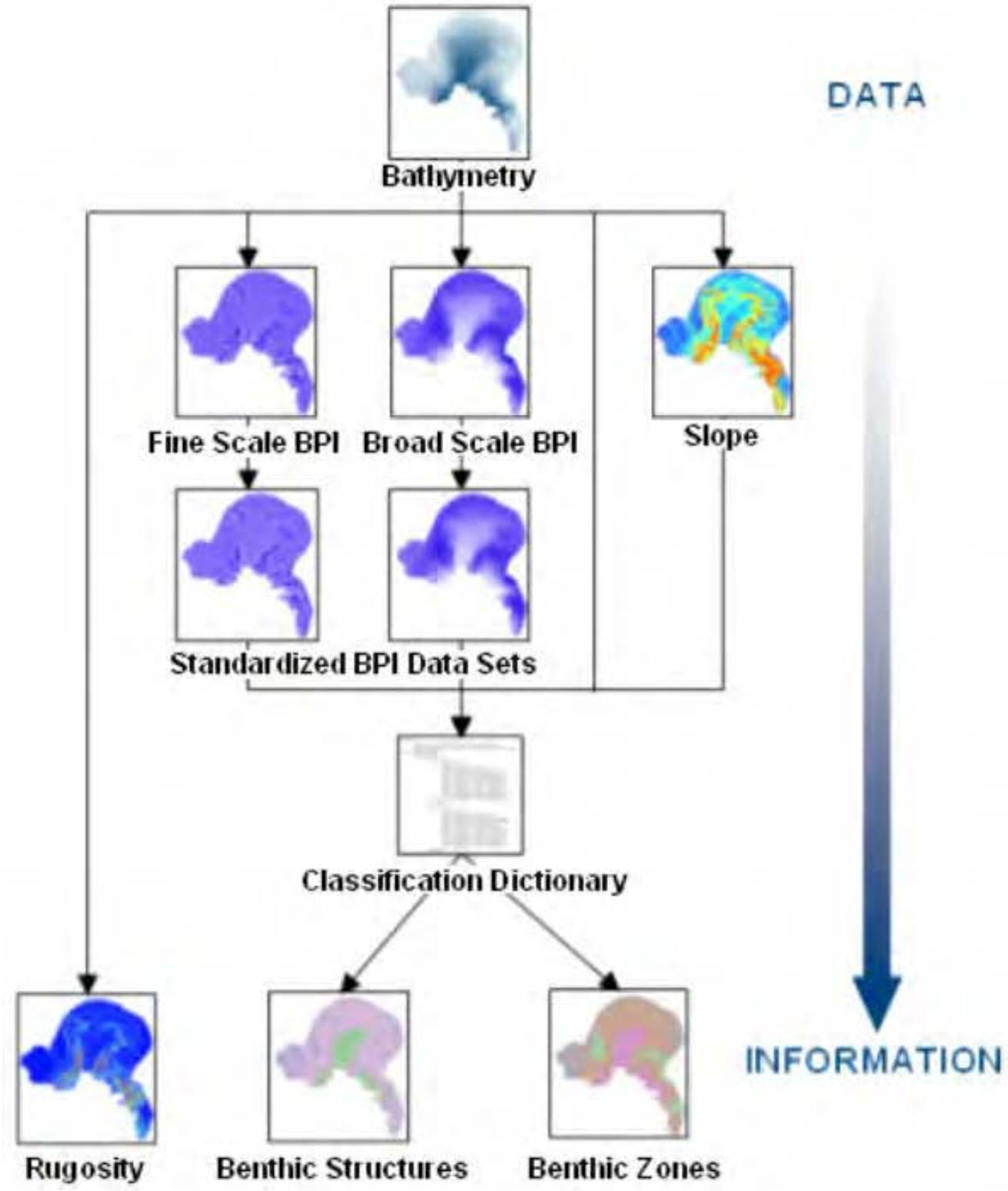
3.5.10 Benthic Characterization and Habitat Assessment

3.5.10.01 The survey area bottom type characterization will build upon the results of the MBE, SSS, and video surveys. MBE and SSS imagery data will be processed using Quester Tangent Swathview™ software, the Geocoder module implementation in the CARIS HIPS/ Sidescan Image Processing System (SIPS) software package, Fledermaus Pro, or an equivalent Geocoder implementation. Geocoder, originally developed by Dr. Luciano Fonseca, contains algorithms for radiometric and geometric backscatter corrections, as well as angular response analysis capabilities, to produce reliable mosaics of acoustic backscatter that can aid in the mapping of surficial seafloor features and facies and aid in seafloor characterization.

3.5.10.02 The BTM will be used to analyze the MBE bathymetry to further evaluate and define bottom types. The BTM is a set of ArcGIS-based tools for benthic analysis developed by the Department of Geosciences at Oregon State University and National Oceanic and Atmospheric Administration Coastal Services Center. The BTM will be used to characterize the seabed bathymetry and classify the benthic terrain within the survey area by comparing positions

of grid points in the bathymetry DTM to adjacent points, to determine areas of different terrain structures (Figure 3-9).

3.5.10.03 These bottom type and classification methods will be used along with readily available aerial photographs to develop a detailed preliminary assessment of the bottom topography and structure, including delineation of areas of different bottom type. This preliminary bottom type classification will be evaluated and revised by both a TtEC geologist and a biologist experienced with classification of bottom and habitat types because all bottom-type classification software is still in developmentr and no commercial off-the-shelf software that produces reliable classification without human interaction is available. The geologist and biologist will review the results of the MBE bathymetry and imagery analyses to identify areas of potential sensitive habitat. The video from these target areas will then be reviewed and assessed as to whether additional video surveys are needed to support bottom-type characterization and identification of features detected in the MBE data and to help define the locations and types of habitat-based ecosystems.



Source: OSU and NOAA

Figure 3-9. Graphical Depiction of the BTM Process

4.0 QUALITY CONTROL PLAN

4.0.01 TtEC will use a range of operator data displays, processing tools, and procedures to ensure all survey equipment are functioning correctly and accurately prior to the start of the survey, at the start of survey day, during the course of data collection, and by performing at least preliminary processing of survey data prior to terminating field operations. These checks will include daily GPS water level checks, sonar bar checks, real-time monitoring of incoming data by trained operators, and quality checks such as the collection of cross lines (lines set at approximately 45 to 90 degrees to the survey lines). The bathymetry data obtained at the intersection of the survey lines and cross lines will be post-processed in CARIS HIPS or Fledermaus Pro to provide a statistical analysis of the correlation between the data from two perpendicular survey lines. The SSS navigation check will be performed daily by surveying two adjacent lines in opposing directions and evaluating the alignment of features. Table 4-1 summarizes the measurement performance criteria for each survey system and the frequency at which the check will be performed. Appendix F contains the SOP and QC forms that will be used for this EBS.

4.1 POSITION VALIDATION

4.1.01 Prior to start of survey operations, the survey crew will verify the positional (X and Y) accuracy of the GPS by comparing it with selected terrestrial control points. RTK GPS measurements will match the published positions to within 0.1 meter x, y, and z. This check will also be conducted at the end of survey operations and documented in the survey log.

4.2 VESSEL SURVEY AND VERIFICATION

4.2.01 Spatial offsets are precisely measured for the multibeam sonar, attitude sensor, and GPS antennas, so that the HYPACK/HYSWEEP acquisition software can accurately combine and convert the sonar and support sensor data into real-world coordinates in real time. These offsets are also used in the CARIS software vessel configuration file (VCF) for data processing. The VCF serves the purpose of spatially integrating sonar and ancillary sensor data and in doing so, converts the raw sonar data into real world coordinates as defined by the project coordinate system. After installation of the MBE equipment on the hull of the survey vessel, the appropriate equipment locations will be measured using a combination of a Leica Disto A8 laser range measurement device (or similar), tape measures and/or total station. All equipment installed will be measured relative to the location and orientation of the IMU. Verification will be performed by having different crew members take independent measurements and comparing the results. The offsets will also be verified through use of the POS MV's GPS azimuth measurement subsystem (GAMS) calibration and documented in the survey log (refer to Section 4.3).

4.3 GAMS CALIBRATION

4.3.01 Prior to performing a multibeam system installation calibration test (a "patch test") and whenever necessary, as automatically determined by the Applanix software (POSView), an alignment calibration of the Applanix motion and heading sensor will be performed. This procedure, which Applanix refers to as a GAMS calibration, utilizes software integrated into the motion sensors. The GAMS calibration procedure is initiated while the survey vessel maneuvers in a figure eight pattern. This calibration procedure allows the POSView software to calculate offsets between the motion sensor's two GPS antennas and align the measured heading with the vessel, resulting in achievement of the POS MV specified heading accuracies, which range from 0.02 to 0.06 degree.

4.4 MBE PATCH TEST

4.4.01 A standard patch test also known as an installation calibration test will be carried out prior to the MBE survey to calculate the angular offsets between the multibeam echosounder and the motion sensor IMU. The installation calibration process is used to derive the roll, pitch, and yaw angular offsets between the multibeam sonar and the local reference frame defined by the IMU. The patch test is also used to determine latency in the positioning equipment. The sonar and acquisition computers are time synchronized by the motion sensor's GPS; as a result, there should be no latency detected between sensors.

4.4.02 The patch test is generally conducted over an area where multiple distinct features with significant changes in depth occur over short distances along track. Pitch, roll, and yaw are measured using areas with the following characteristics and documented in the survey log:

- Roll—reciprocal lines surveyed over a flat bottom
- Pitch—reciprocal lines surveyed over a sloping bottom, or a distinct linear feature
- Yaw—offset lines surveyed over a sloping bottom, or a distinct linear feature

4.5 BAR CHECKS

4.5.01 Bar checks are conducted daily during sonar operations to ensure sonar equipment and processing software are functioning properly. The bar check is a consistency check. An aluminum plate on a calibrated line is manually lowered to a known depth below the sonar head. The depth of the plate below the water surface is recorded and compared to the value reported by the HYSWEEP Bar Check Utility and documented in the survey log.

4.6 WATER SURFACE CHECKS

4.6.01 The water level check compares the water level reported by the HYPACK acquisition software to the value measured at the same time by a field technician using a Leica 1230 RTK GPS rover identical to the model installed on the survey boat. This test verifies proper installation offsets on the vessel and that the GPS is configured properly and receiving accurate real-time corrections and documented in the survey log.

4.7 CROSS LINE TESTS

4.7.01 The cross line test is both a measure of the system function and a data quality check. This test is performed by collecting data (hydrographic or geophysical) along lines intersecting and roughly orthogonal to the primary data collection lines. Data points coincident to both data sets are then statistically compared using Fledermaus Pro (or equivalent) to ensure that the data are consistent. Results of this comparison can be output in a graphical or tabular report. Failures in this test are indicative of malfunction, improper installation or calibration, invalid sound speed corrections, or improper operation of the instrumentation.

4.8 SIDESCAN SONAR NAVIGATION CHECK

4.8.01 A system navigation check will be conducted on the SSS data by measuring the position offset of a target observed on two adjacent lines run in opposite directions against each other and compared to the location of this feature in the MBE data. This check will be conducted at the beginning of the survey once a distinct target has been detected on adjacent lines and throughout the sidescan operations during post-processing and documented in the survey log.

Table 4-1. Measurement Performance Criteria Table

Type of Survey Data	Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency	Failure Response
Hydrographic Surveys	Precision	Cross line data	Data points common to both survey lines and cross lines will have x, y, z coordinates that are repeatable within SOP 01 specified USACE Hydrographic survey standards (refer to Table 3.3). Hydrographic Survey data shall meet or exceed Special Order Standards. Special Order Standards include the following: Horizontal Accuracy (95% confidence Level) is 2 meters. Depth Accuracy for Reduced Depths (95% Confidence Level) is calculated using the following equation $DARD = +/- [a^2 + (b * d)^2]^{1/2}$ where: a (0.25 meter) is a constant depth error, i.e., the sum of all constant errors, (b = 0.0075)*d is the depth dependent. The near full bottom search is compulsory and system detection capability is measured as cubic features >1 meter.	Minimum one cross line per 20 transects	Root cause analysis will be performed. Source of failure will be identified and corrected.
	Completeness	Visual evaluation of real-time data for verification that intended coverage goals are met	Real-time coverage plots (matrix fills) will be utilized to monitor MBE coverage. 90% of the matrix will be filled in areas that are accessible for survey (i.e., sufficient water depth, lack of obstacles, safe for navigation) and do not fall into shadow areas due to objects proud (slightly above) of the bottom, or due to depressions. Coverage will be confirmed during post processing. It is anticipated that there will be areas that are not covered in shoreline, shoal, and restricted areas	Continuous visual monitoring during data collection	Data gaps will be identified and additional data will be collected to fill in the area.

Table 4-1. Measurement Performance Criteria Table (continued)

Type of Survey Data	Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency	Failure Response
Hydrographic Surveys cont'd	Sensitivity	Real-time monitoring and use of gains and gate filters, software quality flags.	MBE data collection depth range is optimized to reduce anomalous reflections and provide optimum data, gains are set to provide appropriate bottom tracking. The MBE conducts internal testing to check the validity of each ping based on colinearity and brightness and each ping is tagged with a quality flag of 0-3 based on the these tests. During processing, the pings are filtered based on the quality flags to eliminate all but the data with a quality of 3 unless conditions warrant accepting lower quality pings (such as shorelines or vertical structures).	Continuous visual monitoring during data collection, sonar system quality flags.	Root cause analysis will be performed. Source of failure will be identified and corrected.
	Accuracy	GPS survey crew will check on selected control points with rover GPS. Water level check – Use GPS rover to check water surface elevation. Compare to survey system navigation reported tide level. Bar check and/or lead line check vs. water surface relative depth from sonar.	GPS measurements will match published position to within 0.1 meter x, y and z. GPS water level and survey system tide level will match to within 0.1 meter. Nadir bathymetry depths relative to surface, corrected for draft and attitude match to within 0.1 meter.	Daily Once at the start and once at the end of survey operations. Once at the Start of MBE Survey Operations	Root cause analysis will be performed. Source of failure will be identified and corrected.

Table 4-1. Measurement Performance Criteria Table (continued)

Type of Survey Data	Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency	Failure Response
Sidescan Sonar	Navigation Precision	Reciprocal Survey lines or adjacent survey lines with overlapping coverage collected in opposite directions	Bottom features will align within 2 meters. Conducted at the beginning of the survey once a distinct target has been detected on adjacent lines and throughout the sidescan operations during post-processing. This criterion may be relaxed if the magnetic heading sensor in the sidescan towfish is adversely affected by the magnetic rock present within the survey areas, or if course made good headings are not sufficient.	Minimum of one check per day	Root cause analysis will be performed. Source of failure will be identified and corrected.
	Completeness	Visual evaluation of real-time data for verification that intended coverage goals are achieved	Post-processed will have no along track coverage gaps. Nadir regions will be covered by adjacent survey lines to achieve full coverage in areas that are accessible for survey (i.e., sufficient water depth, lack of obstacles, safe for navigation) and do not fall into shadow areas due to objects proud (slightly above) of the bottom, or due to depressions. Coverage will be confirmed during post processing. It is anticipated that there will be areas that are not covered in shoreline, shoal, and restricted areas.	Daily	Data gaps will be identified and additional data will be collected to fill in the area.

Table 4-1. Measurement Performance Criteria Table (continued)

Type of Survey Data	Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency	Failure Response
Underwater Video	Quality	Recorded Video	A minimum of 1 minute of recorded and video will be played back at the start of each day to ensure the equipment is functioning properly and providing adequate imagery.	Daily	Root cause analysis will be performed. Source of failure will be identified and corrected.
	Completeness	Tracklines, Data files	Video will be recorded concurrently with MBE and SSS surveys if possible and at transects of no less than 100ft apart if not. Data acquisition coverage plots along with file size monitoring will be used to verify that video has been recorded.	Continuously	Data gaps will be identified and additional data will be collected to fill in the area.

5.0 EXPLOSIVES MANAGEMENT PLAN

5.0.01 Section 5 is not applicable to the project and will serve as a placeholder section only.

6.0 ENVIRONMENTAL PROTECTION PLAN

6.1 INTRODUCTION

6.1.01 This EPP was prepared in accordance with Data Item Description MR-005-12, the Performance Work Statement, and the SOPs developed by the USACE (Appendix B). The purpose of this EPP is to establish general procedures for avoiding, minimizing, and mitigating potential impacts to environmental and cultural resources during field activities and comply with applicable or relevant and appropriate requirements (ARARs). This EPP describes sensitive natural resources specifically within the MRSs Flamenco Bay (MRS 03) and the Luis Peña Channel (MRS 12) and sets forth methods to protect and conserve those resources during the EBS field activities. The intent of the EBS is to photograph and collect video and to perform bathymetry surveys documenting benthic site conditions, define and delineate benthic and coral reef habitats, sensitive or critical habitat areas, and document features of the underwater environment in these two MRSs. This information is being used to help protect these areas and the species that inhabit them from harm during the more intrusive RI activities.

6.1.02 Flamenco Bay is a shallow bay comprising approximately 195 acres that extends up the east side of the Northwest Peninsula and the west side of Flamenco Point in Puerto Rico. Flamenco Bay is currently used for recreational swimming, diving, and snorkeling activities. The Luis Peña Channel is made up of waters that comprise the Luis Peña Channel Marine Reserve, approximately 835 acres of water along the west coast of Culebra from the Northwest Peninsula to Scorpion Point. The Luis Peña Channel Marine Reserve is managed by the DNER, which has identified 41 types of uses (Valdez-Pizzini et al. 2008), including recreational swimming, boating snorkeling, and diving. Fishing is another use documented in the area (Hernández-Delgado 2003a; Pagán-Villegas et al. 1999), although since 2004 its practice is illegal inside the Reserve (Valdez-Pizzini et al. 2008; DNER 2010a).

6.1.03 This EPP outlines potential measures that can be implemented to mitigate potential impacts to sensitive biological resources. These mitigation measures were developed based upon a site-specific analysis that addresses unique concerns for work within and along the beaches of the Culebra Water Ranges and incorporates best management practices and guidelines that have been implemented for intensive field programs previously performed by other Military Munitions Response Program (MMRP) contractors on Culebra. Several SOPs for conservation of endangered species and their critical habitat during underwater investigations were developed by USACE and comprise:

- An April 2012 Final SOP for Endangered Species Conservation and their Critical Habitat during Underwater Investigations (most up-to-date information is contained in this document related to corals) including two appendices as follows:
  - A July 2008 Final SOP for Endangered Species Conservation and their Habitat; and

- An April 2011 Addendum to the 2008 SOP (contains mainly terrestrial based species information).

6.1.04 These SOPs are referenced throughout the EPP and are included in this Work Plan as Appendix B. As stated in Section 4.6 of the 2012 SOP, the July 2008 SOP and its 2011 Addendum remain in effect. The 2012 SOP is meant to supplement, not replace, previous SOPs; it provides the most up-to-date information regarding listed corals.

6.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

6.2.01 This project is being performed as part of a FUDS Program. Through a site inspection (Parsons 2007), it was determined that MRSs 03 and 12 warrant further investigation under the MMRP. FUDS response activities are conducted in accordance with the DERP statute (10 U.S. Code [USC] Section 2701 et seq.), the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA; 42 USC Section 9601 et seq.), Executive Orders 12580 and 13016, and the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Regulations Part 300). An RI/FS will be performed by TtEC for the two MRSs that comprise the Culebra Water Ranges. Prior to the RI fieldwork, an EBS will be performed. The EBS is the subject of this EPP. A separate EPP will be prepared for the RI fieldwork based, in part, on findings of the EBS.

6.2.02 The identification of ARARs and To Be Considered (TBCs) is an iterative process that must be considered throughout the CERCLA process. As such, the list of identified requirements and their relevance may change as more information is obtained following completion of the EBS and during the RI/FS process. The EBS and RI are used to ascertain site conditions and types and extents of contamination. Site remedies are not evaluated until the FS. During the investigation stage of the RI, limited ARARs that potentially directly relate to site activities may be determined. Federal and Puerto Rico-specific potential ARARs and TBCs are presented in paragraphs 6.2.05 through 6.2.07. This Environmental Protection Plan, including associated SOPs help define the requirements that will be followed during the EBS to comply with these ARARs and TBCs. In addition, coordination with Commonwealth of Puerto Rico agencies such as DNER and the PREQB as well as coordinating officials with NMFS/NOAA, USFWS, and Refuge Managers within their jurisdiction is also appropriate to ensure the project is protective of the environment and of listed species and critical habitat.

6.2.03 Federal and state requirements must be considered for identification of site-specific ARARs. Federal and state requirements include ARARs that are:

- Chemical-specific (governing the level or extent of site remediation relative to a specific constituent);
- Location-specific (pertaining to existing site features and location); and
- Action-specific (pertaining to proposed site remedies and implementation of the selected site remedy).

6.2.04 Chemical-specific ARARs are not addressed in this EPP because these will come into play following the RI if MC are found during sediment sampling and are compared to data quality objectives that the project team determines for the FS evaluation. A limited amount of location- and action-specific ARARs and TBCs are listed for the EBS and RI, which may undergo further revision during the FS process as more information is known about these MRSs and remedial alternatives are proposed for comparative analysis. Paragraphs 6.2.06 through 6.2.08 contain the tentatively identified ARARs and TBCs.

6.2.05 Following are some notes regarding the ARARs for the EBS identified below:

- Chapter 4 of the EPA guidance document entitled *CERCLA Compliance with Other Laws Manual, Part II* (EPA 1989) states that "While EPA interprets CERCLA §121(e) to exempt lead agencies from obtaining Federal, State, or local permits (or documents similar to permits) or from complying with the administrative requirements for on-site remedial activities, it is strongly recommended that lead agencies, nevertheless, consult as specified with administering agencies for on-site actions. The administering agencies have the expertise to determine the impacts of a remedial action on particular aspects of the environment and what steps should be taken to avoid and mitigate adverse impacts." For instance, with respect to Archaeological and Historic Preservation Act and Archaeological Resources Protection Act (ARPA) consultation requirements, the guidance states that "Although administrative and procedural requirements are not ARARs for onsite activities, adherence to these steps is strongly recommended for cleanup actions that take place entirely onsite because of the effectiveness of these procedures in identifying cultural resources and the expertise of the SHPO and Advisory Council on Historic Preservation in these matters." As such, while the administrative aspects of consultation do not need to be strictly followed, active input and involvement with resource experts does ensure cultural, historic, and archaeological or other eligible resources are properly documented and preserved.
- The potential ARARs cited in this document specifically prepared for the EBS Survey are not intended to apply to cleanup actions because the EBS is being undertaken for purposes of site characterization only. The RI Work Plan, which will be prepared separately, will identify potential ARARs that apply to the work to be undertaken during the RI which is more intrusive in nature, and will incorporate results of the EBS survey as necessary (e.g., if cultural items are discovered during the EBS). ARARs for the remedial alternatives analysis will be finalized during the CERCLA remedial alternatives evaluation.
- Because the EBS survey is not anticipated to generate hazardous waste (non-intrusive), the potential ARARs list does not include an evaluation of federal hazardous waste regulations as ARARs. The substantive requirements of these regulations will be included in the Environmental Protection Plan within the RI Work Plan.

- EPA guidance recommends that the lead federal agency consult with the state when identifying state ARARs for removal actions (EPA 1988). In essence, the CERCLA/NCP requirements at 40 CFR § 300.515 for removal actions provide that the lead federal agency request that the state identify chemical-, location-, and action-specific state ARARs upon completion of site characterization. At the present time, Puerto Rico–specific ARARs are not identified because site characterization has not been completed. The purpose of the EBS is for further site characterization.

6.2.06 Federal

1. Presence of endangered or threatened species or critical habitat of such species as designated in 50 CFR 17 or 50 CFR 226, Endangered Species Act (ESA) of 1973, as amended and 16 USC 1531 et seq. (50 CFR 402). On-site activities must be conducted in a manner that does not result in a take of these species and actions must not destroy critical habitat. No takes are authorized and penalties may be issued to personnel whose actions result in a "take." Personnel on this project will be trained to recognize these species and their critical habitat as well as the actions that minimize potential for a take to occur and prevent destruction of critical habitat; they will also be informed that penalties may be imposed on persons whose action results in a take.

2. Presence of essential fish habitat (EFH) under the Magnuson-Stevens Fishery, Conservation and Management Act, 50 CFR 600.920(e)(3) and 16 USC 1801. The Act defines EFH as the waters and substrate necessary to fish for spawning, breeding, feeding, and growth to maturity. An adverse impact as defined in the EFH rules is "any impact which reduces quality and/or quantity of EFH. . . . [and] may include direct, indirect, site-specific or habitat wide impacts, including individual, cumulative, or synergistic consequences of actions." U.S. coral reef ecosystems in Puerto Rico were designated as EFH by the Caribbean Fisheries Management Council pursuant to the Magnuson-Stevens Fishery, Conservation, and Management Act. The 2004 *Essential Fish Habitat Consultation Guidance* (NMFS 2004), pursuant to Section 104-279(b)(2) of the Act, states that when an agency determines that its activities may have an adverse effect on EFH, consultation with the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) is required. Although administrative requirements such as consultation need not be complied with for CERCLA actions and are not ARARs, if it is determined, for instance, during the EBS that in situ MEC disposal (blow in place) is required because an item is deemed unstable and posing immediate potential for harm and that this detonation could have an adverse impact on coral reefs, consultation with NOAA Fisheries (as well as consultation regarding ESA species and their critical habitat, which could result in an incidental take of listed species) may be warranted so that appropriate mitigation strategies can be identified.

3. **Archaeological Resources Protection Act (ARPA) of 1979.** Substantive provisions at 16 USC § 470ee(a) state that no person may excavate, remove, damage, or otherwise alter or deface, or attempt to excavate, remove, damage, or otherwise alter or deface any archaeological resource located on public or Indian lands unless such activity is pursuant to a permit or is exempted. In addition, no person may sell, purchase, exchange, transport, or receive any archaeological resource if resource was excavated or removed in violation of this regulation. Should suspected archaeological, cultural, or historical items be discovered during the course of the investigation, the item(s) will not be disturbed. Any such findings will be reported to the USACE representative so that notification of the SHPO and Advisory Council can be made. Identification of resources during the EBS and consultation will help ensure that these items are not adversely impacted during the RI or remedial action that follows.
4. **Archaeological and Historic Preservation Act, 16 USC § 469–469c-1.** Substantive provisions of this Act require the preservation of historical and archaeological data that might otherwise be lost as a result of an activity. If an activity in connection with any federally approved project may cause irreparable loss to significant scientific, prehistorical, or archaeological data, the Act requires the agency undertaking the project to preserve the data or request the Department of the Interior to do so. Should suspected archaeological, cultural, or historical items be discovered during the course of the investigation, the items will not be disturbed. Any such findings will be reported to the USACE representative so that notification of the SHPO and Advisory Council can be made. Identification of resources during the EBS and consultation will help ensure that these items are not adversely impacted during the RI or remedial action that follows.
5. Criteria for evaluating effects to waters of the U.S., including wetlands. Clean Water Act; 40 CFR 320.1 et seq.; 401, 404 et seq. Project activities will consider ways to lessen impact to estuarine or marine wetlands using methods that involve least disturbance of the benthic environment, least impact to threatened or endangered species, sensitive habitats, and least potential for suspension of sediment.
6. Coastal Zone Management Act; 16 USC 1451-1464; 15 CFR 921-933. Federal agency actions affecting the coastal zone must be consistent with the enforceable policies of the approved Puerto Rico coastal zone management program.
7. The Migratory Bird Treaty Act; 16 USC 701-712. This Act makes it unlawful to (or attempt to) pursue, hunt, take, capture, or kill any migratory bird, part, nest, egg, or product. All but a few bird species naturally occurring in the U.S. are protected under this Act. On-site activities must be conducted in a manner that does not result in a take of these species.

8. Marine Mammal Protection Act of 1972 (MMPA); 16 USC 1361, 50 CFR 12. It is unlawful for any person or federal agency to take (harass or kill any marine mammal) on the high seas, in U.S. waters, or on land under the jurisdiction of this Act. On-site activities must be conducted in a manner that does not result in a take of these species.

6.2.07 Worker and Public Safety:

1. DoD Ammunition and Explosives Safety Standards DoD 6055.9-STD. Establishes uniform safety standards applicable to ammunition and explosives, to associated personnel and property, and to unrelated personnel and property exposed to the potential damaging effects of an accident involving ammunition and explosives during development, manufacturing, testing, transportation, handling, storage, maintenance, demilitarization, and disposal.
2. Ammunition and Explosives Safety Standards DA PAM 385–64. This pamphlet provides force protection guidance for commanders with an ammunition or explosives mission. It sets forth procedures for use when transporting ammunition or explosives over the public highway. Provides guidance for the remediation of active and FUDS contaminated with ammunition and explosives.

6.2.08 Puerto Rico:

1. Regulation Number 6766 – Regulation to designate Threatened and Endangered Species of the Commonwealth of Puerto Rico, Puerto Rico DNER. On-site activities must comply with the requirements of Law Number 241 (Puerto Rico Wildlife and Critical Habitats Law).
2. Law 112 Protection Law for the Terrestrial Archeological Patrimony of the Commonwealth of Puerto Rico.
3. Regulation for the Control of Hazardous Solid Waste of the PREQB.
4. Regulation for the Control of Non-Hazardous Solid Waste of the PREQB.
5. Regulation for Water Quality Standards of the PREQB.
6. Law 416 – Puerto Rico Environmental Policy Act.

6.2.09 The following are some of the sources that were consulted for identifying biological and cultural resources known to exist or potentially existing at the Culebra Water Ranges site:

- 2012 SOPs (including sub-appendices A and B) (Appendix B);
- Ecological Services in the Caribbean (website) (USFWS 2011a)
- Draft Stock Assessment: West Indian Manatee (*Trichechus manatus*) Puerto Rico Stock (Antillean subspecies, *Trichechus manatus manatus*) (USFWS 2009)
- Draft Site Inspection Report, Northwest Peninsula of Culebra (Parsons 2011)

- Culebra National Wildlife Refuge (website) (USFWS 2008)
- DNER website (http://www.drna.gobierno.pr/)
- Draft Puerto Rico Coastal and Estuarine Land Conservation Plan (DNER 2010b)
- Elkhorn Coral (website) (NOAA Fisheries 2011a)
- Sea Turtles (website) (NOAA Fisheries 2011b)
- Resource Category 1 Designation: The Seagrass Beds of Culebra Island, Puerto Rico (USFWS 1992)
- Environmental Protection Plan, Non-Time Critical Removal Action, Municipality of Culebra, Puerto Rico Final Work Plan (EEG 2006)
- National Wetlands Inventory website (http://107.20.228.18/Wetlands/WetlandsMapper.html)
- National Register Information System (NRIS), National Register of Historic Places
- List of National Historic Landmarks – National Historic Landmarks Program (NHL)
- List of National Heritage Areas (NHA), National Heritage Areas Program
- Coastal Zone Management Program (NOAA)
- National Marine Fisheries Service (NMFS) (NOAA)
- National Marine Sanctuaries and Marine Protected Areas (NOAA)

6.3 ENDANGERED AND THREATENED SPECIES

6.3.01 According to the USFWS, in Puerto Rico and the U.S. Virgin Islands there are 78 protected species including 29 animals. According to the Caribbean and U.S. Virgin Islands threatened and endangered (T&E) species database for the Culebra Archipelago, there are seven endangered species (three with critical habitat); three threatened species (one with critical habitat); and one species that has been delisted, but is subject to a monitoring plan (USFWS 2011a). In addition, two threatened coral species, listed by NMFS, may also be present in the Culebra Water Ranges (NOAA Fisheries 2011c). On October 20, 2009, NMFS received a petition from the Center for Biological Diversity to list 83 species of corals as T&E and to designate critical habitat for these corals. Seven of the 82 coral species have the potential to occur in waters around Culebra and listing of these corals may be warranted. Several endangered whales may be present during certain times of the year around Culebra though they are not likely present in the shallower waters of these MRSs. There are two listed endangered species of plant and two listed reptiles that are not likely to be found in areas of work for the Culebra Water Ranges due to location and project tasks to be performed.

6.3.02 Other than roseate tern and brown pelican, the T&E species listed and/or proposed for listing in Table 6-1 are described in Section 3.0 of the 2012 SOP and in Appendix B of the 2012

SOP, along with photographs typical of the species and identification of breeding/nesting behaviors and critical habitat designations. Reptile and plant (terrestrial) species are addressed in Appendix B to the 2012 SOP in Appendix B. All project personnel will be fully briefed by a qualified staff member (e.g., project biologist) on this EPP and the 2012 SOP (including Appendices A and B) requirements prior to beginning the EBS in order to raise awareness and protect T&E species and sensitive or critical habitats, including sea turtles, sea turtle critical habitat, and other marine mammals. An emphasis will be made as to the potential for civil and criminal penalties to be issued to individuals who harm, harass, or kill T&E species (referred to as a "take"). These documents, including this EPP, will be available to all field teams during the EBS.

6.3.03 Threatened and/or endangered species that may be present in the Culebra Water Ranges, including corals that may be subject to listing, are included in Table 6-1. Logs will be maintained during the project detailing endangered or threatened species sightings in both terrestrial and marine habitats as required in Section 4.1.6 of the 2012 SOP and its appendices.

Table 6-1. Listed or Proposed Threatened or Endangered Species

Common Name	Scientific Name	Group	Status[1/]	Distribution
Loggerhead Sea Turtle	*Caretta caretta*	Reptile	T	Coastal Zones
Green Sea Turtle	*Chelonia mydas*	Reptile	T, CH	Coastal Zones
Leatherback Sea Turtle	*Dermochelys coriacea*	Reptile	E, CH	Coastal Zones
Hawksbill Sea Turtle	*Eretmochelys imbricate*	Reptile	E, CH	Coastal Zones
Brown Pelican	*Pelecanus occidentalis*	Bird	D, MP	Coastal Zones, No Nesting
Roseate Tern	*Sterna dougallii*	Bird	T	Coastal Areas and Offshore Cays, Nesting
Culebra Giant Anole	*Anolis roosevelti*	Reptile	E, CH	Arboreal forest
Virgin Islands Tree Boa	*Epicrates monensis granti*	Reptile	E	Forest and Shrublands
Wheeler's peperomia	*Peperomia sheeleri*	Tree	E	Mesic, Semi-Evergreen Forest
[No Common Name]	*Leptocereus grantianus*	Cactus	E	Subtropical Dry Forest, Rock Substrate
Antillean Manatee	*Trichechus manatus manatus*	Mammal	E	Coastal Zones
Elkhorn Coral	*Acropora palmata*	Invertebrate	T, CH	Coral Reefs
Staghorn Coral	*Acropora cervicornis*	Invertebrate	T, CH	Coral Reefs
Lamarck's Sheet Coral	*Agaricia lamarcki*	Invertebrate	Proposed	Coral Reefs
Boulder Star Coral	*Montastraea annularis*	Invertebrate	Proposed	Coral Reefs
Mountainous Star Coral	*Montastrae faveolata, Montastrae franksi*	Invertebrate	Proposed	Coral Reefs
Pillar Coral	*Dentrogyra cylindrus*	Invertebrate	Proposed	Coral Reefs
Elliptical Star Coral or Pineapple Coral	*Dichocoenia stokesii*	Invertebrate	Proposed	Coral Reefs
Rough Cactus Coral	*Mycetophyllia ferox*	Invertebrate	Proposed	Coral Reefs

Table 6-1. Listed or Proposed Threatened or Endangered Species (continued)

Common Name	Scientific Name	Group	Status[1/]	Distribution
Blue Whale	*Balaenoptera musculus*	Mammal	E	Oceans
Sperm Whale	*Physeter macrocephalus*	Mammal	E	Oceans
Sei Whale	*Balaenoptera borealis*	Mammal	E	Oceans
Fin or Finback Whale	*Balaenoptera physaluis*	Mammal	E,	Oceans
Humpback Whale	*Megaptera novaeangliae*	Mammal	E, De	Oceans

1/ E=Endangered; T=Threatened; CH=Critical Habitat; De=Delisted due to Recovery; MP= Monitoring Plan; Proposed = May be subject to listing as endangered or threatened, but not listed at the present time; De – depleted
Sources:
NOAA Fisheries 2011a, b, c; USFWS 2011b; SOPs (see Appendix B)

6.3.04 Chapter 9 of the ESA prohibits the taking of listed species without special exemption. There is no authorized take of any listed species during this project and no exemptions will be granted. Individuals whose action results in a take may be subject to penalties under the ESA. Taking is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. If any take does occur, work will stop immediately and the take will be reported. Under terms of sections 7(b)(4) and 7(o)(2) of the ESA, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act, provided such taking is in compliance with an incidental take statement.

6.4 CRITICAL HABITAT DESIGNATIONS

6.4.01 On Culebra, critical habitat designations for several listed species have been made as follows (USFWS 2011b; NMFS 2008).

6.4.02 Hawksbill Sea Turtle: On Culebra, critical habitat designation has been made for areas of beachfront on the north shore of the island from mean high tide inland to a point 150 meters from shore Playa Resaca, Playa Brava, and Playa Larga. These critical habitat areas are not within the survey areas of Flamenco Bay or the Luis Peña Channel though these turtles may be present.

6.4.03 Elkhorn and Staghorn Coral: The NMFS has designated critical habitat for Elkhorn and Staghorn corals in Puerto Rico that encompasses the entire Island and associated cays of Culebra. Coral is discussed further in Section 6.6.1.

6.4.04 Green Sea Turtle: On Culebra, critical habitat designation has been made in the waters surrounding the island of Culebra from the mean high water line seaward to 3 nautical miles (5.6 km). The surrounding islands and cays are also critical habitat for green sea turtles. Seagrass

beds such as those in the Luis Peña Channel provide shelter and food for green sea turtles. Seagrass beds are discussed further in Section 6.6.2.

6.4.05 Culebra Giant Anole: On Culebra, critical habitat designation has been made under the ESA for most of the remaining forests on Culebra Island, comprising Monte Resaca, Punta Flamenco, Playa Resaca, and Playa Brava.

Methods to Avoid or Minimize Impacts to T&E Species

6.4.06 Site personnel will coordinate closely with the USACE representative as well as federal and Commonwealth of Puerto Rico environmental agencies as required in the SOPs included as Appendix B to this Work Plan, to avoid and minimize potential impacts to listed species and their habitat. There is no authorized "take" of any of these species during the EBS fieldwork. These SOPs were developed to avoid or minimize impacts take to T&E species listed, pursuant to the ESA, proposed species of coral, and their critical habitats (where identified) during underwater investigations on Culebra Island and the adjacent cays. If take occurs, work must stop immediately and the take must be reported.

6.4.07 Site personnel will follow the requirements included in these SOPs to avoid and/or minimize possible impacts to T&E species and their habitats. Measures to avoid or minimize possible impacts that TtEC will follow during this work are included in Section 4.0 of the 2012 SOP as well as in both Appendices A and B of the 2012 SOP.

6.4.08 Section 4.1.6 of the 2012 SOP will be followed. TtEC will maintain a log detailing endangered or threatened species sightings in terrestrial and marine habitats. The log will include, but not be limited to, the following information: date and time; location coordinates using a GPS unit; species; one or more photographs, if possible; and any actions taken (e.g., species identification and distance from working area, reasons to cease operation, reasons to determine that operation may be resumed, among others) during the work period. All data shall be provided to USACE.

6.4.09 Descriptions of and specific measures to be taken for protection of various species are identified in the following sections of this EPP as follows:

- Marine mammals, including manatees, dolphins, whales, and sea turtles (Section 6.5)
- Coral reefs and seagrass beds (Sections 6.6.1 and 6.6.2)
- Nesting birds (Section 6.6.3)
- Terrestrial endangered plants (Section 6.11)
- Terrestrial endangered reptiles (Section 6.6.4)

6.4.010 The Puerto Rico DNER has jurisdiction on every resource in Puerto Rico (marine and terrestrial). Project activities will be coordinated with the DNER Endangered Species Division, Mr. Carlos Diez. In addition, other agencies also have jurisdiction regarding

endangered species and must be coordinated with/consulted as appropriate, if not coordinated through Mr. Diez. The coordinating official on T&E species on Culebra is the Chief of the USFWS, Caribbean Field Office in Boquerón for species under their jurisdiction (sea turtles inland, manatees, birds, and terrestrial species). For aquatic species (sea turtles in water, corals, and marine mammals), Dr. Lisamarie Carrubba, Coordinating Official for NOAA Fisheries, has jurisdiction. For activities being conducted adjacent or within the Culebra National Wildlife Refuge, the Refuge Manager also has jurisdiction.

6.4.011 In the event that a T&E species is harmed or incidentally taken during the EBS activities, work will stop, and the TtEC PjM will notify the USACE Project Manager (PM) and the DNER coordinating official, and others will be notified as required (e.g., Refuge Manager, NOAA Coordinating Official, USFWS). Following this EPP and the 2012 SOP and its two appendices for work in Flamenco Bay or the Luis Peña Channel will help minimize potential impacts to threatened or endangered species and minimize harm to sensitive or critical habitat areas.

6.5 MARINE MAMMALS AND SEA TURTLES

6.5.01 Several species of marine mammals (whales, dolphins, and manatee) and sea turtles could be present in the offshore or potentially nearshore areas around Culebra.

6.5.02 The MMPA protects all marine mammals and prohibits the take of marine mammals in U.S. waters and by U.S. citizens on the high seas. Additionally, six species (sperm, sei, fin, blue, and humpback whales, and the West Indian manatee) are listed as endangered under the ESA (see Table 6-1). All of these species are managed by NOAA Fisheries, with the exception of West Indian manatee (*Trichechus manatus*), which is managed by the USFWS. A sub-species of the West Indian manatee, the Antillean manatee (*Trichechus manatus manatus*), occurs in Puerto Rico and is endangered. The following describes these species and the sections of the SOPs that contain further information.

6.5.03 Whale species listed in Table 6-1 (T&E species) as well as other species that are not endangered or threatened but are protected under the MMPA may be present at times, though their presence around Culebra, especially in the two water ranges, is not likely and work activities are not likely to impact the species. Whales are addressed in Sections 3.6 through 3.10 of the 2012 SOP. There are procedures to follow to minimize potential impacts to marine mammals from project activities which are included in the SOPs.

6.5.04 Manatees have been reported irregularly in Culebra Island through the years, the individuals usually staying only for a couple of weeks. Although Culebra Island has available habitat, it lacks fresh water, which may hinder a longer stay by manatees (USFWS 2009). Manatees are described in Section 3.5 of the 2012 SOP.

6.5.05 Several species of T&E sea turtles—the loggerhead sea turtle (described in Section 3.1 of the 2012 SOP), green sea turtle (described in Section 3.2 of the 2012 SOP), leatherback sea turtle (Section 3.3 of the 2012 SOP), and the hawksbill sea turtle (described in Section 3.4 of 2012 SOP)—may be present in the waters around Culebra. Seagrass beds (see Section 6.6.2 below) and coral reefs (see Section 6.6.1 below) are an important habitat for sea turtles for foraging and feeding. Seagrass beds are designated as critical habitat for the green sea turtle, as is the area surrounding Culebra to 3 nautical miles offshore, including surrounding islands and cays. Damage to seagrass beds and coral reefs must be avoided during field activities and extra vigilance is required when operating boats near these habitats as potential contact with sea turtles is more likely. In addition, during breeding season, turtles make nests and lay eggs on beaches on Culebra Island and the adjacent cays, making them susceptible to boating activities being performed in shallow water or on beaches during particular times of the year.

Measures to Mitigate Potential Impacts to Marine Mammals and Sea Turtles

6.5.06 One major threat to sea turtles includes destruction and alteration of nesting and foraging habitats. Turtles are also vulnerable in their pelagic stages as juveniles and adults, when they may be caught in fishing nets, struck by boats, or caught in debris.

6.5.07 All of the general and specific conservation measures in Section 4.0 of the 2012 SOP will be followed during the EBS. Specific conservation measures are identified in Section 4.2 (Staging Area Sea Turtle Nesting Monitoring), Section 4.4 (Marine Mammals and Sea Turtles Avoidance Measures), and Section 4.3 (Coral and Seagrass Avoidance Measures). In addition, Section 4.5 (Diving Operations and Equipment) will also be followed during the EBS activities in order to avoid harming of sea turtles and marine mammals and habitat during these activities. Some site activities performed in the Luis Peña Channel may require coordination and scheduling around dates of high green sea turtle activity if the seagrass beds are within the work area. More procedures are included in Appendix A to the 2012 SOP. Where information is provided in more than one location in these SOPs, the most stringent is to be applied.

6.5.08 Beach surveys are an important component of sea turtle protection if staging areas are required in beach areas. In order to select staging areas on beaches and minimize potential impacts to sea turtles and their nests from, on, or near shore survey activities, TtEC will coordinate with the DNER Endangered Species Division (Mr. Carlos Diez). Nest monitoring will be performed in accordance with Section 4.2 of the 2012 SOP and Beach Monitoring and Designation of Beach Zones sections in Appendix A to the 2012 SOP (as applicable) based on activities being performed, though the EBS does not include UXO clearance or vegetation clearance activities. The standard beach monitoring protocol will include having the Project Biologist perform daily morning beach patrols to identify the potential presence of new nests prior to and during the nesting season. The priorities for the beach monitoring protocol are to identify and record nesting behavior (tracks), site selection (sand, vegetation, and borderline), and threats to hatch success (predators, poachers, seawater, and desiccation). As part of the

protocol, if sea turtle nests are found, the Project Biologist, their supervisor, and/or monitoring personnel will communicate daily with the USFWS Boquerón Endangered Species Specialist and the Culebra Islands National Wildlife Refuge Manager (if within the Refuge) as well as the DNER Endangered Species Division. Communications will help ascertain whether new nests have been located and their locations within the work area.

6.5.09 When it is not nesting season, the Project Biologist or appropriately trained personnel will conduct morning beach surveys prior to crews commencing daily activities to determine whether sea turtle nesting has occurred. The same priorities for the protocol inside a nesting season, and described above, will be followed.

6.5.010 Any collisions or sighting of injured or incapacitated marine mammals or sea turtles will be reported immediately to the USACE, USFWS, NMFS/NOAA, and DNER as required in Section 4.4.12 of the 2012 SOP.

6.6 SENSITIVE ENVIRONMENTS AND HABITATS

6.6.01 The Culebra National Wildlife Refuge comprises about 1,480 acres, includes 23 islands and rocks in addition to the four tracts on the main island of Culebra and associated cays, including Luis Peña. The refuge is well known as a nesting site for a variety of seabirds and preserves important habitat for endangered sea turtles.

6.6.02 Conservation priority areas for Culebra include all of the lagoons and beaches on Culebra, the Flamenco Peninsula, all cayos and cays around Culebra, and the Canal Luis Peña Natural Preserve. Flamenco Point and the Northwest Peninsula, and all beaches are managed by the USFWS or DNER for wildlife conservation and recreational use.

6.6.03 Flamenco Bay includes the tourist areas most visited in Culebra and endangered turtle nesting areas. The Luis Peña Channel is located in the Marine Natural Reserve and has coral reef barriers and endangered turtle nesting areas.

6.6.04 The following sections address the varieties of sensitive environments that may be found in the Culebra Water Ranges.

6.6.1 Coral Reefs

6.6.1.01 The DNER, through the Bureau of Fisheries and Wildlife Program, is responsible for conservation and management of coral reefs in Puerto Rico under Law 147, July 15, 1999 (Law for the Protection, Conservation, and Management of Coral Reefs in Puerto Rico). At the national level this coral reef program is part of the Coral Reef Initiative under Executive Order 13809 (Coral Reef Protection), which seeks to "preserve and protect the biodiversity, health, heritage, and social and economic value of U.S. coral reef ecosystems and the marine environment." The NOAA Fisheries Southeast Region's coral reef ecosystem conservation activities in Puerto Rico are managed by the Southeast Fisheries Science Center and the Southeast Regional Office, including the Caribbean Field Office. The activities are also

executed pursuant to the Coral Reef Conservation Act, which provides funding for NOAA's Coral Reef Conservation Program. Coral reef ecosystem conservation activities also support and strengthen efforts related to the implementation of NOAA mandates under the Magnuson-Stevens Fishery Conservation and Management Act and the ESA. Hurricanes, namely Hurricane Hugo, caused widespread damage to coral reefs in Puerto Rico; in addition, other factors, such as pollution and damage from commercial and recreational activities, are causing continued decline. Coral reef restoration efforts continue to be made in Puerto Rico, with limited success.

6.6.1.02 Elkhorn coral (*Acropora palmata*) and staghorn coral (*Acropora cervicornis*) are both coral species in the genus Acropora. The NMFS designated critical habitat in Puerto Rico for both elkhorn and staghorn corals in November 2008 and in May 2006, NMFS listed both species as threatened. Staghorn and elkhorn coral are two of the three most important Caribbean corals in terms of their contribution to reef growth and fish habitat. Other corals also may be present and, though not currently listed, provide essential habitat for fish and reef structure that is protective of inner lagoons and cays. An additional seven species of coral have been proposed for listing.

6.6.1.03 Coral reefs in the Luis Peña Channel are documented since 1927 (Valdez-Pizzini et al. 2008) where most are patch reefs (Pagán-Villegas et al. 1999) and fringing reefs (Vicente 1995) and are described to maintain an extensive development of coral communities healthier than the vast majority of reef communities around Puerto Rico (Hernández-Delgado 2000; Hernández-Delgado and Sabat 2000).

6.6.1.04 Since 1980, populations have collapsed throughout their range from disease outbreaks with losses compounded locally by hurricanes, increased predation, bleaching, elevated temperatures, and other factors. This species is also particularly susceptible to damage from sedimentation.

6.6.1.05 Threats to coral reefs include:

- disease, such as white band disease
- hurricanes
- predation
- bleaching
- algae overgrowth
- sedimentation
- temperature and salinity variation
- low genetic diversity

6.6.1.06 Descriptions, including photographs, of elkhorn and staghorn corals are included in Sections 3.11 and 3.12 of the 2012 SOP. Descriptions including photographs of the other seven species of coral proposed for listing are included in Section 3.13 of the 2012 SOP.

6.6.2 Seagrass Beds

6.6.2.01 The Culebra seagrass beds have been proposed by the USFWS for designation as Resource Category 1 because these areas are unique and irreplaceable on a national or eco-regional level. Seagrass beds are considered a habitat area of particular concern as a subset of EFH in the U.S. Caribbean under the Magnuson-Stevens Fishery Conservation and Management Act because they provide important ecological functions and/or are especially vulnerable to degradation. Consultation with NOAA Fisheries is required for federal projects that may have adverse impacts upon EFH. Seagrass beds are extensive in the Luis Peña Channel (Hernández-Delgado 2003a) comprising the most abundant marine habitat in the Luis Peña Channel (Hernández-Delgado et al. 2002). These beds provide important habitat for a variety of species, including the endangered green sea turtle. Projects undertaken must not decrease the integrity of this habitat. The EBS performed prior to the RI will ascertain the location and extents of these seagrass beds so that intrusive activities performed during the RI can minimize damage to these beds.

6.6.2.02 The following information is excerpted from Resource Category 1 Designation: The Seagrass Beds of Culebra Island (USFWS 1992).

> "There are about 49 species of plants that have become fully adapted to marine environments. These species are called seagrasses because of their external morphological similarity to terrestrial grasses. These marine flowering plants have undergone very little speciation since and represent less than l % of the 250,000 flowering plants known worldwide. Although little speciation has occurred, seagrasses have developed a necessary adaptation called hydrophilic pollination. There is no equivalent of insect pollinators in aquatic plants.
>
> The association of seagrasses with other tropical or subtropical, shallow marine systems (mangroves and coral reefs) has been known to exist since Cretacean times. However, recent seagrass bed systems developed as the continental and insular shelves became flooded during the Holocene transgression following the Wisconsian Glaciation. Seagrass beds have therefore accumulated and trapped huge amounts of sediments, created and modified shorelines, and probably sustained large turtle, manatee, and fish populations within the West Indian tropics for long periods of time. Seagrass beds continue to keep pace with rising sea levels and fulfill physical and biological functions which ensure the ecological integrity of our coastlines.
>
> There are 4 species of seagrasses within the Culebra archipelago: turtle grass (*Thalassia testudinum*), manatee grass, shoal grass (*Halodule wrightii*), and sea vine (*Halophilia decipiens*). Turtle and manatee grasses are usually found growing together in shallow, protected environments with unconsolidated

> substrates. Manatee grass occurs as monotypic stands in wave-exposed sandy bottoms. *H. decipiens* is usually found in deeper water but may occur in shallow, turbid water. Shoal grass, with or without manatee grass, is usually found colonizing blowouts or other barren exposed bottoms. *Ruppia maritimea* (widgeon grass) is found only in very shallow semi-enclosed lagoons where salinities of 25 parts per trillion or less may be found because low salinities are required for Ruppia to reproduce sexually. On the other hand, extremely high salinities exclude seagrasses from Flamenco Lagoon, the largest lagoon in Culebra."

6.6.2.03 The seagrass beds of the Culebra archipelago support a large juvenile population of green turtles and are identified as critical habitat for this species.

Measures to Mitigate Potential Impacts to Coral Reefs and Seagrass Beds

6.6.2.04 Coral and seagrass avoidance measures are included in Section 4.3 (Coral and Seagrass Avoidance Measures) of the 2012 SOP. These measures will be followed at all times during the EBS activities. Notifications to the NMFS Boquerón Office and DNER will be made in accordance with Section 4.3.9 of the 2012 SOP should any coral be damaged or injured. Any activities causing the damage will be ceased and the coral will be left in place. If any boat runs aground, the boat operator will follow the procedures in Section 4.3.10 of the 2012 SOP. Diving operation procedures are included in Section 4.5 of the 2012 SOP.

6.6.3 Nesting Areas for Birds

6.6.3.01 The cays and coastal areas of Culebra are known nesting areas for shorebirds and seabirds with abundant suitable habitat amongst the rocky shores and cliffs and associated coastal vegetation. The largest seabird nesting colony occurs at Peninsula Flamenco, where 50,000 sooty terns nest. Most of the nesting for birds occurs in the spring and summer months (April through September) though birds may reside year-round. Migratory birds also frequent Culebra along routes of migration and the Culebra National Wildlife Refuge areas provide a haven for these species.

6.6.3.02 Several species of marine birds nest on the island of Culebra and surrounding cays as follows, one of which is listed as threatened species (EEG 2006):

- Brown noddy
- Laughing gull
- Red-billed tropicbird
- White-tailed tropicbird
- Audubon's shearwater
- Bridled tern

- Roseate tern (threatened)
- Cayenne tern
- Sooty tern
- Royal tern
- Sandwich tern

6.6.3.03 It is not anticipated that activities performed during the RI will have adverse impact on nesting seabirds or shorebirds as the nesting areas will not be directly disturbed and disposal of munitions are not likely to be performed during the EBS. Boating operations may be performed near shore where nesting birds are present, which could cause disturbance to nesting birds if present. TtEC will coordinate site activities in consultation through the USACE with USFWS and DNER personnel as required to minimize potential impacts to nesting birds and will attempt to coordinate work schedules so that impacts are lessened for nesting birds.

6.6.4 Terrestrial Reptiles

6.6.4.01 Two endangered and/or threatened species of reptile are present on Culebra and its adjacent cays. Species include the Culebra giant anole (*Anolis roosevelti*) and the Virgin Islands tree boa (*Epicrates monensis granti*). Sections 2.1 and 2.2 of Appendix B to the 2012 SOP contain information and photographs of these species. Critical habitat has been designated for the Culebra giant anole at Monte Resaca, Punta Flamenco, Playa Resaca, and Playa Brava. No critical habitat has been designated for the Virgin Island tree boa on Culebra. Impacts to these species are not likely during the EBS because this work will be performed on water, though during travel to and from the sites, these species could be encountered. Sections 3.0, 3.2, and 3.3 of Appendix B to the 2012 SOP will be followed to avoid impacts to these species during the work. The project biologist will brief employees at project start so that these species can be recognized and avoided. All sightings of these species will be recorded on a daily log and reported to the USACE. If the Culebra giant anole is sighted during any field activities, the USACE and USFWS must be notified immediately as specified in Appendix B to the 2012 SOP as these are extremely rare.

6.7 WETLANDS

6.7.01 There are no freshwater wetlands in Culebra. Estuarine and marine wetlands, including conservation priority area lagoons, are the wetland types that could potentially be impacted by work during the RI. Marine wetlands represent 27 percent of the total wetland resources in Puerto Rico. Seagrass beds are included in this category of wetland and are described in Section 6.6.2 above. Long stretches of beach and shore habitats, along with associated buffer areas, are becoming increasingly rare due to agriculture and recreational or commercial activities and development. The principal habitats of concern in Puerto Rico's coastal and estuarine environment are: shoreline, wetland, and adjacent coastal upland areas. Each of these habitats

provides a key contribution to the ecological integrity of the overall coastal environment and "ecological significance" is determined by the quality of existing natural habitats, the diversity of species present, and the existence of threatened or endangered species (DNER 2010a).

6.7.02 The USFWS Wetlands Online Mapper was used to identify wetlands within the Culebra Water Ranges. There are several marine and estuarine wetland areas identified in small bays along the Luis Peña Channel of the main island of Culebra and there are extensive seagrass beds in the Luis Peña Channel (Hernández-Delgado 2002; Valdez-Pizzini et al. 2008). Extensive areas of Flamenco Bay are identified as estuarine or marine wetlands. These sensitive areas were delineated as part of the EBS performed by TtEC so that they can be protected during work activities.

6.7.03 It is anticipated that impacts to wetlands will not occur during the EBS as intrusive investigations will not be performed and conservation measures will be followed for performing work near seagrass beds.

6.8 CULTURAL AND ARCHAEOLOGICAL RESOURCES

6.8.01 The NRIS, NHL list, NHA list, and the National Park Service list one registered property, Faro Isla de Culebritas, which is part of the Lighthouse System of Puerto Rico. This lighthouse is not within the areas that will be worked in during the EBS or RI. There are known prehistoric sites on Culebra Island (USFWS n.d.); however, these are documented to be on land and not in the areas where the EBS will be conducted. A literature assessment by Valdés Pizzini et al. (2008) showed that there is not extensive information about cultural and archaeological resources for the Luis Peña Channel Reserve.

6.8.02 During the EBS, snorkeler personnel will visually observe work areas for cultural and archaeological artifacts during the course of site activities. If the snorkelers or data from geophysical or bathymetry surveys identify potential cultural or archaeological items or structures, the USAESCH PM will be notified. If any known or suspected cultural or archaeological items are found, the location will be marked, a photo will be taken (if possible), and the USAESCH PM will be notified of the finding. Work in the immediate area of an artifact will be halted until a qualified person, typically the State Historic Preservation Officer, can inspect the item.

6.9 WATER RESOURCES

6.9.01 Groundwater on Culebra is scarce and only known to occur in alluvial deposits and in fractures in volcanic and plutonic rocks. Average annual rainfall is 30 to 50 inches, and all aquifer recharge comes from direct rainfall. The public water supply on Culebra comes from a desalination plant located near Lower Town. In some households, municipal water is supplemented with rooftop cisterns or groundwater for non-drinking water uses. There are no permanently flowing surface water streams on Culebra (Parsons 2011).

6.9.02 Groundwater and freshwater resources will not be adversely impacted by project activities and are not the focus of the EBS. Care will be exercised to minimize adverse impacts to estuarine or marine wetlands and to preserve sensitive habitats and ecologically and economically important marine and estuarine water resources.

6.10 COASTAL ZONES

6.10.01 The management of the coastal zone was adopted on July 12, 1978, as the Coastal Land Use Plan of Puerto Rico. The lead agency for coastal zone management in Puerto Rico is the DNER, whose primary responsibility is to protect the natural resources of Puerto Rico. The Planning Board is the government agency responsible for administering the certification process with the Federal Support Program. The NMFS also has jurisdiction in coastal zones. The Coastal Zone of Culebra as described in the Puerto Rico Coastal Zone Management Program (DNER 2008) as "a strip of land one thousand linear meters inland, measured from the coastline, as well as the additional distance necessary to incorporate key natural systems of the coastal environment. In addition, it includes the territorial waters of Puerto Rico and the corresponding submerged lands (three marine leagues, 9 nautical miles or 10.35 land miles), the islands of Vieques, Culebra, Mona, Monito, Desecheo, Caja de Muertos and all keys and small islands within them." All project activities taking place for the Culebra Water Ranges are considered within the Coastal Zone.

6.10.02 In order to access the MRSs, work crews and equipment must be transported by boat. In addition, sonar and marine geophysical detection equipment and snorkeling operations will be used during the EBS. Any anchorage areas will be carefully examined following procedures in the 2012 SOP and its appendices to protect coral reefs and seagrass beds. Information from bathymetric surveys, snorkel surveys, and remotely operated vehicle photo-documentation collected during the EBS will be used to further delineate sensitive habitats and procedures to avoid damage to these resources. Information contained in the 2012 SOP and its appendices will be amended as necessary with supplementary information and followed to ensure that anchorage of boats or grounding of boats on sensitive coral reefs does not occur during the follow-on RI. The EBS is being performed prior to the RI to help characterize the benthic environment and delineate sensitive habitats and coral reef areas so that provisions to avoid adverse impacts can be planned for during the RI.

6.10.03 TtEC will utilize public or private docks for launching boats. TtEC will not be landing boats onto beaches and will avoid damaging coral reefs, turtle and bird nesting areas, and seagrass beds during this work as outlined in Sections 6.4 through 6.6 of this EPP and the referenced SOPs. No anchoring will take place in areas other than unvegetated sandy bottoms, and the use of existing mooring buoys rather than anchoring is preferred whenever possible. Consultation with agencies such as the PREQB, NMFS/NOAA, the USFWS, and the Refuge Manager on this project, as well as meeting regulations or other requirements of these agencies

during the EBS, will ensure this project adheres to coastal zone management objectives and protects marine and estuarine water resources.

6.11 TREES AND SHRUBS

6.11.01 There will be no removal of trees or shrubs on this project because this work is being performed wholly within marine areas using existing dock facilities. Beach surveys will not disturb or harm trees and access to work sites will utilize existing docks, roads, trails, and paths whenever possible.

6.11.02 Appendix B to the 2012 SOP, Section 2.3, contains information on Wheeler's peperomia (*Peperomia wheeleri*) and *Leptocereus grantianus*, an unnamed species of spineless cactus, both of which are considered endangered. Information contained in these sections as well as the mitigation measures in Sections 3.0 and 3.4 of this appendix will be communicated to project personnel by the project biologist so that these species can be avoided if there is potential for impact through vegetation disturbance in areasr where these species may be present. In addition, association of other canopy species may be an indicator of the potential presence of the Wheeler's peperomia, and particular attention will also be paid to these types of forest canopies. If any of these species are present where work will be conducted or along an intended travel route, the route will be adjusted so that these species are not contacted. Reporting of any finds of these species in work areas or paths will be logged and reported to the USACE as required in Appendix B to the 2012 SOP.

6.12 EXISTING WASTE DISPOSAL SITES

6.12.01 There are no known munitions waste disposal sites within the Culebra Water Ranges of Flamenco Bay or the Luis Peña Channel. MEC was used during training exercises and is considered UXO. Discarded military munitions, which are military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal, are not known to be present in these MRSs.

6.13 PROJECT WASTE MANAGEMENT

6.13.01 The following sections describe wastes that may be generated during the EBS and the disposition of these wastes. Wastes will be managed, transported, and disposed of in accordance with federal and Commonwealth of Puerto Rico regulations and requirements.

6.13.1 Unexploded Ordnance

6.13.1.01 It is anticipated that UXO, if discovered during the EBS, will be identified, photographed, and left in place and position documented.

6.13.1.02 If the underwater investigation team identifies an item that is UXO and it is determined that disposal activities for the UXO are warranted (explosive hazard poses a high risk to site receptors), the related work and its conservation measures plan will be closely developed and coordinated with the TPP Team. Alternatives to munitions detonation exist, which may be

performed in particularly sensitive environments that otherwise may cause damage to these areas, in particular coral reefs. One alternative involves placement of a pre-cast concrete coffin over the munitions that are not considered safe to move. This alternative also functions as a small-scale artificial reef structure, providing potential habitat for fish and invertebrate species substrate.

6.13.2 Common Trash

6.13.2.01 Common trash such as food wastes, food containers, and office-related trash will be collected off boats on a daily basis and disposed of in the office trash dumpster. This dumpster will be regularly picked up and disposed of in a local sanitary waste facility as arranged with the Municipality of Culebra.

6.13.3 Vehicle and Boat Maintenance Fluids

6.13.3.01 Project vehicle and boat maintenance (e.g., oil changes), if required during the project, will be performed by a vendor on Culebra who will perform disposal and/or recycling of waste materials.

6.13.4 Sanitary Wastes

6.13.4.01 Sanitary wastes from boats equipped with U.S. Coast Guard–approved marine sanitation devices and grey water from hand washing will be regularly pumped out at/by an approved facility at public or private dock.

6.14 WASTE TRANSPORTATION AND DISPOSAL

6.14.01 Waste profile sheets are not anticipated to be required based on the anticipated wastes that will be generated during the EBS because no special waste or hazardous waste will be generated.

6.14.02 If required (e.g., if unanticipated contaminated wastes require special waste disposal), profile sheets will be coordinated with the intended facility based on their waste acceptance criteria. Waste profile sheets will be submitted for review and signature by the USACE representative. If the disposal facility issues permits for receiving waste, the permit will accompany the waste to the disposal facility when shipped.

6.14.03 Likewise, based on anticipated wastes that will be generated during the EBS, manifests are not required, though straight bills of lading may be used to track shipments or for payment purposes.

6.14.04 Munitions are regulated for transportation on public roads though there will be no transportation of UXO items from their in situ location to any land-based disposal area during the EBS. No other wastes listed above are regulated for transport on public roadways by the U.S. Department of Transportation, Hazardous Material Regulations. As such, these wastes may

either be self-transported to the disposal/recycling facility or a local solid waste vendor affiliated by contract for disposal to the intended facility by contract.

6.14.05 All waste generated during field activities will be properly containerized and disposed of in accordance with all applicable federal and Puerto Rico regulations and through approved channels.

6.14.06 Solid waste facilities will be chosen based on their waste handling permit and waste acceptance criteria. Wastes will only be sent to facilities that are operating in compliance with their permits and applicable federal and Puerto Rico regulatory requirements.

6.15 CONTINGENCY FOR UNANTICIPATED WASTE

6.15.01 If unanticipated wastes are generated during project activities, TtEC will notify the PjM and Program Environmental Safety Manager (PESM), as well as the USACE PM to determine the proper and safe course of action to properly characterize, containerize, transport, and dispose of the waste. The PESM will ensure hazardous waste trained personnel are identified, and will initiate and identify appropriate sampling and analysis, containerization requirements, waste storage requirements, proper shipping descriptions per the U.S. Department of Transportation, Hazardous Material Regulations, initiate waste profile sheets and manifests for the appropriate RCRA licensed and permitted facilities, and ensure that the paperwork is completed from point of generation to disposal in accordance with federal and Puerto Rico regulations.

6.15.02 If a waste is discovered during the EBS and the waste is not related to project activities, TtEC will notify the PjM, PESM, and the USACE PM. The USACE PM will determine proper federal and local agency notifications to make (e.g., if the waste is not the result of project activities). TtEC will not handle the waste if it is not generated as part of the project.

6.15.03 Depending on the USACE generator status (large, small, or conditionally exempt small quantity generator), hazardous waste disposal must occur within the required timeframes specified under the regulations (e.g., large quantity generators have 90 days and small quantity generators have 180 days from accumulation start date).

6.15.04 TtEC will also notify the client representative, the Contracting Officer as the Generator of Record, to ensure provisions are made for signature of the waste profile sheet, land disposal restriction, and uniform hazardous waste manifest, and to determine the generator category and disposal timeframe requirements. TtEC personnel cannot sign any of these Generator of Record documents as TtEC or as Agents of the Government unless designated specifically in the contract agreement.

6.16 IMPACT MINIMIZATION MEASURES

6.16.01 Impact minimization procedures, in addition to those discussed throughout this EPP, will include briefing all on-site personnel on applicable health and safety issues as well as the need for minimizing impacts on sensitive biological resources as outlined in this EPP. Methods for recognizing, avoiding, and minimizing potential impacts on the plant and animal species and habitats of concern will be stressed during the on-site training.

6.16.02 Close coordination with environmental resource agencies before and during the project will help ensure impacts to sensitive environments; critical habitats, endangered/threatened species, as well as impacts to recreational activities are minimized throughout this project.

6.16.03 Areas disturbed during the EBS activities will be kept to the minimum required to accomplish the project tasks.

6.17 BURNING

6.17.01 Burning of materials within or around the Culebra Water Ranges will not be performed during the EBS.

6.18 DUST AND AIR POLLUTION CONTROL

6.18.01 Widespread dust control is not anticipated on this project because much of the project takes place on the water. However, control of fugitive dust on the project may include best management practices such as keeping speeds down on dirt or gravel roads to minimize generation of dusts and housekeeping efforts to prevent buildup of dirt or mud on boat decks, equipment, docks, and ramps to prevent the dirt or mud from drying out and causing dust in work areas.

6.18.02 Other emissions sources include vehicles and boats used to transport personnel. All vehicles and equipment will be in good working order, inspected, and will meet applicable vehicle emissions requirements. Vehicles will not be left idling for extended periods of time.

6.19 SPILL CONTROL PLAN

6.19.01 Reporting of spills to federal and Commonwealth of Puerto Rico agencies will occur after immediate notification has been made to the TtEC PjM and USAESCH PM. Spills on the water are immediately reportable to the National Response Center without delay. All spills that occur on this project from vessels or on land will be reported to the National Response Center. The Response Center notifies all trustees automatically of the reported spill.

6.19.02 For oil or chemical spill notification, call the National Response Center at **800-424-8802.**

6.19.1 Spill Potential

6.19.1.01 Due to the nature of the operations, a spill of pollutants to the environment could occur. The most likely spill is a spill of fuel to water which could occur during operation of boats, primarily during refueling operations. Refueling operations, however, will not be done on the water, other than at the dock. Refueling will be performed following best management practices, including slowing down when filling fuel tanks; knowing the size of the tank, and avoiding topping off the tank. Fuel collars, absorbent pads, and fuel/air separators are tools that can be used to help avoid spills or to contain excess fuel that has accidentally spilled. A fuel collar is a doughnut of absorbent material that fits around the fueling nozzle and catches splashes or drips during refueling. Absorbent pads can be used to wipe up excess fuel or to capture fuel from leaks. A fuel/air separator can prevent the escape of fuel from the air vent during filling.

6.19.1.02 In addition, boats will be maintained in proper working order and subject to a preventative maintenance schedule. Boat operators will also conduct a pre-launch boat inspection every day.

6.19.1.03 In the event of a spill, the largest quantity of pollutant (gasoline) that can reasonably be lost at any one time during refueling is 10 gallons of gasoline. If a leak of fuel or other fluids, such as hydraulic or transmission fluid, occurs on a boat, field personnel will promptly attempt to plug the hole and/or turn off pumps if safe to do so.

6.19.1.04 If the spill occurs on the ground, the material spilled will be bermed with dirt so that the fluid does not spread along the ground surface. Any spills originating from small containers (e.g., gasoline cans) will be contained by the use of absorbent materials. Any spill cleanup materials will be contained and managed for disposal according to federal and Puerto Rico regulations.

6.19.2 Other Preventive Spill Control Measures

6.19.2.01 Containers of liquids containing petroleum products (gas or diesel) or other chemicals with potentially hazardous constituents (paints, lubricants, etc.) will be kept closed when not in use, maintained in original containers with labels affixed, and will be kept in appropriate storage areas (e.g., flammable storage cabinets).

6.19.2.02 TtEC plans to conduct all fueling, maintenance, and repair of vehicles and boats off-site. This practice will decrease the amount of pollutants that need to be stored on the site. Those liquids of a hazardous nature that are absolutely necessary to conduct field operations will be stored in the minimum required quantities.

6.19.2.03 Any spills originating from small containers (e.g., gasoline cans) will be contained by the use of absorbent materials.

6.19.3 Emergency Spill Response and Notification

6.19.3.01 The procedures described below will be followed in the event of a spill on-site.

6.19.3.02 All spills, leaks, and fires involving oil or hazardous substances must be reported to the PjM and the PESM as well as the client representative and the National Response Center. The person reporting the leak or spill is required to provide the following information:

- His/her name
- Location of spill and facility number, if known
- Number of injured personnel and nature of injuries, if known
- Substance spilled
- Estimated amount spilled
- Extent of spill
- Estimated rate at which the substance is currently being released
- Estimated time the spill occurred
- Any other pertinent information

6.19.3.03 Minor and major spill procedures are outlined below.

6.19.3.1 Minor Spill Procedure

6.19.3.1.01 A minor spill would involve no immediate threat to human health or the environment (e.g., not cause sheen or discoloration on the water), cause minimal property damage, be readily cleaned up by TtEC crewmembers, be a known substance, and not exceed the reportable quantity for that material. In the event of a minor spill, the appropriate response action is for the responsible person to notify the client and the PjM as well as the National Response Center and supply the responders with as much information as possible. In the case of a spill of contaminated or hazardous materials, the following procedures will be followed:

- Stop the source of the spill if safe to do so (e.g., upright a container, shut off valve, etc.).
- Notify a supervisor (FOL, Site Safety and Health Officer [SSHO]).
- SSHO or FOL notifies the PjM and the PESM.
- Identify protective clothing or equipment required to respond.
- Contain the spill.
- Neutralize and/or solidify any product.
- Transfer material into appropriate waste containers as directed by the FOL or PjM. Transfer the waste to the appropriate storage area for management and disposal at the direction of the FOL or PjM.
- Document the incident.

6.19.3.2 Major Spill Procedure

6.19.3.2.01 In the event of a major spill where human health and/or the environment is at risk (e.g., spill is to a surface water, persons are injured, there is a risk of fire or explosion from the materials, material spilled is not known, the spilled material is more than can be reasonably handled with on hand resources in a few minutes time, or spills that have or are likely to enter a storm drain or other conveyance), the following procedures shall be followed.

- A spill to surface water may not constitute an immediate hazard to workers; however any spill to surface water is agency reportable and is to be treated as an emergency.
- Isolate the spill area, shut down equipment if safe to do so, and evacuate upwind.
- Keep others from entry into the area.
- If anyone is injured, at risk, or there is a fire or explosion, call 911.
- Notify the FOL and/or SSHO.
- SSHO or FOL will immediately notify the PjM, PESM, and client and relay pertinent information. Notify the National Response Center.
- If source of spill is not unknown and other hazards are not likely to exist (e.g., fires, exposures, or explosions), assess extent of spill and identify potential pathways of dispersion. Cover or isolate these pathways in advance of the spill, if feasible, but only if exposures can be avoided.
- Note type, amount, and location of material released. Provide Material Safety Data Sheets for response personnel.

6.20 STORAGE AREAS AND TEMPORARY FACILITIES

6.20.01 A temporary office facility and equipment storage space will be located for use (location is to be determined).

6.21 ACCESS ROUTES

6.21.01 Existing roads will be used to access and transport personnel to dock facilities.

6.22 CONTROL OF WATER RUN-ON AND RUN-OFF

6.22.01 This investigation involves work within marine waters and not land-based activities. There will not be any drainage patterns that are altered by site activities and therefore mitigation procedures will not be required to control water run-on or run-off. Furthermore, TtEC will not conduct any activities that discharge pollutants into waterways or waterbodies. Spill prevention practices and response procedures will be in place to minimize the chances for spills and releases. Waste management and disposal will comply with federal and Puerto Rico regulations.

6.23 DECONTAMINATION OF EQUIPMENT

6.23.01 There is no anticipated decontamination required on this project.

6.24 MINIMIZING AREAS OF DISTURBANCE

6.24.01 Boating activities will be performed to the extent required to map and survey the benthic environment while minimizing harm through direct contact with coral reefs, seagrass beds, and marine mammals or sea turtles. Work areas will be planned in advance so that appropriate resource agencies can review them and scheduled activities will cause minimal potential for impact to the environment. Maps, charts, and aerial photos will help ensure that the areas worked in are minimally disturbed and sensitive areas (coral reefs and seagrass beds) can be avoided. Equipment checks will be performed daily before and during work to ensure data collection is completed with minimal amount of potential rework. Boat trips to and from the launch will be minimized to the extent possible through proper pre-trip planning to minimize boat traffic overall and the most direct routes with the least potential for impacts to coral reefs and seagrass beds will be used to access the work areas.

6.25 POST-ACTIVITY CLEANUP

6.25.01 Following completion of both daily work and the project, all boats and equipment will be properly secured and stowed. Periods of potential severe weather will require paying particular attention to securing and stowing of gear as required to minimize the potential for damage or materials to be dispersed by wind or rain. Cleaning of boats will only be done in a designated onshore location and laydown area. Trash and sanitary waste will be removed and placed in designated waste receptacles. All waste will be properly disposed of prior to demobilization from the project.

7.0 PROPERTY MANAGEMENT PLAN

7.0.01 This Property Management Plan has been prepared in accordance with DID MR-005-09 and Federal Acquisition Regulations (FAR), Part 45.5 and it supplements to provide detailed information on the types, quantities, and sources of equipment and materials that will be required to perform field and office operations on this Task Order. Field operations include all activities to be performed to complete the fieldwork. Office operations include all tasks performed in support of project management and the implementation of project work in the field through completion consistent with the requirements of the scope of work (Appendix A). The types of equipment recommended, selected, and proposed for this work are those that have been tested and proven in the industry and, therefore, are reliable to use in performing the various activities associated with this project. The quantities proposed are needed to help perform the work in a timely and cost-effective manner as dictated by the project schedule.

7.1 FIELD EQUIPMENT

7.1.1 Survey Equipment

7.1.1.01 Survey vessel and equipment that will be used during the EBS phase are described in detail in Section 3, Field Investigation Plan.

7.1.2 Transportation Equipment

7.1.2.01 Various types of transportation equipment will be required during field operations. Vehicles required during the project may include standard automobiles and pickup trucks with vessel trailers.

7.1.3 Safety Gear

7.1.3.01 The EBS is non-invasive and no contact with potential MEC is expected. Appropriate personal protective equipment (PPE) for vessel operations will be worn and may include, but is not limited to, boots, leather work gloves, latex or nitrile gloves, hardhats, and safety glasses. Personnel will typically conduct their operations in Level D PPE consisting of standard work clothes with long pants, safety boots (as needed), hard hats (when overhead hazard is present), safety glasses or face shields (as needed), and hearing protection (as needed). Personnel working away from active field investigations will not be required to wear safety boots or hard hats.

7.1.4 Communication Equipment

7.1.4.01 Communications equipment to be used includes handheld two-way radios, VHF radios, and cellular telephones.

7.1.5 Office Equipment

7.1.5.01 The majority of the survey equipment to be used on this project, including the vessel, will be brought to the site from the TtEC office in Bothell, Washington, with support

from the office in TtEC office in Carolina, Puerto Rico. Most of the equipment (for example, vessel, MBE, SSS, underwater video, GPS equipment, radios, CADD or GIS workstations, computers, printers, plotters, etc.) is owned by TtEC, and the charges to the project will be as proposed for this Task Order. However, some items may need to be rented or purchased for fieldwork.

7.1.6 Consumable Supplies

7.1.6.01 Consumable supplies planned for the purchase in support of the EBS include but are not limited to:

- Fuel for vessels, vehicles and equipment;
- Disposable gloves and leather work gloves;
- Potable water;
- Eye wash;
- First aid kits;
- Fire extinguishers;
- Log books; and
- Ink cartridges for printers and copy paper.

7.1.7 Vendors and Associated Costs

7.1.7.01 TtEC will provide the majority of the field and office equipment; however, certain types of equipment and materials will be rented, leased, or purchased from vendors with proven records of furnishing well-maintained, reliable, and updated equipment that can be used to successfully complete the field and office operations. General cost estimates on the types, quantities, and sources of equipment proposed for the EBS are summarized in Table 7-1. The majority of consumable supplies will be provided by local vendors; however, some consumables may be purchased from specialty vendors.

Table 7-1. List of Equipment

Office/Field Operations	Equipment Type (or equivalent)	Number of Units	Anticipated Source	Status
Communication during fieldwork	Motorola handheld radios and cellular telephones	8	TtEC	Own*
Interpretation of field data and information processing	Field laptop computers, printer, scanner	3	TtEC and local vendor	Own* and purchase
Survey Operations	MBE, SSS, underwater video, positioning	8	TtEC	Own*
Survey Operations	Vessel	2	TtEC	Own*
Transportation of personnel and equipment	Pickup truck, vessel trailer	2	Local Vendor	Lease
Field Office	Portable Trailer	1	Local Vendor	Lease

Table 7-1. List of Equipment (continued)

Office/Field Operations	Equipment Type (or equivalent)	Number of Units	Anticipated Source	Status
Sanitation	Portable toilets	3	Local Vendor	Rent
Remote office processing of data and development of maps/graphics	Desktop computers, laptop computers, GIS workstation, printers/copiers/plotters	4	TtEC	Own*
Photodocumentation of fieldwork	Digital cameras	2	TtEC	Own*
Field Safety	AED	1	TtEC	Own*

* Equipment is owned and maintained by TtEC and will be rented to the project at the contract rates.

7.1.8 Procurement Procedures

7.1.8.01 Equipment will be leased or rented, and consumables and supplies will be purchased in a procurement process in strict conformance with the FAR and Defense Federal Acquisition Regulations. There are no known instances where purchase of equipment on behalf of the government will be required on this project. TtEC will follow standard procurement procedures for all purchases. TtEC will acquire at least three quotes for each item and a comparison of rental versus purchase of each item will be performed in accordance with FAR thresholds.

7.1.9 Leased and Rented Vehicles

7.1.9.01 The leased vehicles will be selected using the comparison of rate quotes from at least three commercial vendors. The number of vehicles will be determined by one vehicle for approximately four personnel working on-site. The type of vehicles used will be determined by the site's physical conditions, such as terrain, weather conditions, and distances between lodging, the site office, and the fieldwork area. Any exceptions will be justified by TtEC and approved by the Contracting Officer.

7.1.10 Consumable Supplies and Personal Property

7.1.10.01 TtEC's disclosed accounting practices prescribe that all materials and supplies required for the performance of the contract and Task Order will be direct charged to that order, and such materials and supplies are not included in the basis for overhead computation. The only exception is limited to home office supplies and equipment such as letterhead, pens, pencils, standard personal computers, office furnishings, etc. Field office supplies are typically direct charged to the project and not included in the overhead computation.

7.1.11 Property Storage Plan

7.1.11.01 The site office will be used to store purchased items for the EBS. If needed, an off-site storage unit will be rented. TtEC-owned property will be segregated from government property.

7.1.12 Ultimate Disposal Plan

7.1.12.01 Non-consumable items purchased on time and material (T&M) tasks will be reassigned to other government projects at the end of the project. TtEC will provide an inventory to USAESCH and request further direction for transfer/disposal details.

7.1.13 Property Tracking Plan

7.1.13.01 An inventory list will be maintained by TtEC for the non-consumable items purchased on T&M tasks for the EBS. When applicable, the serial number, model or manufacturer, date purchased, present location of item, cost, current status (functional, need of repair, needs batteries, etc.), and a description of the item are recorded on the inventory list. A property tracking log report will be submitted to USAESCH that will list all TtEC-acquired property that is directly charged to the Task Order on T&M tasks. The property tracking log report will be submitted at the conclusion of the field investigation.

7.1.14 Loss Notification

7.1.14.01 For all non-consumable items purchased on the inventory for the EBS, TtEC will notify the Contracting Officer if the item is lost, damaged, stolen, or destroyed.

8.0 INTERIM HOLDING FACILITY SITING PLAN FOR RECOVERED CHEMICAL WARFARE MATERIEL (RCWM) PROJECTS

8.0.01 Section 8 is not applicable to this project and will serve as a placeholder section only.

9.0 PHYSICAL SECURITY PLAN FOR RCWM PROJECT SITES

9.0.01 Section 9 is not applicable to the project and will serve as a placeholder section only.

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