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SAMPLING AND ANALYSIS PLAN FOR MUNITIONS RESPONSE PROGRAM SITE INSPECTIONS AT EIGHT MUNITIONS RESPONSE SITES VOLUME 2 OF 2 APPENDIX A
MCRD PARRIS ISLAND SC
1/1/2010
TETRA TECH NUS

Comprehensive Long-term Environmental Action Navy

CONTRACT NUMBER N62467-04-D-0055

Rev. 1
01/10

Sampling and Analysis Plan for Munitions Response Program Site Inspections at Eight Munitions Response Sites

Marine Corps Recruit Depot
Parris Island, South Carolina

Contract Task Order 0089

January 2010
Volume II of II
Appendix A

NAVFAC
Naval Facilities Engineering Command
NAS Jacksonville
Jacksonville, Florida 32212-0030

TETRA TECH NUS, Inc.

SAP Worksheet #1 -- Title and Approval Page

(UFP-QAPP Manual Section 2.1)

SAMPLING AND ANALYSIS PLAN
FOR
MUNITIONS RESPONSE PROGRAM
SITE INSPECTIONS AT MUNTIONS RESPONSE SITES
MEC (DETECTOR-AIDED SURFACE SURVEY/GEOPHYSICS) INVESTIGATION
MARINE CORPS RECRUIT DEPOT
PARRIS ISLAND, SOUTH CAROLINA

December 2009

Prepared for:
Naval Facilities Engineering Command Southeast
NAS Jacksonville
Jacksonville, Florida 32212-0300

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Prepared under:
Comprehensive Long-Term Environmental Action Navy Contract
No. N62467-04-D-0055
Contract Task Order 0089

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1-1: Technical Site Information
1-2: References
Attachment 2: MEC Field Standard Operating Procedures
Attachment 3: Explosives Safety Submission Determination

ACRONYMS

ºF	degree Fahrenheit
APP	Accident Prevention Plan
ASR	Archive Search Report
bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
COMMARSYSCOM	Commander, Marine Corps Systems Command, Program Manager of Ammunition
CSM	Conceptual Site Model
CTO	Contract Task Order
CWM	Chemical warfare material
DDESB	Department of Defense Explosive Safety Board
DERP	Defense Environmental Restoration Program
DGPS	Digital Global Positioning System
DID	Data item description
DoD	Department of Defense
DQO	Data quality objective
EFT	Equipment Function Test
EM	Electromagnetic
e-mail	Electronic mail
EOD	Explosive Ordnance Disposal
EP	Engineering Pamphlet
ES	Executive Summary
ESS	Explosives Safety Submission
FFA	Federal Facilities Agreement
FTMR	Field Task Modification Request
FUDS	Formerly Used Defense Sites
GIS	Geographic Information System
GPS	Global Positioning System
H&S	Health and Safety
HASP	Health and Safety Plan
HDOP	Horizontal Dilution of Precision

HE	High Explosives
HSM	Health and Safety Manager
HTRW	Hazardous, toxic, and radiological waste
IAS	Initial Assessment Study
ITS	Instrument Test Strip
LUC	Land Use Control
M.S.	Masters of Science
MC	Munitions Constituents
MCRD	Marine Corps Recruit Depot
MD	Munitions Debris
MEC	Munitions and explosives of concern
mm	millimeter
MMCX	Munitions Mandatory Center of Expertise
MMRP	Military Munitions Response Program
MPPEH	Material Potentially Presenting an Explosive Hazard
MRP	Munitions Response Program
msl	mean sea level
mV	Millivolt
NA	Not Applicable
NAD	North American Datum
NAVD	North American Vertical Datum
NAVFAC	Naval Facilities Engineering Command
NIRIS	Naval Installation Restoration Information Solution
NOSSA	Naval Ordnance Safety and Security Activity
nT	nano Tesla
OE	Ordanance/Explosive
OSHA	Occupational Safety and Health Administration
pc	Personal Computer
PM	Project Manager
POC	Point of Contact
QA	Quality Assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
RI	Remedial Investigation

RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
SCAR	subcaliber aerial rockets
SCDHEC	South Carolina Department of Health and Environmental Control
SI	Site Inspection
SE	Southeast
SOP	Standard Operating Procedure
SSO	Site Safety Officer
SUXOS	Senior UXO Officer Supervisor
TBD	To be determined
TOM	Task Order Manager
TP	Technical Paper
TtNUS	Tetra Tech NUS, Inc.
USEPA	United States Environmental Protection Agency
UFP	Uniform Federal Policy
USACE	United States Army Corps of Engineers
UXO	Unexploded Ordnance
UXOQC	UXO Quality Control
UXOSO	Unexploded Ordnance Safety Officer
WWII	World War II

EXECUTIVE SUMMARY

Tetra Tech NUS, Inc. (TtNUS) has prepared this Munitions and Explosives of Concern (MEC) Sampling and Analysis Plan (SAP) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62467-04-D-0055 Contract Task Order (CTO) 89. This plan has been prepared for a Site Inspection (SI) at six Munitions Response Areas or Munitions Response Sites (MRA/Ss) located at Marine Corps Recruit Depot (MCRD) Parris Island, South Carolina. The general location of MCRD Parris Island is shown on Figure ES-1.

The Navy has conducted various testing, training, and disposal activities related to military munitions at MCRD Parris Island which was established in 1915 as a recruit training facility. As a result of these activities, MEC and munitions constituents (MC) may be present at various sites throughout MCRD Parris Island. The term MEC includes Discarded Military Munitions (DMM), Unexploded Ordnance (UXO), and MC in high enough concentrations to pose an explosive hazard. MC is any material originating from UXO, DMM, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. The Department of Defense (DoD) has established the Military Munitions Response Program (MMRP) to address MC and MEC at closed ranges. The DoD is following the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process for the investigation and remediation of these sites. The Navy is responsible for implementing the Munitions Response Program (MRP) at MCRD Parris Island.

An Archive Search Report (ASR) and Range Identification and Preliminary Range Assessment were completed in May 1999. Eight MRA/Ss were identified for further investigation at MCRD Parris Island and are shown on Figure ES-2. MEC investigations will be conducted at all sites except UXO 01 and UXO 02. As discussed in the MC SAP [presented in the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP aka UFP-SAP) for MC under a separate cover] UXO 01 will not be investigated and MEC is not of concern at UXO 02. This SAP describes the MEC investigation and is designed to be “stand alone” in regards to the technical details of the MEC investigation. The six MRA/Ss and that are the focus of this MEC SAP are listed below.

- Aerial Bombing Target at Parade Deck (UXO 03)
- Field Artillery West Main Range (UXO 04)
- Field Artillery East Shrapnel Range (UXO 05 and UXO 06)
- Aerial Bombing Target at Golf Course (UXO 07)
- Aerial Bombing Target at Southern Tidal Flats (UXO 08)

This SI plan consists of two distinctly different investigations, which will be conducted in two phases. The first phase consists of the MEC investigations which include detector-aided surface surveys for MEC followed by subsurface geophysics investigations. The first phase is discussed in this SAP. The second phase consists of the MC investigation, which is described in a separate SAP.

This SAP has been prepared in accordance with the DoD requirements for developing QAPPs for the management of environmental data collection and the use of environmental data as described in the UFP-QAPP. The UFP SAP worksheets have been developed for the collection and evaluation of data on concentrations of chemical constituents in environmental media. These worksheets are not designed for the collection of geophysical data. The Navy MRP Workgroup has modified the UFP SAP worksheets to be applicable to MEC investigations. These modified worksheets have been used in the preparation of this MEC SAP.

The SI objective is to determine whether further response actions or remedial investigations (RIs) are appropriate for any of the sites identified in the ASR and Range Identification and Preliminary Range Assessment (PRA) to restore the sites to an acceptable environmental condition. The SI investigative plan is based on background information provided in the ASR and PRA and will govern the collection of supplemental site-specific environmental data to further characterize the nature and extent of MEC at the sites identified in the ASR and PRA. Following is a discussion of each of the sites which are the subject of this investigation.

Aerial Bombing Target at Parade Deck (UXO 03)

This former bombing target was known to be on the parade deck as early as 1937. The target consisted of concentric circles outlined on the ground that would have been visible from the air. The target use ceased with paving of the parade field completed in the early 1940s. Additional paved parking lots and buildings have also been built in this area since the time of target use. Miniature practice bombs are reported to have been used at this site. It is unknown whether MEC exist in the subsurface soil (depths of 2 feet bgs or greater) in unpaved areas of UXO 03 Aerial Bombing Target at the Parade Deck. MEC, if present, could present a safety hazard to humans. The subsurface soil will be investigated during the SI to determine the absence or presence of MEC.

Field Artillery West Main Range (UXO 04)

In 1937, the Marines established two impact areas for field artillery firing, the largest being the West Main Range and the other being the Field Artillery East Shrapnel Range. Munitions use included artillery ammunition for 75mm guns and howitzers, M1897 and M1, respectively. Types of munitions used at this

range included High Explosives (HE) and shrapnel. Historical uses of the West Main Range may have resulted in the presence of MEC in surface/subsurface soils or sediments. In particular, MEC may be present in the target/impact (areas of highest elevation) and firing point areas. MEC, if present, may present a safety hazard to humans and serve as an MC release source. No investigations have been conducted to determine whether MEC may be present in the West Main Range. Investigations are required to determine whether MEC may be present. The MEC SI field investigation includes detector-aided surface surveys, land-based subsurface geophysical surveys, and boat-based aquatic geophysical surveys.

Field Artillery East Shrapnel Range (UXO 05 and UXO 06)

In 1937, the Marines established two impact areas for field artillery firing, the largest being the West Main Range and the other being the Field Artillery East Shrapnel Range. Presumably, the ordnance used included 75mm gun ammunition, which was the most common caliber during this time. Historical uses of the East Shrapnel Range may have resulted in the presence of MEC in the surface/subsurface soils. In particular, MEC may be present at the firing point in UXO 05 and the impact areas in UXO 06. MEC, if present, could present a safety hazard to humans and serve as an MEC release source. To date, no investigations have been conducted to determine where MEC may be present. The MEC SI field investigation includes detector-aided surface surveys, land-based subsurface geophysical surveys, and boat-based aquatic geophysical surveys.

Aerial Bombing Target at Golf Course (UXO 07)

This former bombing target was established as a replacement for the Aerial Bombing Target at Page Field in 1942. Miniature practice bombs were used at this target; there is no evidence that other types of bombs were used at the Aerial Bombing Target at Golf Course. Range use is thought to have ceased in July 1946. A golf course was completed over the target by 1948. The former target center was located on the green of the present day eighth hole. Historical use of the Bombing Target at the Golf Course may have resulted in the presence of MEC in surface/subsurface soils. MEC presence could result in a safety hazard to humans and serve as an MEC release source. To date, no investigation has been conducted to determine if MEC may be present. The MEC SI field investigation includes detector-aided surface surveys in the undeveloped areas of the golf course bomb target area. Subsurface geophysical surveys are planned to cover the areas described for detector-aided surface surveys and also in the developed area of the golf course green.

Aerial Bombing Target at Southern Tidal Flats (UXO 08)

This former bombing target existed on the tidal flats south of the golf course. Presumably, the time frame of range use spanned World War II, though the target is barely discernable on 1945 aerial imagery. Two

ten-foot tall metal posts, which formed the target's center; and other rusty sheet metal debris apparently from 100-pound practice bombs have been found. This rusty sheet metal debris is considered munitions debris (MD) and not MEC. No debris from 2.25-inch subcaliber aerial rockets (SCAR) or HE bombs at this location has been observed, though the Parris Island air station had these items and used them at other locations in the Port Royal Sound area. Historical use of the Bombing Target at Southern Tidal Flats may have resulted in the presences of MEC in surface, subsurface, and sediments. MEC, if present, could result in a safety hazard to humans and serve as an MEC release source. To date, no investigation has been conducted to determine if MEC is present. The MEC SI field investigation includes detector-aided surface and subsurface geophysical surveys within a 650-foot-diameter area, centered on the bombing target circle.

SAP Worksheet #2 -- SAP Identifying Information

(UFP-QAPP Manual Section 2.2.4)

Site Name/Number: MCRD Parris Island, South Carolina
Operable Units: UXO-03, 04, 05, 06, 07, 08
Contractor Name: Tetra Tech NUS, Inc. (TtNUS)
Contract Number: N62467-04-D-0055
Contract Title: Comprehensive Long-Term Environmental Action Navy (CLEAN)
Work Assignment Number (optional): Contract Task Order (CTO) 0089

1. This SAP was prepared in accordance with the requirements of the *Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP)* (U.S. EPA, 2005) and *U.S. EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS (2002)*.

2. Identify regulatory program: Department of Defense (DoD) MMRP using the general Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process.

3. This SAP is a **project-specific SAP**.

4. List dates of scoping sessions that were held:

Scoping Session	Date
Meeting No. 1 – Kick-off Meeting	March 2009
Meeting No. 2 – Information Gathering and Data Quality Objective (DQO) Facilitation	May 2009

5. List dates and titles of any SAP documents written for previous site work that are relevant to the current investigation.

Title	Date
Not applicable – This is the initial Munitions Response Program (MRP) SI and the first SAP	

6. List organizational partners (stakeholders) and connection with lead organization:

United States Environmental Protection Agency (USEPA) Region 4 – Regulatory Oversight
South Carolina Department of Health and Environmental Control (SCDHEC) – Regulatory Oversight
Marine Corps Recruit Depot (MCRD) Parris Island – Facility Oversight

7. Lead organization (see Worksheet 7 for detailed list of data users)
Naval Facilities Engineering Command (NAVFAC) Southeast

8. If any required SAP elements or required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below:

UFP-QAPP Worksheet #	Required Information	Crosswalk to Related Information
A. Project Management		
Documentation		
1	Title and Approval Page	NA
2	Table of Contents SAP Identifying Information	NA
3	Distribution List	NA
4	Project Personnel Sign-Off Sheet	NA
Project Organization		
5	Project Organizational Chart	NA
6	Communication Pathways	NA
7	Personnel Responsibilities and Qualifications Table	NA
8	Special Personnel Training Requirements Table	NA
Project Planning/Problem Definition		
9	Project Planning Session Documentation (including Data Needs tables) Project Scoping Session Participants Sheet	Refer to Worksheet #9 and Appendix B3 in MC portion of SAP
10	Problem Definition, Site History, and Background. Site Maps (historical and current)	NA
11	Site-Specific Project Quality Objectives	NA
12	Measurement Performance Criteria Table	NA
13	Sources of Secondary Data and Information, Secondary Data Criteria and Limitations Table	NA
14	Summary of Project Tasks	NA
15	Reference Limits and Evaluation Table	Not used – No samples proposed for collection/analysis during MEC geophysics survey/ investigation
16	Project Schedule/Timeline Table	Refer to Worksheet #16 in MC portion of SAP
B. Measurement Data Acquisition		
Sampling Tasks		
17	Sampling Design and Rationale	NA
18	Sampling Locations and Methods/Standard Operating Procedure (SOP) Requirements Table Sample Location Map(s)	NA
19	Analytical Methods/SOP Requirements Table	Not used – No samples proposed for collection/analysis during MEC geophysics survey/ investigation
20	Field Quality Control Sample Summary Table	NA
21	Project Sampling SOP References Table, Sampling SOPs	NA
22	Field Equipment Calibration, Maintenance, Testing, and Inspection Table	NA

UFP-QAPP Worksheet #	Required Information	Crosswalk to Related Information
Analytical Tasks		
23	Analytical SOPs, Analytical SOP References Table	Not used – No samples proposed for collection/analysis during MEC geophysics survey/ investigation
24	Analytical Instrument Calibration Table	Not used – No analytical instrument calibration data will be required to support MEC geophysics surveys/ investigations
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	Not used – No analytical instrument equipment maintenance, testing, or inspections will be required to support MEC geophysics surveys/investigations
Sample Collection		
26	Sample Handling System, Documentation Collection, Tracking, Archiving, and Disposal Sample Handling Flow Diagram	Not used – No analytical sampling handling system will be required to support MEC geophysics surveys/ investigations
27	Sample Custody Requirements, Procedures/SOPs Sample Container Identification Example Chain-of-Custody Form and Seal	Not used – No samples are proposed for collection/analysis during the MEC geophysics survey/investigation
Quality Control (QC) Samples		
28	QC Samples Table, Screening/Confirmatory Analysis Decision Tree	Not used – No analytical laboratory QC sampling will be required to support MEC geophysics surveys/ investigations
Data Management Tasks		
29	Project Documents and Records Table	NA
30	Analytical Services Table Analytical and Data Management SOPs	Not used – No analytical services will be required to support MEC geophysics surveys/investigations.
C. Assessment Oversight		
31	Planned Project Assessments Table	NA
32	Assessment Findings and Corrective Action Responses	NA
33	QA Management Reports Table	NA

UFP-QAPP Worksheet #	Required Information	Crosswalk to Related Information
D. Data Review		
34	Verification (Step I) Process Table - Preparatory and Initial Inspection	NA
35	(Tier 2) QC Process Summary Table - Follow-Up Inspections	NA
36	Analytical Data Validation (Steps IIa and IIb) Summary Table	NA
37	Usability Assessment	NA

SAP Worksheet #3 -- Distribution List

(UFP-QAPP Manual Section 2.3.1)

Name of SAP Recipient	Title/Role	Organization	Telephone Number (Optional)	E-Mail or Mailing Address	Document Control Number (Optional)
Charles Cook	Navy Remedial Project Manager (RPM)/Manages Project Activities for Navy	NAVFAC Southeast	904.542.6409	charles.cook2@navy.mil	NA
Tim Harrington	MCRD Point of Contact (POC)/Manages Site Activities	MCRD Parris Island	843.228.3423	timothy.j.harrington@usmc.mil	NA
Meredith Amick	SCDHEC Project Manager (PM)/Provides State Regulator Input	SCDHEC	803.896.4218	amickms@dhec.sc.gov	NA
Annie Gerry	SCDHEC Geologist/Hydrologist /Provides State Regulator Input	SCDHEC	803.896.4018	gerryam@dhec.sc.gov	NA
Lila Llamas	USEPA Region 4 RPM/Provides USEPA Regulator Input	USEPA Region 4	404.562.9969	llamas.lila@epa.gov	NA
Debbie Humbert	Program Manager/Manages Program Activities	TtNUS	412.921.8968	debra.humbert@tetratech.com	NA

Name of SAP Recipient	Title/Role	Organization	Telephone Number (Optional)	E-Mail or Mailing Address	Document Control Number (Optional)
Mark Sladic	Task Order Manager (TOM)/Manages Project Activities	TtNUS	412.921.8216	mark.sladic@tetratech.com	NA
Ralph Brooks	UXO/MEC Manager/Manages Corporate MEC Hazards and Risks	TtNUS	7770.413.0965 x231	ralph.brooks@tetratech.com	NA
Jeffrey Fournier	MRP Site Manager/Manages UXO Staff and Field Activities	TtNUS	770.413.0965 x227	jeffrey.fournier@tetratech.com	NA
Jim Coffman	Project Geophysicist/Manages Geophysical Activities	TtNUS	412.921.8244	jim.coffman@tetratech.com	NA
Matt Soltis [Health and Safety Plan (HASP)]	Health and Safety Manager (HSM)/Manages Corporate Health and Safety Program	TtNUS	412.921.8912	matt.soltis@tetratech.com	NA

SAP Worksheet #4 -- Project Personnel Sign-Off Sheet

(UFP-QAPP Manual Section 2.3.2)

Certification that project personnel have read the text will be obtained by one of the following methods as applicable:

1. In the case of regulatory agency personnel with oversight authority approval letters or e-mails will constitute verification that applicable sections of the SAP have been reviewed. Copies of regulatory agency approval letters / e-mails will be retained in the project files and are listed in Worksheet 29 as project records.

2. E-mails will be sent to Navy, TtNUS, and subcontractor project personnel whom will be requested to verify by e-mail that they have read the applicable SAP / sections and the date on which they were reviewed. Copies of the verification e-mail will be included in the project files and identified in Worksheet 29.

A copy of the signed Worksheet 4 will be retained in the project files and identified as a project document in Worksheet 29.

Name	Organization/Title/Role	Telephone Number (optional)	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
Navy and Regulator Project Team Personnel					
Charles Cook	Navy RPM/Manages Project Activities for Navy	904.542.6409	See Worksheet 1 for signature	All	
Tim Harrington	MCRD POC/Manages Site Activities	843.228.3423		All	
Meredith Amick	SCDHEC PM/Provides State Regulator Input	803.896.4218		All	

Name	Organization/Title/Role	Telephone Number (optional)	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
Annie Gerry	SCDHEC Geologist/Hydrologist/Provides State Regulator Input	803.896.4018		All	
Lila Llamas	USEPA Region 4 RPM/Provides USEPA Regulator Input	404.562.9969		All	

TtNUS Project Team Personnel

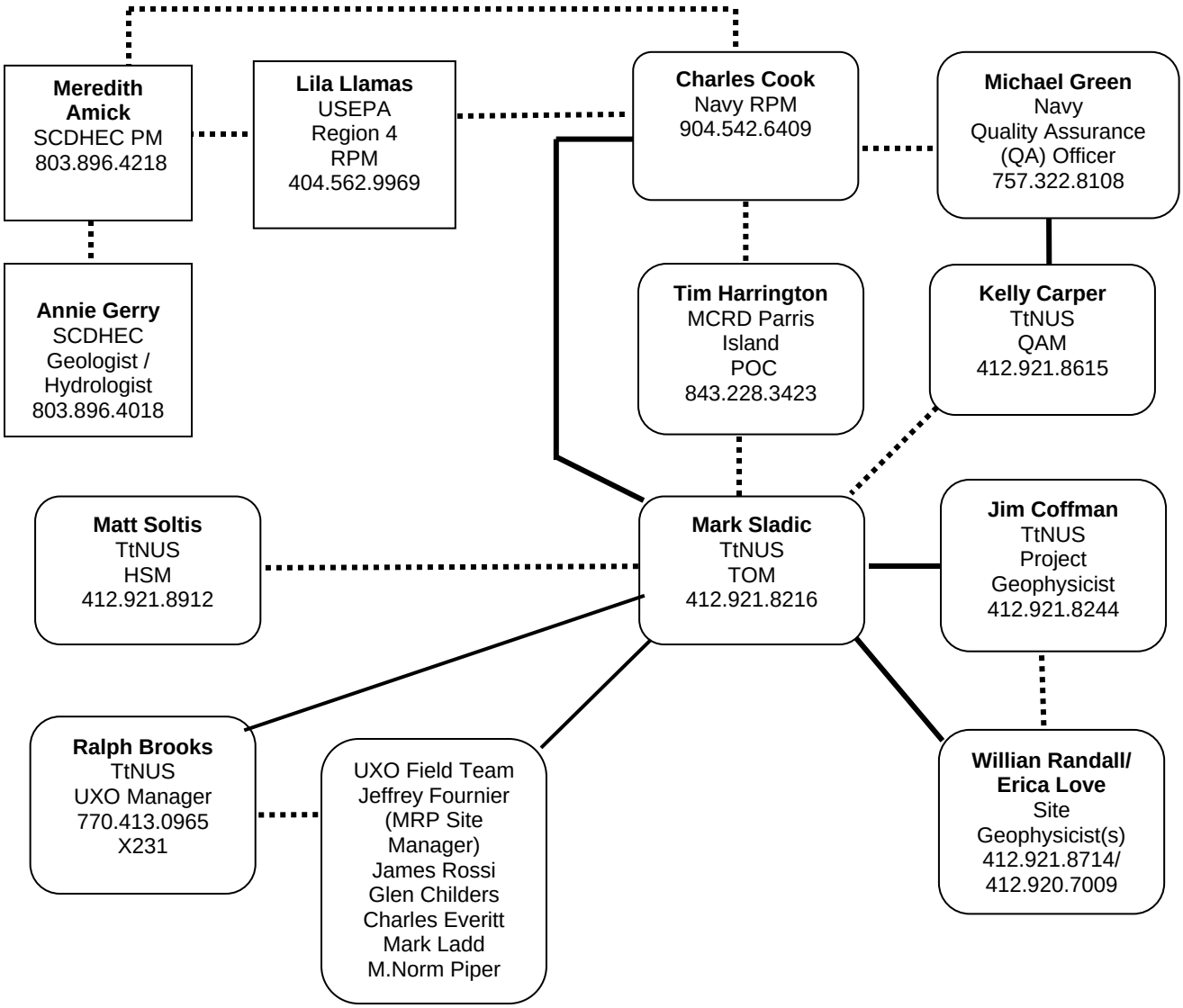
Mark Sladic	TOM/Manages Project Activities	412.921.8216	See Worksheet 1 for signature	All	
Ralph Brooks	UXO/MEC Manager/Manages Project MEC Hazards and Activities	770.413.0965 x231		All	
Kelly Carper	Project Quality Assurance Manager (QAM)/Manages Corporate QA Program and Implementation	412.921.7273	See Worksheet 1 for signature	All	
Jim Coffman	Project Geophysicist/Manages Geophysical Activities	412.921.8244		All	
William Randall/ Erica Love	Site Geophysicist(s)/Conducts on-Site Geophysical Activities	412.921.8714/ 412.920.7009		All	
Matt Soltis	HSM/Manages Corporate H&S Program	412.921.8912	See signature on HASP	HASP Worksheet 17	

Name	Organization/Title/Role	Telephone Number (optional)	Signature/E-Mail Receipt	SAP Section Reviewed	Date SAP Read
Jeffrey Fournier	MRP Site Manager/Manages UXO Staff and Field Activities	770.413.0965 x227		All	
James Rossi	Senior UXO Supervisor (SUXOS)/Supervises UXO field activities	707.845.6046		All	
Glen Childers	UXO Quality Control Specialist (UXOQC)/Provides QC during UXO field activities	TBD		MEC Worksheets	
Glen Childers	UXO Safety Officer (UXOSO)/Manages UXO safety operations	TBD		MEC Worksheets	

SAP Worksheet #5 -- Project Organizational Chart

(UFP-QAPP Manual Section 2.4.1)

Lines of Authority ——— Lines of Communication



SAP Worksheet #6 -- Communication Pathways
(UFP-QAPP Manual Section 2.4.2)

Communication Driver	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure
MEC Find	TtNUS UXO Staff TtNUS UXO Manager TtNUS TOM Navy RPM MRCD POC SCDHEC PM USEPA RPM	Jeffrey Fournier Ralph Brooks Mark Sladic Charles Cook Tim Harrington Meredith Amick Lila Llamas	770.413.0965 x 227 770.413.0965 x 231 412.921.8216 904.542.6409 843.228.3423 803.896.4218 404.562.9969	Within 30 minutes TtNUS UXO Technicians will notify field staff, secure area, and contact TtNUS UXO Manager. TtNUS UXO Manager will verbally inform TtNUS TOM the same day. TtNUS TOM will notify Navy RPM and MCRD POC on the same day. MCRD POC or designee will make base emergency notifications and will notify SCDHEC and USEPA. Navy RPM will inform Commander, Marine Corps Systems Command, Program Manager of Ammunition (COMMARSYSCOM) on the same day as informed.
Field issues that require change in field tasks	TtNUS Project Geophysicist TtNUS UXO Manager TtNUS TOM Navy RPM SCDHEC PM USEPA RPM	Jim Coffman Ralph Brooks Mark Sladic Charles Cook Meredith Amick Lila Llamas	412.921.8244 770.413.0965 x231 412.921.8216 904.542.6409 803.896.4218 404.562.9969	The responsible person will inform TtNUS TOM on the day the issue is discovered; TtNUS TOM will inform Navy RPM within 1 business day; Navy RPM will issue scope change approval [verbally or via electronic mail (e-mail)] if warranted scope change will be implemented before work is executed. Document via a Field Task Modification Request (FTMR) form within 2 days. TtNUS TOM will notify SCDHEC and USEPA either verbally of via e-mail.

Communication Driver	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure
SAP amendments	TtNUS TOM Navy RPM	Mark Sladic Charles Cook	412.921.8216 904.542.6409	TtNUS TOM will notify NAVFAC Program Management Office via e-mail within 1 business day of recognizing a need for change and will also notify the Project Team.
Fieldwork schedule changes	TtNUS TOM MCRD POC Navy RPM SCDHEC PM USEPA RPM	Mark Sladic Tim Harrington Charles Cook Meredith Amick Lila Llamas	412.921.8216 843.228.3423 904.542.6409 803.896.4218 404.562.9969	Verbally inform Navy RPM on the day that schedule change is known and document via schedule impact letter as soon as impact is realized. TtNUS TOM will notify SCDHEC and USEPA either verbally or via e-mail.
Field issues that require changes in the scope of field work	TtNUS TOM MCRD POC TtNUS UXO Manager TtNUS Project Geophysicist Navy RPM SCDHEC PM USEPA RPM	Mark Sladic Tim Harrington Ralph Brooks Jim Coffman Charles Cook Meredith Amick Lila Llamas	412.921.8216 843.228.2423 770.413.0965 x231 412.921.8244 904.545.6409 803.896.4218 404.562.9969	Project Geophysicist or UXO Manager will inform TtNUS TOM on the day that the issue is discovered. TtNUS TOM will inform Navy RPM and MCRD POC within 1 business day. Navy RPM will issue scope change, if warranted; scope change to be implemented before further work is executed. Document change on FTMR form. TtNUS will notify SCDHEC and USEPA either verbally or via e-mail.

Communication Driver	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure
Recommendation to stop work and initiate work upon corrective action	TtNUS TOM TtNUS UXO Manager TtNUS Project Geophysicist TtNUS QAM TtNUS HSM Navy RPM MCRD POC SCDHEC PM USEPA RPM	Mark Sladic Ralph Brooks Jim Coffman Kelly Carper Matt Soltis Charles Cook Tim Harrington Meredith Amick Lila Llamas	412.921.8216 770.413.0965 x231 412.921.8244 412.921.7273 412.921.8912 904.542.6409 843.228.3423 803.896.4218 404.562.9969	Within 1 hour, the UXO Manager or Project Geophysicist (verbally or via e-mail) will inform subcontractors and TtNUS TOM. TtNUS TOM will inform (verbally or via e-mail) the TtNUS QAM, Navy RPM, and the Project Team.
Geophysical data issues	TtNUS Project Geophysicist TtNUS TOM TtNUS QAM	Jim Coffman Mark Sladic Kelly Carper	412.921.8244 412.921.8216 412.921.7273	Geophysical field team will notify TtNUS Project Geophysicist as soon as the impact is realized. TtNUS Project Geophysicist will notify TtNUS TOM and QAM on the same day.
Corrective action for field program	TtNUS QAM	Kelly Carper	412.921.7273	TtNUS QAM will notify TtNUS TOM within 1 day that the corrective action has been completed. TtNUS TOM will then notify the Navy RPM within one day.

SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table

(UFP-QAPP Manual Section 2.4.3)

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
Debra Humbert	Program Manager	TtNUS	Oversees CLEAN Program.	B.S., Chemical Engineering, over 28 years of experience
Mark Sladic	TOM	TtNUS	Oversees project, financial, schedule, and technical day-to-day management of the project. • Ensures timely resolution of project-related technical, quality, and safety questions associated with TtNUS operations. • Functions as the primary TtNUS interface with the Navy RPM, MCRD Parris Island POC, TtNUS field and office personnel, and laboratory POCs. • Ensures that TtNUS health and safety issues related to this project are communicated effectively to all personnel and off-site laboratories. • Monitors and evaluates all TtNUS subcontractor performance. • Coordinates and oversees work performed by TtNUS field and office technical staff (including data validation, data interpretation, and report preparation). • Coordinates and oversees maintenance of all TtNUS project records. • Coordinates and oversees review of TtNUS project deliverables. • Prepares and issues final TtNUS deliverables to the Navy.	B.S., Mechanical Engineering, 20 years of environmental experience

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
Ralph Brooks	UXO Manager	TtNUS	Oversees selection of qualified UXO personnel, establishes overall quality control program for UXO activities, addresses UXO-related issues as identified by field personnel.	B.S., General Studies; Graduate, Navy Explosive Ordnance Disposal (EOD) School - Indian Head, 25 years of military EOD experience, 6 years commercial UXO experience.
Jeffrey Fournier James Rossi Charles Everitt Mark Ladd	UXO Technician III	TtNUS	Supervises the conduct of all on-site UXO-related operations. Prepares daily reports of field activities. Conducts daily site safety briefings. Escorts non-UXO personnel in suspect MEC areas. Determines location and identification of suspect MEC. Conducts detector-aided surface surveys.	Minimum of 8 years prior military EOD and or commercial UXO experience in munitions response actions or range clearance activities. [Department of Defense Explosive Safety Board (DDESB) Technical Paper (TP) 18]
Glen Childers	UXOSO	TtNUS	Ensures that initial site-specific training is delivered for all field personnel before field activities begin and that all safety control measures have been established. Ensures that all UXO-specific certifications are filed on site and are available for Navy inspection. Enforces personnel limits and safety exclusion zones. Conducts, documents, and reports safety inspections.	Minimum of 8 years prior military EOD and or commercial UXO experience in munitions response actions or range clearance activities and applicable safety standards. (DDESB TP 18)
Glen Childers	UXOQC	TtNUS	Conducts quality control audits. Identifies, documents and reports corrective actions.	Minimum of 8 years prior military EOD and/or commercial UXO experience in munitions response actions or range clearance activities and the transportation, handling and storage of munitions and commercial explosives. (DDESB TP 18)

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
Kelly Carper	QAM	TtNUS	Reviews SAP, coordinates with laboratory, and conducts data quality review. Ensures quality aspects of the CLEAN program. • Develops, maintains, and monitors QA policies and procedures. • Provides training to TtNUS staff in QA/Quality Control (QC) policies and procedures. • Conducts systems and performance audits to monitor compliance with environmental regulations, contractual requirements, SAP requirements, and corporate policies and procedures. • Audits project records. • Monitors subcontractor quality controls and records. • Assists in the development of corrective action plans and ensuring correction of non-conformances reported in internal or external audits. • Ensures that this SAP meets TtNUS, Navy, and SCDHEC requirements. • Oversees the responsibilities of the TtNUS Project Quality Assurance Officer (QAO). • Prepares QA reports for management.	B.S., Biology, 16 years environmental experience
Jim Coffman	Project Geophysicist	TtNUS	• Overall responsibility for design, implementation, and management of all geophysical investigations required for the work effort, but may not necessarily be on site full time. • Project geophysicist-of-record.	B.S., Geology, M.S., Geophysics, 11 years geophysical experience

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
William Randall/ Erica Love	Site Geophysicist	TtNUS	• Responsible for day-to-day operations for geophysical investigation and works under general supervision of project geophysicist	Degree in geophysics, geology, geological engineering, or closely related field. Minimum of 5 years experience (waived if working under general supervision of project geophysicist)
Matt Soltis	HSM	TtNUS	Oversees CLEAN Program Health and Safety Program • Provides technical advice to the TtNUS TOM on matters of health and safety. • Oversees the development and review of the HASP. • Conducts health and safety audits. • Prepares health and safety reports for management.	B.S., Industrial Safety Sciences, 24 years environmental experience

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
Glen Childers	Site Safety Officer (SSO)	TtNUS	• Controls specific health and safety-related field operations such as personnel decontamination, monitoring of worker heat or cold stress, and distribution of safety equipment. • Conducts and documents a daily health and safety briefing each day while on site. • Assures that field personnel comply with all procedures established in the HASP. • Identifies assistant SSOs in his/her absence. • Terminates work if an imminent safety hazard, emergency situation, or other potentially dangerous situation is encountered. • Assures the availability and condition of health and safety monitoring equipment. • Coordinates with the UXO Manager, Project Geophysicist, and TOM to institute and document any necessary HASP modifications. • Ensures that facility personnel and subcontractors are adequately advised and kept clear of unexploded ordnance and potentially contaminated materials.	NA

In some cases one person may be designated responsibilities for more than one position. For example, the UXOSO may also be responsible for SSO duties. This action will be performed only as credentials, experience, and availability permits.

SAP Worksheet #8 -- Special Personnel Training Requirements Table

(UFP-QAPP Manual Section 2.4.4)

Project Function	Specialized Training by Title or Description of Course	Training Provider/ Verifier	Training Date	Personnel/ Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Project Operations	Site Orientation, Ethics Training, and UXO Avoidance	SUXOS	Upon arrival at MCRD Parris Island	All personnel	TtNUS and Subcontractors	Documentation of special training requirements will be maintained on site. After the field investigation is complete, special training documentation will be maintained in the permanent project file.
	Accident Prevention and First Aid	SSO				
	Overview of Project Plans	Project Geophysicist, SUXOS				
	29CFR1910.120 Training	Vendor	Prior to arrival at MCRD Parris Island	All field personnel		
Munitions Response	MEC Safety Training	UXOSO, SUXOS	Training will have been received prior to participation in field activities	Personnel entering exclusion zone		
Geophysical Survey	Use of Digital Global Positioning System (DGPS) equipment	Project Geophysicist		Geophysical Survey Team		
	Use of geophysical survey sensor	Project Geophysicist		Geophysical Survey Team		
	Geophysical Survey SOP	Project Geophysicist		Geophysical Survey Team		
	Geophysical Data Processing SOP	Project Geophysicist		Data Processors and Interpreters		

Project Function	Specialized Training by Title or Description of Course	Training Provider/ Verifier	Training Date	Personnel/ Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Grid Layout, Surface Survey	Use of hand-held Global Positioning System (GPS)	Project Geophysicist, SUXOS		Geophysical Survey Team and UXO Team		
MEC Data Collection	Surface Survey and MEC Management and Accountability SOPs	SUXOS		UXO Team		

SAP Worksheet #9 -- Project Scoping Session Participants Sheet

(UFP-QAPP Manual Section 2.5.1)

See Worksheet #9 in the MC portion of the UFP-SAP and Appendix B3 of the UFP-SAP for MC for full meeting minutes.

SAP Worksheet #10 -- Problem Definition, Site History and Background

(UFP-QAPP Manual Section 2.5.2)

10.1 GENERAL INTRODUCTION AND PROBLEM DEFINITION

MCRD Parris Island consists of approximately 8,095 acres of which 3,263 are habitable (MCRD Parris Island Strategic Plan 2008 - 2013), and is located along the southeastern coast of South Carolina, approximately 1 mile south of the City of Port Royal and 30 miles northeast of Savannah, Georgia. Hilton Head Island is located approximately 3 miles southwest of MCRD Parris Island across Port Royal Sound. MCRD Parris Island is the reception and recruit training facility for the Marine Corps for enlisted men from states east of the Mississippi River and for enlisted women nationwide. MCRD Parris Island is the oldest major Marine Corps facility in the United States. The facility has been operated as a recruit training facility for the United States Marine Corps since 1915.

Prior to its establishment in 1915, MCRD Parris Island had a military past that spanned over 400 years and included fortifications constructed by the Spanish, French and United States Navy. In 1884, the Navy purchased approximately 41 acres of land on the northeastern side of MCRD Parris Island and construction began on the Naval station. In 1891, the facility was officially designated as the United States Naval Station, Port Royal, South Carolina. The name of the post was changed to Marine Barracks, Paris Island, South Carolina, in 1917 and the spelling with two “r”s was mandated in December 1917. Following World War II (WWII), MCRD Parris Island’s primary mission remained recruit training, and it was redesignated as the Marine Corps Recruit Depot, Parris Island, South Carolina in 1946. In 1983, the base was officially redesignated Marine Corps Recruit Depot, Eastern Recruiting Region, Parris Island, South Carolina.

MCRD PARRIS ISLAND PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

The following sections provide general information for MCRD Parris Island including climate, topography, geology, soil and vegetation types, hydrology, hydrogeology, cultural and natural resources, and threatened, endangered, and protected species.

Climate

MCRD Parris Island climate experiences long and hot summers and short and mild winters. Precipitation is abundant, averaging about 49 inches per year, and in the range of 40 to 58 inches during most years. The abundant supply of warm, moist, relatively unstable air produces frequent scattered showers and

thunderstorms. The winter season is short and mild. Average daily maximum and minimum temperatures are 63 and 38ºF (degrees Fahrenheit), respectively.

Topography

MCRD Parris Island lies within a system of islands, marshes and interconnecting man-made causeways that form a peninsula. MCRD Parris Island lies in the Lower Coastal Plain physiographic province. Elevations range from sea level to 22 feet above mean sea level (msl). MCRD Parris Island consists of Parris Island (the largest and most developed island), seven smaller named islands, many small unnamed islands, salt marshes, and related tidal creeks. Most of MCRD Parris Island is within the 100-year flood plain. The majority of the area of Parris Island north of Ballast Creek, the east central area of Page Field, and the central part of Horse Island are the only surfaces above the 100-year flood plain (NEESA, 1986).

Geology

The islands comprising MCRD Parris Island consist primarily of barrier-island sand, silt and clay deposits Federal Facilities Agreement (FFA). A further discussion of the descriptive and structural geology of the Beaufort-Jasper County area can be found in the Master Work Plan for MCRD Parris Island (B&R Environmental, 1998a) or the Initial Assessment Study (IAS) (NEESA, 1986).

Soil and Vegetation Types

Soils at MCRD Parris Island have been mapped by the U.S. Soil Conservation Service as both individual soils and groupings of soils (units). MCRD Parris Island has been mapped as having 15 individual soil types, while three soil units have been mapped for MCRD Parris Island (the Wando-Seabrook-Seewee, Coosaw-Williman-Ridgeland, and Bohicket-Capers-Handsboro).

Hydrology

The marsh areas and tidal creeks that border MCRD Parris Island drain into the Beaufort River and Broad River to form the Port Royal Sound. For the most part, surface water runoff flows into the surrounding surface water bodies or storm drains that discharge into the marshes.

Hydrogeology

The hydrogeologic framework of the Parris Island area consists of a shallow unconfined surficial aquifer, exists throughout Parris Island and, is estimated to be 30 feet thick and is typically found at a depth of approximately 3 feet. Beneath the unconfined surficial aquifer lies the Floridian Aquifer. The surface of the aquifer lies 40 to 90 feet below the surface of the land with more than 20 feet of the low permeable Hawthorn formation and a confining layer of clay under the marshes separating the two aquifers. This low permeable formation has been discovered to be thinned or missing in localized areas in and around Parris Island (FFA). The water table in the MCRD Parris Island area usually ranges from 0 to 10 feet bgs and is most commonly found at a depth of 3 feet bgs. The direction of groundwater flow in the upper portion of the shallow surficial aquifer is generally toward the nearest surface water body, such as a pond, river, or tidal creek. A further discussion of the descriptive and hydrogeology can be found in the Master Work Plan for MCRD Parris Island (B&R Environmental, 1998a) or the IAS (NEESA, 1986).

Cultural and Natural Resources

No existing cultural or natural resources were identified during information gathering for the ASR.

Threatened, Endangered and Special Status Species

No threatened or endangered plant species are known to occur on MCRD Parris Island.

Access/Controls Restrictions

Currently, access to MCRD Parris Island is controlled at the main base entrance and the surrounding rivers, swamps, and tidal flats make additional ingress difficult. However, there are no access controls or restrictions in place to limit access to this base once on the installation. Several areas of the base, including the parade deck and golf course are open to the general public.

INDIVIDUAL MRP SITE-SPECIFIC CHARACTERISTICS/PROBLEM DEFINITIONS

Table 10-1 summarizes the six MRP sites at MCRD Parris Island that are the focus of this UFP-SAP for MEC. Figure ES-2 shows the locations of all eight MRP sites located within MCRD Parris Island six of which are MEC sites addressed in the remainder of this worksheet.

TABLE 10-1

SUMMARY OF MUNITIONS RESPONSE PROGRAM SITES INCLUDED IN THE UFP-SAP FOR MEC MCRD PARRIS ISLAND PARRIS ISLAND, SOUTH CAROLINA

Site Name	UXO Site No.	Size	Historical Use	Dates of Use
Aerial Bombing Target at Parade Deck	UXO 03	Approximately 11.5 acres including target circle	Target Use	1930s-early 1940s
Field Artillery West Main Range	UXO 04	9,000 feet in length; 16,500 feet including range fan	Field Artillery	1937-1940
Field Artillery East Shrapnel Range: UXO 05 is the northern section of this range and includes the firing point; UXO 6 is the southern portion of this range and includes the impact areas	UXO 05 and UXO 06	11,000 foot long impact area and 17,000 Foot long danger zone fan	Field Artillery	1937-1940
Aerial Bombing Target at Golf Course	UXO 07	Approximately 0.72 acre including target circles	Bombing Target	1942-1946
Aerial Bombing Target at Southern Tidal Flats	UXO 08	Approximately 3.65 acres including target circles	Bombing Target	1940s (utilized during WWII)

The following sections provide the site-specific background information, Conceptual Site Model (CSM) summaries, and problem definitions for each of the MRP sites located at MCRD Parris Island which will be the focus of this UFP-SAP for MEC.

10.2 CSM SUMMARY AND PROBLEM DEFINITION FOR AERIAL BOMBING TARGET AT PARADE DECK (UXO 03)

10.2.1 Conceptual Site Model

The following subsections present the potential or known sources of contamination, migration pathways, receptors, and the problem statement for the Aerial Bombing Target at Parade Deck. Figure 10-1 shows an aerial view of UXO 03.

10.2.1.1 Site Setting and Background

The former Bombing Target at the Parade Deck center is known to have been located at the site of the current parade deck as early as 1937 (Figure 10-1). The bomb target consisted of concentric circles outlined on the ground (sometimes with lime), that would have been visible from the air. Target use ceased when the paving of the parade field which was completed in the early 1940s. Miniature inert practice bombs with pyrotechnic signal cartridges are reported to have been the ordnance used at the time. An open area/field, parking lot areas, and several buildings currently surround the former target area. There are also unpaved areas surrounding the target area that have been maintained, mowed, have trees and shrubs planted on them. It is possible, but not confirmed, that the open area/field to the north of the bomb target and other non-paved areas surrounding the target may have received ricochets or impacts from bombs that missed their targets, but this has not been confirmed. It is expected that any practice bombs/munitions discovered during construction of the parade deck, parking lot, and other structures in the area (which covers a majority of the site, or during maintenance of the area) would have been removed. The ASR did not uncover any information concerning range clearances at this location.

The Parade Deck is used regularly for ceremonies with military personnel and visitors frequenting the site and surrounding area.

10.2.1.2 Potential or Known Sources of MEC

The sources of potential contamination at the Aerial Bombing Target at the Parade Deck are the target area itself and other areas that may have received ricochets or impacts from bombs that may have missed their target. It is possible that MEC (practice bombs) may be present in subsurface soils of the unpaved areas of the sites. Penetration depths for the types of practice bombs used is estimated to be up to 2 feet bgs; however, penetration may be deeper because the target area and most of the area surrounding it have been paved over. MEC are not expected to be present on the surface at this site because it is assumed that any MEC that might have been present on the surface would have been previously discovered and removed. The USACE has conducted studies regarding the depth of recovery for thousands of ordnance items. The data (Figure 8-12 of EM 1100-1-400d http://www.itrcweb.org/Documents/USACEMilitaryMunitionsResponseActionsJune2007.pdf) shows that while the maximum depth of penetration will resemble the penetrating depth predicted by the penetration analysis, the actual depth of penetration for most items is much lower. In fact, most items were located less than two feet deep. There is no documentation indicating that MEC have ever been found at this

site. The unpaved portions of the site will be investigated during this SI, upon receipt of the results of the SI, the Project Team will evaluate the need to investigate the paved portions of the site.

10.2.1.3 MEC Migration Pathways and Receptors

Subsurface soil at the Aerial Bombing Target at the Parade Deck could be impacted by MEC. Migration of MEC is not expected to be significant. Penetration depths for these types of practice bombs is expected to be up to 2 feet bgs and may be deeper at the target area and because a majority of the area surrounding the target have been paved over and, unpaved areas surrounding the target area have been maintained. It is also assumed that MEC items would have been reported or removed during paving, planting, and other grounds keeping procedures if discovered. There is no documentation indicating that MEC has ever been found at this site. If MEC is found to be present at this site, future construction, excavation, and/or maintenance at the site could act as a release mechanism allowing MEC to migrate.

Human receptors at this site include military and civilian personnel, contractors, and maintenance workers who may take part in intrusive activities at this site. Visitors attending ceremonies at the parade deck would not take part in intrusive activities.

10.2.2 Problem Statement

It is unknown whether MEC exist in the subsurface soil (depths of 2 feet bgs or greater) in unpaved areas of UXO 03 Aerial Bombing Target at the Parade Deck. MEC, if present, could present a safety hazard to humans. The subsurface soil in unpaved areas of the site will be investigated during the SI to determine the absence or presence of MEC. Upon receipt of the results and recommendations of the SI, the Project Team will evaluate the need to investigate the paved areas of the site.

10.3 CSM SUMMARY AND PROBLEM DEFINITION FOR FIELD ARTILLERY WEST MAIN RANGE (UXO 04)

10.3.1 Conceptual Site Model

The following subsections present the potential or known sources of MEC migration pathways, receptors, and the problem statement for the Field Artillery West Main Range. Figure 10-2 shows an aerial view of UXO 04 and also shows the site boundaries as presented in the ASR.

10.3.1.1 Site Setting and Background

In 1937, the Marines established two impact areas for field artillery firing, the Field Artillery West Main Range (the larger of the two) and the Field Artillery East Shrapnel Range. The Field Artillery West Main Range had a concrete observation point and a total of nine firing positions, including three concrete points (firing points B, H, and R). Firing point R on Horse Island provides the apex of the surface danger zone (range fan). The impact area was 9,000 feet in length and the range fan extended 16,500 feet. The area which previously encompassed the Field Artillery West Main Range, including the firing points, is now covered by numerous buildings and other structures, roadways, cleared areas, housing areas (Argonne Trailer Park), Page Field, active ranges, and marsh/swamp areas. Artillery use is known to have included HE, shrapnel rounds, Model 1897 artillery ammunition from the 75mm gun, and MI ammunition from the 75mm pack howitzer. Other calibers such as 2.95-inch mountain gun, 37mm anti-tank and 105mm howitzer may also have been fired, but there is no evidence was found to confirm this. There is also no evidence that this impact area was used for aerial bombing. Photographs 10-3.1 and 10-3.2 present some of the open, undeveloped areas of UXO 04. Photographs 10-3.3 and 10-3.4 present concrete firing positions B and R as observed during the Archive Search Report site visit.

Photographs 10-3.1 and 10-3.2: UXO 04 Field Artillery West Main Range (2009)

Photograph 10-3.3: Concrete Firing Position B

Photograph 10-3.4: UXO 04Concrete Firing Position R

(photographs from ASR site visit)

The locations of utilities that may be present at the open undeveloped portions of this site are unknown at this time. The Broad River borders this site on the west and access to this site would be possible from the river.

10.3.1.2 Potential or Known Sources of MEC

The sources of potential MEC at the Field Artillery West Main Range are the area surrounding the range fan, the target area/impact areas (assumed to be areas of higher elevation), and the firing points. Former impact area target locations are unknown, and the impact area as it is referred to in the ASR is very large (greater than 1000 acres of marsh and flat land). Sandy high topographic points near the center of the impact area are considered to be the most likely areas for the former impact area targets. These higher areas would have allowed visual observation, kept targets out of tidal wash, and provided access to targets for periodic maintenance. Furthermore, these areas are present at the center of the impact area (where impact area targets would be expected). Therefore, they are surmised to be the most likely location for the impact area targets based on what is known. Additionally, these high points are also relatively distant to Page Field, Page Field Road, the estuary, and more recently developed areas on the western side of the impact area. Penetration depths for the types of munitions used are estimated to be between 5 and 10 feet bgs, depending on the soil type and angle of penetration. The USACE has conducted studies regarding the depth of recovery for thousands of ordnance items. The data (Figure 8-12 of EM 1100-1-400d http://www.itrcweb.org/Documents/USACEMilitaryMunitionsResponseActionsJune2007.pdf) shows that while the maximum depth of penetration will resemble the penetrating depth predicted by the penetration analysis, the actual depth of penetration for most items is much lower. In fact, most items were located less than two feet deep. Expended shrapnel rounds have little ability to penetrate the ground surface and

are typically found on the surface. The impact area within the range fan would have received the most ammunition that failed to detonate (duds). The area around the firing points could potentially contain complete rounds of ammunition. There may have been instances when complete rounds/residue may have been discarded (i.e., thrown or tossed) around the firing points after exercises. Therefore, if present, the discarded rounds would be expected to be present on or near the surface. Four of the nine firing points, D, F, H, and L are located in developed areas of the site, with firing points L and H located on active ranges. MEC would not be expected to be present at these firing points, during development of these areas, any munitions-related items found on or near the surface would have been disposed at that time. Therefore, these firing points will not be investigated during the SI.

10.3.1.3 MEC Migration Pathways and Receptors

As a result of past artillery firing, soil, and sediment at the Field Artillery West Main Range could be impacted by MEC. It is expected that, if present, MEC would be concentrated in impact/target areas (areas of higher elevation) and the firing points. Horizontal migration of potential MEC at this site is not expected to be significant. Smaller MEC items may become mobile within soil and sediment and MEC located just beneath the ground surface may also become exposed to the surface, particularly during extended periods of surface runoff. MEC migration (although not expected to be significant) and exposure of MEC located at or just below the ground surface and just beneath the ground surface may also occur through influences of the rising and falling tides along the waterways throughout this site. Future construction, excavation and/or maintenance in developed areas of the site could also act as a exposure mechanism.

Human receptors would include military and civilian personnel, contractors, maintenance workers, recreational users, and trespassers. Ecological receptors would include common flora and fauna, large mammals (e.g., deer), small mammals (e.g., squirrels, rabbits, opossum, and raccoon), reptiles, and birds. Fish, shellfish, crustaceans, wading birds, ospreys, and pelicans may also be potential receptors in areas where sediment has been impacted.

10.3.2 <u>Problem Statement</u>

Historical uses of the West Main Range may have resulted in the presence of MEC in surface/subsurface soils or sediments. In particular, MEC may be present in the target/impact (areas of highest elevation) and firing point areas. MEC, if present, may present a safety hazard to humans and serve as an MEC release source. No investigations have been conducted to determine whether MEC may be present in the West Main Range. Investigations are required to determine whether MEC may be present.

10.4 CSM SUMMARY AND PROBLEM DEFINITION FOR FIELD ARTILLERY EAST SHRAPNEL RANGE (UXO 05 AND UXO 06)

10.4.1 Conceptual Site Model

The following subsections present the potential or known sources of MEC migration pathways, receptors, and the problem statement for the Field Artillery East Shrapnel Range. Figure 10-3 shows an aerial view of UXO 05 and UXO 06 and also shows the site boundary as presented in the ASR.

10.4.1.1 Site Setting and Background

The Field Artillery East Shrapnel Range was established in 1937 (see Section 10.3) and has been designated as UXO 05 (the northern portion of the former range, which includes the firing point) and UXO 06 (the southern portion of the former range, which includes the target/impact areas). The current grenade range is located between the UXO 05 and UXO 06 areas (shown on Figure 10-3) are not included in this MRP site. The Field Artillery East Shrapnel Range consisted of a single firing position (firing point T) at Ballast Creek with a southerly direction of fire. The surface danger zone was approximately 17,000 feet long and extended along the eastern edge of MCRD Parris Island. This range did not have any concrete observation points or firing points; and, there are no records of the specific weapons fired there. Presumably, munitions used at this range included M1897 artillery ammunition for 75mm guns, and M1 ammunition for howitzers

10.4.1.2 Potential or Known Sources of MEC

The sources of potential MEC contamination at the Field Artillery East Shrapnel Range are located in the range fan, the target area/impact area and the firing point. Presumably, munitions use at this range included artillery ammunition for 75mm guns and howitzers, M1897 and M1, respectively. Types of munitions used at this site included shrapnel rounds. The impact areas would have received any dud ammunition. Maximum penetration depths for these types of munitions are estimated to be 5 to 10 feet bgs, depending on soil type, specific munitions and angle of impact. The USACE has conducted studies regarding the depth of recovery for thousands of ordnance items. The data (Figure 8-12 of EM 1100-1-400d http://www.itrcweb.org/Documents/USACEMilitaryMunitionsResponseActionsJune2007.pdf) shows that while the maximum depth of penetration will resemble the penetrating depth predicted by the penetration analysis, the actual depth of penetration for most items is much lower. In fact, most items were located less than two feet deep. Shrapnel round, which functioned properly, would have deposited lead pellets over target areas with the casing and pellets initially deposited onto the ground surface. The

area around the firing point could potentially contain complete rounds of ammunition. There may have been instances when complete rounds/residue may have been discarded (i.e., thrown or tossed) around the firing points after exercises. Therefore, if present, the discarded rounds would be expected to be present on or near the surface.

10.4.1.3 MEC Migration Pathways and Receptors

Soil (at UXO 05 only) and sediment at the Field Artillery East Shrapnel Range could be impacted by MEC and MC contamination. Potential MEC would be concentrated in impact/target areas and at the firing point. Horizontal migration of potential MEC at this site is not expected to be significant; however, smaller MEC items may become mobile within soil and sediment and MEC located just beneath the ground surface could become exposed to the surface, particularly during extended periods of surface runoff or through influences of the rising and falling tides along the waterways throughout this site.

Human receptors would include military and civilian personnel, contractors, maintenance workers, recreational users, and trespassers. Ecological receptors would include common flora and fauna, large mammals (e.g., deer), small mammals (e.g., squirrels, rabbits, opossum, and raccoon), reptiles, and birds. Fish, shellfish, crustaceans, wading birds, ospreys, and pelicans may also be potential receptors in areas where sediment has been impacted.

10.4.2 <u>Problem Statement</u>

Historical uses of the East Shrapnel Range may have resulted in the presence of MEC in the surface/subsurface soils. In particular, MEC may be present at the firing point in UXO 05 and the impact areas in UXO 06. MEC, if present, could present a safety hazard to humans and serve as an MEC release source. To date, no investigations have been conducted to determine where MEC may be present.

10.5 CSM SUMMARY AND PROBLEM DEFINITION FOR AERIAL BOMBING TARGET AT GOLF COURSE (UXO 07)

10.5.1 Conceptual Site Model

The following subsections present the potential or known sources of MEC migration pathways, receptors, and the problem statement for the Aerial Bombing Target at Golf Course. Figure 10-4 shows an aerial view of UXO 07.

10.5.1.1 Site Setting and Background

The Aerial Bombing Target at the Golf Course was established as a replacement for the Aerial Bombing Target at Page Field in 1942. Miniature practice bombs were used at the original target at Page Field; and, there is no evidence that any other types of bombs were used at the Aerial Bombing Target at Golf Course. Miniature practice bombs have been recovered in the area during archaeological excavations. Other areas in and around the target may also have received ricochets or impacts from bombs that may have missed their target. Use of this bombing target is thought to have ceased around the time Page Field was placed on caretaker status in July 1946. The construction of the golf course over the target area was completed in 1948. The former target center was located on what is not the present golf course eight-hole green. The grade of the original target area was raised to construct the golf course. Photographs 10-5.1 and 10-5.2 present the area of the site adjacent to the golf course green.

Photographs 10-5.1 and 10-5.2: UXO 07 Aerial Bombing Target at Golf Course (2009)

The Golf Course is open to the general public as well as military personnel; and, there are no access controls or restrictions in place to limit access to this area once on the installation. There are buildings associated with the golf course located near the site.

10.5.1.2 Potential or Known Sources of MEC

The sources of potential MEC contamination at the Aerial Bombing Target at the Golf Course include the area in and around the target and other areas that may have received ricochets or impacts from bombs that missed their target. The types of munitions employed at this site were practice bombs and miniature bombs. The spatial charge signal contained a black powder expelling charge and a red phosphorous pyrotechnic mixture to provide smoke and to burn brightly. Penetration depths for the types of munitions used are estimated to be between 1 and 2 feet bgs surface; however, since the original grade near the center of the target has been raised to construct the golf course, the actual depth of potential munitions is unknown. It is assumed that any munitions-related items in this area would either have been removed during construction of the golf course or would be under the fill that was used to raise the level of the grade in this area to construct the golf course. The USACE has conducted studies regarding the depth of recovery for thousands of ordnance items. The data (Figure 8-12 of EM 1100-1-400d http://www.itrcweb.org/Documents/USACEMilitaryMunitionsResponseActionsJune2007.pdf) shows that while the maximum depth of penetration will resemble the penetrating depth predicted by the penetration analysis, the actual depth of penetration for most items is much lower. In fact, most items were located less than two feet deep. There is a possibility that munitions-related items may be located near the surface in areas just outside the Golf Course greens due to ricochets and bombs from drops that were off-target.

10.5.1.3 MEC Migration Pathways and Receptors

The surface and subsurface soil at the Aerial Bombing Target at the Golf Course could possibly be impacted by MEC. If MEC are present in the subsurface soil at the Golf Course green or in the surface soil or subsurface soil in areas surrounding the Golf Course horizontal migration is not expected to be significant. Penetration depths for these types of practice bombs used expected to be up to 2 feet bgs depending on the angle of impact; however, since the original grade near the center of the target was raised to construct the golf course, the actual depth of potential munitions is unknown. Any MEC present in the area of the golf course green would be deeper where the grade has been raised. Also, frost heave, which may cause MEC to migrate into subsurface soil, is not an issue at this site.

Human receptors at this site include military and civilian personnel, contractors, maintenance workers, visitors, recreational users, and trespassers that may be exposed to hazards in the surface and maintenance workers or other personnel who may take part in intrusive activities at this site. Ecological receptors at this site would consist of common flora and fauna, large mammals (e.g., deer), small

mammals (e.g., squirrels, rabbits, opossum, and raccoon), reptiles, birds and those animals that may burrow into impacted subsurface soil.

10.5.2 Problem Statement

Historical use of the Bombing Target at the Golf Course may have resulted in the presence of MEC in surface/subsurface soils. MEC presence could result in a safety hazard to humans and serve as an MC release source. To date, no investigation has been conducted to determine if MEC may be present.

10.6 CSM SUMMARY AND PROBLEM DEFINITION FOR AERIAL BOMBING TARGET AT SOUTHERN TIDAL FLATS (UXO 08)

10.6.1 Conceptual Site Model

The following subsections present the potential or known sources of contamination, migration pathways, receptors, and the problem statement for the Aerial Bombing Target at Southern Tidal Flats. Figure 10-5 shows an aerial view of UXO 08.

10.6.1.1 Site Setting and Background

Although not identified on any of the historical site plans obtained during ASR information gathering, a bombing target is known to have existed on the tidal flats directly south of the Golf Course. The time frame of range use covered WWII. Munitions used at this site included miniature and 100-pound practice bombs. The 100-pound practice bombs are light case munitions, which normally break ups on impact. The Mk15 Practice Bombs may also have been used at this site. The ASR site team located two 10-foot tall metal posts, which formed the target's center, and rusty sheet metal debris scattered around the target area, which were probably from 100-pound practice bombs. This rusty sheet metal debris is considered MD and not MEC. The team did not locate any debris from 2.25 inch subcaliber aerial rockets (SCAR) or HE bombs at this location, although the Parris Island Air Station had used these items at other locations in the Port Royal sound area [i.e., at Formerly Used Defense Sites (FUDS)]. Photographs 10-6.1 through 10-6.2 present UXO 08 and examples of the metal debris observed during the 2009 site visit.

Photograph 10-6.1: Metal debris observed near the bombing target at UXO 08

Photograph 10-6.2: UXO 08 (2009)

Photograph 10-6.3: UXO 08 (2009)

Photograph 10-6.4: Metal post observed at UXO 08 (2009)

10.6.1.2 Potential or Known Sources of MEC

The sources of potential MEC contamination at the Aerial Bombing Target at the Southern Tidal Flats are the areas in and around the target, and other areas that may have received ricochets and bombs from drops that were off-target. Munitions use at this site included practice bombs such as 100-pound bombs and probably the miniature type as well. The penetration depths for an intact 100-pound round are estimated to be between 3 and 10 feet bgs depending on the angle of impact and the soil properties. Penetration depths for the smaller, miniature practice bombs are estimated to be between 1 and 2 feet bgs depending on the angle of impact and the soil properties. The USACE has conducted studies regarding the depth of recovery for thousands of ordnance items. The data (Figure 8-12 of EM 1100-1-400d http://www.itrcweb.org/Documents/USACEMilitaryMunitionsResponseActionsJune2007.pdf) shows that while the maximum depth of penetration will resemble the penetrating depth predicted by the penetration analysis, the actual depth of penetration for most items is much lower. In fact, most items were located less than two feet deep. The Mk 15 Practice Bomb may have been used at this site. Metallic munitions-related debris, which resulted from past aerial bombing, is present on the surface at this site and may be present in the subsurface, deeper sediment. The entire area of the Aerial Bombing Target at the Southern Tidal Flats is a suspect MEC area and surface munitions-related debris must be removed as well.

10.6.1.3 MEC Migration Pathways and Receptors

The sediment at the Aerial Bombing Target at the Southern Tidal Flats may have been impacted by MEC. If MEC are present in the subsurface, deeper sediment, or on other surface areas that have not been investigated, horizontal migration is not expected to be significant. Visual evidence of surface metal in the area of the targets indicates that little if any migration has occurred since the target was last used in

the 1940s. Also, frost heave, which may cause MEC to migrate vertically into the subsurface is not an issue at this site.

Human receptors at this site include military and civilian personnel, contractors, recreational users, and trespassers. Ecological receptors would include common flora and fauna, small mammals (e.g., squirrels, rabbits, opossum, and raccoon), reptiles, and birds. Crustaceans, wading birds, ospreys, and pelicans may also be potential receptors in impacted areas.

10.6.2 Problem Statement

Historical use of the Bombing Target at Southern Tidal Flats may have resulted in the presences of MEC in surface, subsurface, and sediments. MEC, if present, could result in a safety hazard to humans and serve as an MC release source. To date, no investigation has been conducted to determine if MEC is present.

SAP Worksheet #11.1 - Data Quality Objectives for the Aerial Bombing Target at Parade Deck (UXO 03)

11.1.1 IDENTIFY THE GOAL OF THE STUDY

The primary goal of the SI for the Aerial Bombing Target at Parade Deck is to obtain environmental data for use in making the following decision:

Determine whether surface MEC debris or subsurface anomalies indicate the presence of suspect MEC in the grassy area of the site. Investigate any anomalies during an RI to determine if MEC are present in the surface or subsurface. If suspected anomalies are not detected, then no further investigation of MEC is required in the grassy area of the site. In this case, the Project Team will evaluate the need to investigate the paved area of the site.

11.1.2 IDENTIFY INFORMATION INPUTS

Data and information that will be required to achieve the above goals include the following:

1. Geophysical Investigation Data: The geophysical team will conduct the land-based geophysical survey in the established survey area. The subsurface geophysical investigation data will be observed by a geophysicist using a Geonics EM61-MK2 to locate suspect metal objects in subsurface soil. Suspect MEC material potentially presenting an explosive hazard (MPPEH) and subsurface metals (if metals are MEC, MPPEH, or MD) could potentially result in the release of MC.

2. GPS Data: GPS data will be gathered to map the geophysical survey area and any suspect MEC locations. The grassy area of the Parade Deck is open and there is no interference with signal reception.

11.1.3 DEFINE BOUNDARIES OF THE STUDY

The SI at the Aerial Bombing Target at Parade Deck is limited to an evaluation of soil (surface and shallow subsurface soil).

The center of the bombing target lies on the eastern side of the parade deck located in the main station area. The horizontal boundary for the MEC investigation includes the triangular-shaped piece of the grassy area located adjacent to and north of the parade deck. The parade deck and paved areas of the

site will not be investigated as part of the SI. The target area and the investigation area boundary are presented in Figure 17-1.

The subsurface geophysical survey will be conducted within the established survey area (i.e., the grassy area of the site). The initial vertical boundary for the subsurface geophysical MEC investigation will be up to 2 feet bgs in accessible, grassy unpaved areas. It anticipated that targets at this site will be shallow (buried up to 2 feet bgs).

11.1.4 DEVELOP THE ANALYTICAL APPROACH

The decision rule for this investigation is as follows:

If the geophysical investigation shows no subsurface anomalies are present in the grassy area, then further investigation of the grassy area of the site will not be warranted and the Project Team will evaluate the need to investigation the paved area of the site. If subsurface anomalies exist that are indicative of buried munitions, then the Project Team will investigate the suspect subsurface anomaly in the grassy area during an RI. The RI would be presented in another UFP-SAP.

11.1.5 SPECIFY PERFORMANCE OR ACCEPTANCE CRITERIA

The grassy area of the site will be investigated for the presence of suspect MEC and MEC debris. The survey will be conducted in an accessible area of the site that, based on the CSM, may contain suspect MEC or MPPEH. The project team will use the results of the investigation (anomalies) to verify that all proposed data were collected, that the data meets quality specifications of this SAP, especially adherence to method-specific quality specifications identified in Worksheets 35 and 36. The project team will review the geophysical survey results and ensure that all stakeholder viewpoints are included in decision making. Worksheet 37 describes the data usability assessment process which goes beyond an evaluation of method-specific quality evaluations to include evaluations of planning assumptions and other factors. This will involve a review of survey coverage and anomaly patterns by the project team to determine if they are representative of suspect MEC.

11.1.6 DEVELOP THE PLAN FOR OBTAINING DATA

The proposed SI field data collection program for the Aerial Bombing Target at Parade Deck is described in detail in Worksheet 17 of this UFP-SAP for MEC.

SAP Worksheet #11.2 - Data Quality Objectives for Field Artillery West Main Range (UXO 04) and Field Artillery East Shrapnel Range (UXO 05 and 06)

The CSM, as presented in Worksheets 10.3 and 10.4 are similar for these sites, which are both artillery ranges with similar types of munitions use; therefore, they are combined in this worksheet.

11.2.1 IDENTIFY THE GOAL OF THE STUDY

The primary goal of the SI for the Field Artillery West Main Range (UXO 04) and the Field Artillery East Shrapnel Range (UXO 05 and UXO 06) is to obtain environmental data for use in making the following decisions:

1. Determine whether MEC are present in conditions or quantities that present an immediate human health hazard and that requires an immediate action. If such quantities are present, then initiate an appropriate remedial response. Otherwise, take no immediate action.

2. Determine whether surface MEC, MEC debris, or subsurface anomalies indicate the presence of suspect MEC/MPPEH within the surveyed areas. If present, then return to the site for further investigation of potential MEC/MPPEH during an RI. If no surface MEC or MPPEH are present, and no anomalies indicate the presence of subsurface MEC/MPPEH within the surveyed areas, then no further investigation is required. In this case, the Project Team will evaluate the need to investigate other areas, including areas of greater depths within the surveyed area if investigation depth was not sufficient for projected penetration depth, as well as those areas which have been deferred and/or not surveyed in this investigation. Under either circumstance, continue to investigate the site for the presence of MC during the SI (presented in the UFP-SAP for MC).

11.2.2 IDENTIFY INFORMATION INPUTS

Data and information that will be required to achieve the above goals include the following:

1. UXO Surface Survey Data: UXO Team and the geophysicist will establish survey areas for both the detector-aided surface surveys and geophysical surveys. Data will be collected from detector-aided surface surveys conducted by UXO personnel using hand-held metal detectors such as the Schonstedt GA-52Cx, White's Spectrum XLT or equivalent, and visual observations. UXO technicians will use metal detectors to locate metallic items on the surface and to confirm the location of the suspect target areas and the firing points. Items located on the surface will be visually

examined to determine if they are suspect MEC, MPPEH, MD or non-MD. Suspect MEC items will be left in place and will be avoided during the geophysical investigation. When allowed by the conditions of the Explosives Safety Submission (ESS) determination, any non-munitions debris may be moved to facilitate a more effective surface survey and/or geophysical survey. Non-munitions debris may be collected and stockpiled in a designated area within the boundaries of the site.

2. Land and Aquatic Geophysical Survey Data: The geophysical team will conduct the land-based geophysical survey in the survey areas established for the UXO detector-aided surface surveys in order to confirm the suspect target areas and to investigate for the presence of MEC/MPPEH in the subsurface of the target areas. The aquatic surveys will take place in the navigable waterways and marshy areas surrounding the potential target areas at UXO 04 and UXO 06 and the waterway adjacent to the firing point at UXO 05 in order to investigate the presence of MEC/MPPEH along the bottom of the waterways and marshy areas.

3. Location Data: In clear areas where vegetation does not interfere with signal reception, GPS data will be gathered to map the detector-aided surface and geophysical survey areas and any suspect MEC locations. In areas where tree canopy precludes use of a GPS unit, locations will be established using a tape measure and compass measurements from a known location(s) for the detector-aided surface survey. For the geophysical survey, a professional land survey form may be used to provide absolute coordinate points as needed.

11.2.3 DEFINE THE BOUNDARIES OF THE STUDY

Horizontal Boundaries, UXO 04, 05 and 06

The focus of the SI of the former ranges will be the suspect target areas at UXOs 04 and 06 and the firing points at UXOs 04 and 05. Figure 17-2 shows the boundaries for UXO 04. Figure 17-4 shows the boundaries for UXOs 05 and 06.

<u>UXO 04 Target Areas</u>

Within UXO 04, the target area locations are unknown, but sandy high topographic points near the center of the impact area are expected to be the former target locations where any dud ammunition and shrapnel or MEC debris targets would be concentrated. The detector-aided surface and boat-aided aquatic geophysical surveys will be used to confirm the locations and the approximate horizontal boundaries of the suspect target areas by identifying concentrated MEC or MEC debris on the surface or in the subsurface and will guide the MC investigation in those areas. Additionally, most of the suspected

target areas are surrounded by waterways and marshy areas where shrapnel or MEC debris could also be present. A boat-based aquatic geophysical survey will also be conducted in the navigable waterways and marshy areas to confirm the potential presence of MEC or MEC debris.

UXO 06 Target Areas

Most of the impact area is located in low-lying wetlands and there are waterways meandering through the site. A boat-based aquatic geophysical survey will be conducted along with a limited detector-aided surface survey of two potentially dry areas within the range fan, which were identified in recent aerial photographs of the site. Actual accessibility to survey these areas will be determined in the field. Additional areas may be added (where possible) if the UXO team observes indications of other potential target areas or suspect MEC areas during the aquatic geophysical or land-based surveys.

Firing Points, UXO 04 and 05

Also included in the horizontal investigation boundary are the nine firing points at UXO 04 and the single firing point at UXO 05 where there is the potential for complete rounds to exist. A detector-aided surface survey will be conducted within a 100-foot radius around five of the nine firing point to identify any potential MEC or MEC debris and a boat-based aquatic geophysical survey will be conducted in the waterway adjacent to the firing point at UXO05. The potential locations of the UXO 04 firing points which are to be investigated are presented in Figure 17-2, while the UXO 05 firing point is presented in Figure 17-3

Vertical Boundaries for Surveys at UXO 04, 05, and 06

The vertical boundaries for the land-based and aquatic MEC investigations (detector-aided surface and geophysical investigations) will be within the nominal survey depth of the instruments and are presented in Worksheet 18.

11.2.4 DEVELOP THE ANALYTICAL APPROACH

The decision rules for this investigation are as follows:

If the detector-aided surface surveys and land/aquatic geophysical investigations indicate that no suspect surface MEC and subsurface anomalies are present, then no further investigation of the site at this depth for MEC is required in the areas surveyed and the Project Team will evaluate the need to investigate deeper and/or other areas of the site which may have been deferred and/or not investigated. If suspect

MEC is observed on the surface or if subsurface anomalies exist, then return to the site to further investigate the suspect surface MEC or MEC debris and subsurface anomalies during an RI.

11.2.5 SPECIFY PERFORMANCE OR ACCEPTANCE CRITERIA

The project team will review the results of the investigations (surface MEC/MPPEH findings and subsurface anomalies) to verify that all proposed data was collected and that the data quality specifications of this SAP, especially adherence to method-specific quality specifications identified in Worksheets 35 and 36. The project team will review the geophysical survey results and ensure that all stakeholder concerns are included in decision-making. Worksheet 37 describes the data usability assessment process which goes beyond an evaluation of method-specific quality evaluations to include evaluations of planning assumptions and other factors. This will involve a review of anomaly patterns by the project team to determine if the data is representative of suspected MEC/MPPEH.

11.2.6 DEVELOP THE PLAN FOR OBTAINING DATA

The proposed SI field data collection program for the Field Artillery West Main Range (UXO 04) and the Field Artillery East Range (UXOs 05 and 06) is described in detail in Worksheet 17.

SAP Worksheet #11.3 - Data Quality Objectives for the Aerial Bombing Target at Golf Course (UXO 07) and the Aerial Bombing Target at Southern Tidal Flats (UXO 08)

Worksheet 10.5 contains the problem definition for the Aerial Bombing Target at Golf Course and Worksheet 10.6 contains the problem definition for the Aerial Bombing Target at Southern Tidal Flats (UXO 08), both are aerial bombing targets and had similar types of munitions use and are; therefore combined in this worksheet.

11.3.1 IDENTIFY THE GOAL OF THE STUDY

The primary goal of the SI for the Aerial Bombing Target at Golf Course (UXO 07) and the Aerial Bombing Target at Southern Tidal Flats (UXO 08) is to obtain environmental data for use in making the following decisions:

1. Determine whether suspect MEC are present in conditions or quantities that presents an immediate human health hazard and require an immediate action. If such quantities are present, then initiate an appropriate remedial response. Otherwise, take no immediate action.

2. Determine if surface MEC, MEC debris, or subsurface anomalies indicate the presence of suspect MEC/MPPEH within the surveyed areas. If present, then return to the surveyed areas for further investigation of potential MEC/MPPEH during an RI. If no surface MEC or MPPEH are present, and no anomalies indicate the presence of subsurface MEC/MPPEH within the surveyed areas, then no further investigation is required. In this case, the Project Team will evaluate the need to investigate other areas, including areas of greater depth within the surveyed area if investigation depth was not sufficient for projected penetration depth, as well as those areas which have been deferred and/or not surveyed in this investigation.

11.3.2 IDENTIFY INFORMATION INPUTS

Data and information that will be required to achieve the above goals include the following:

1. UXO Surface Surveys and Geophysical Investigation:

   Surface: Data will be collected from detector-aided surface surveys conducted by UXO personnel using hand-held metal detectors such as the Schonstedt GA-52Cx, or equivalent, and visual observations. UXO Technicians will use metal detectors to locate metallic items on the surface. Items located on the surface will be visually examined to determine if they are suspect MEC, MPPEH,

MD or non-MD. Suspect MEC items will be left in place and will be avoided during the geophysical investigation; no MEC items will be moved or disturbed during this phase of the project. When allowed by the conditions of the ESS determination, any non-munitions debris may be moved to facilitate a more effective surface survey and/or geophysical survey. Non-munitions debris may be collected and stockpiled in a designated area within the boundaries of the site. The facility must agree to take possession of this non-munitions debris and arrange for the proper disposition of the material before any items may be moved or disturbed.

Subsurface: Metal detector anomalies (i.e., a response from the metal detector at locations where no surface materials are found) that result from the detector-aided surface surveys will be used, along with data from a subsurface geophysical investigation conducted by a geophysicist using a Geonics EM61- MK2 at UXO 07 and a Geonics EM61-MK2 and Geometrics G-858 at UXO 08 to locate suspect metal objects in subsurface soil.

2. In clear areas where vegetation does not interfere with signal reception, GPS data will be gathered to map the UXO detector-aided surface and geophysical survey areas and any suspect MEC locations. In areas where tree canopy precludes use of a GPS unit, locations will be established using a tape measure and compass measurements from a known location(s).

11.3.3 DEFINE THE BOUNDARIES OF THE STUDY

UXO 07

To ensure full coverage and to account for bombing runs that may have missed their target a 600-foot-radius centered on the former Golf Course target center was used to help define the horizontal boundary for the investigation (Figure 17-4). A UXO detector-aided surface survey will be performed in the undeveloped areas of the Golf Course target that will extend approximately 200 feet into the wood-line to the west and to the edge of the creek to the east. A geophysical survey will be performed in the accessible portions of the specified survey area. The expected munitions density is low according to the United States Army Corps of Engineers (USACE) Range Identification and Preliminary Range Assessment (1999). It is possible that potential MEC, if present, could be buried too deep for detection in filled areas. The maximum detection depth capability of the survey instruments, as presented in Worksheet 18, is approximately 2 feet for 3-pound practice bombs. This defines the vertical boundary of the investigation.

UXO 08

Although not identified on any of the historical site plans, a bombing target existed on the tidal flats south of the golf course that was potentially 450 feet in diameter (Figure 17-5). A 650-foot-diameter survey area, centered on the bombing target circle, is planned for investigation. A detector-aided surface survey covering 100 percent of the accessible area is planned. This will be followed by a geophysical survey of the same area along 5-foot-spaced parallel survey lines in the accessible portions of the investigation area. The expected munitions density is low according to the USACE Range Identification and Preliminary Range Assessment (1999). The maximum detection depth capability of the survey instruments, as presented in Worksheet 18, is approximately 2 feet for 3-pound practice bombs. This defines the vertical boundary of the investigation.

11.3.4 DEVELOP THE ANALYTICAL APPROACH

The decision rules for this investigation are as follows:

If the detector-aided surface surveys and geophysical investigations indicate that no suspect surface MEC or subsurface anomalies are present, then no further investigation of the site at this depth for MEC is required in the areas surveyed and the Project Team will evaluate the need to investigate deeper and/or other areas of the site which may have been deferred and/or not investigated. If suspect MEC is observed on the surface or if subsurface anomalies exist, then return to the site to investigate the suspect MEC or MEC debris and subsurface anomalies during an RI.

11.3.5 SPECIFY PERFORMANCE OR ACCEPTANCE CRITERIA

The project team will review the results of the investigations (surface MEC/MPPEH findings and subsurface anomalies) to verify that all proposed data was collected and that the data quality specifications of this SAP, especially adherence to method-specific quality specifications identified in Worksheets 35 and 36. The project team will review the geophysical survey results and ensure that all stakeholder concerns are included in decision-making. Worksheet 37 describes the data usability assessment process which goes beyond an evaluation of method-specific quality evaluations to include evaluations of planning assumptions and other factors. This will involve a review of anomaly patterns by the project team to determine if the data is representative of suspected MEC/MPPEH.

11.3.6 DEVELOP THE PLAN FOR OBTAINING DATA

The proposed SI field data collection program for the Aerial Bombing Target at Golf Course (UXO 07) and the Aerial Bombing Target at Southern Tidal Flats (UXO 08) will be described in detail in Worksheet 17.

SAP Worksheet #12 -- Measurement Performance Criteria Table

(UFP-QAPP Manual Section 2.6.2)

Definable Feature of Work Data Type	Geophysical Anomaly Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
Site Preparation (including mobilization)	Completeness	Verify all plans are approved Verify equipment needed is on site. Verify communications needed are on site. Verify emergency services. Verify Site-specific training. Verify project plans are reviewed and signed.	All plans approved. All equipment needed is on site. Communications checked Emergency services checked Site-specific training completed. Project plans reviewed and signed.	Once
Site Survey	Accuracy	Verify site boundaries have been established Verify survey grids have been established	Site boundaries have been established. Survey grids have been established in accordance with the SOP	Once
Vegetation Management	Completeness	Verify that vegetation has been removed in accordance with the SOP	Vegetation cut to greater than (>) 6 inches and less than (<) 12 inches	Daily

Definable Feature of Work Data Type	Geophysical Anomaly Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
Detector-aided surface survey - Grid	Precision	Resurvey grids to perform a direct comparison to field data collected during detector-aided surface survey.	Detect all metallic debris 20mm or larger on surface.	Resurvey 25 percent (%) of first four grids and after any failure, then 10% of remaining grids after four grids in a row pass QC. If any grid does not pass QC, UXO team will resurvey entire grid and another QC check will be performed.
GPS Positional Data	Real-Time Accuracy	Horizontal Dilution of Precision (HDOP) and number of satellites	HDOP <3, number of satellites at least six	On-Going
	Accuracy	GPS positioning - comparison with two known locations	Sub-meter	Daily
Geophysical Equipment Calibration, Maintenance, Testing and Inspection	Completeness and Accuracy	Instrument setup and testing	Confirm equipment calibrations, inspection and testing within specified criteria (Worksheet #22)	Daily

Definable Feature of Work Data Type	Geophysical Anomaly Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
Instrument Test Strip (ITS)	Sensitivity	Detection capabilities test of representative seed items	Vertical detection of individual inert munitions seeds or surrogates (30mm diameter and larger) within 11x rule [United States Army Corps of Engineers (USACE)] Horizontal detection positioning within 1 meter horizontal accuracy for land based, and within 1-2 meters for aquatic based ITSs	During ITS
Equipment Function Test (EFT)	Sensitivity	Instrument response to metallic targets	Confirm ITS or EFT detections to ensure proper equipment function	Daily
Geophysical Data Collection	Completeness	Data capture	Minimize data dropouts and unusable data. 90% minimum of usable data per survey line	Daily
Geophysical Data Processing and Interpretation	Completeness/Accuracy	Verify all data are usable and accurate for the site	Minimize data dropouts and unusable data. 90% minimum of usable data per survey line	Daily
Demobilization	Completeness	Verify that sites have been restored and all equipment is inspected, packaged, and shipped to appropriate location.	Temporary markers removed and ITS seed holes are filled. All equipment is off site and has arrived at the appropriate location.	Once at the end of field operations.

Definable Feature of Work Data Type	Geophysical Anomaly Measurement Data Quality Indicator	QC Sample and/or Activity to Assess Measurement Performance	Measurement Performance Criteria	Frequency
Site Specific Final Report Preparation and approval	Completeness	QC of MEC Tracking Log and Daily Field Reports.	Tabulation of MEC items discovered during the SI is included in the MEC Tracking Log Daily Field Reports are complete and accurate	Once at the end of field operations prior to demobilization

Explanations for criteria listed above explained in Worksheet #22.
An ITS will be performed to evaluate geophysical surveying techniques and personnel to represent land surveying and aquatic surveying that will be used at MEC MRP sites.

GPS Global Positioning System
HDOP Horizontal Dilution of Precision
USACE United States Army Corps of Engineers

SAP Worksheet #13 -- Secondary Data Criteria and Limitations Table

(UFP-QAPP Manual Section 2.7)

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation / collection dates)	How Data Will Be Used	Limitations on Data Use
Archives Search Report	US Army Corps of Engineers St. Louis District / Archive Search Report Marine Corps Recruit Depot Eastern Recruiting Region Parris Island / May 1999	St Louis District	Basis for UFP-SAP, Site Histories, and CSMs	The information is qualitative and no quantitative (site-specific nature and extent of contamination) information is available. The information was used to establish the field work program and identify areas most likely to be contaminated.
Range Identification and Preliminary Range Assessment	US Army Corps of Engineers St. Louis District / Archive Search Report Marine Corps Recruit Depot Eastern Recruiting Region Parris Island / May 1999	St Louis District	Basis for UFP-SAP, Site Histories, and CSMs	The information is qualitative and no quantitative (site-specific nature and extent of contamination) information is available. The information was used to establish the field work program and identify areas most likely to be contaminated.

SAP Worksheet #14 -- Summary of Project Tasks

(UFP-QAPP Manual Section 2.8.1)

The implementation of the MEC investigation has been divided into definable features of work and the tasks required to complete each definable feature of work have been identified. Procedures for these tasks, including recording data, forms and checklists, data generation, QC checks, data management, and information management, are defined in the SOPs for the project indexed in Worksheet #21.

Definable Feature of Work	Tasks
Site Preparation (including mobilization)	• Prepare Project Plan [Work Plan review, Geographic Information System (GIS) setup, document and data management procedure, approved work plan and subcontractors and schedule is confirmed] • Verify Personnel Qualifications • Coordinate with local authorities and establish communication logistics • Set up Administrative Offices • Equipment Setup and Checkout • Remove Surface Non-Munitions Related Debris, as applicable • Initial Orientation and Training (including Safety and Emergency Response)
Site Survey	• Survey site boundaries with GPS or conventional means • Survey grid corners with GPS or conventional means Survey transect endpoints with GPS or conventional means
Vegetation Management	• Check equipment for proper height • Complete UXO Escort and MEC avoidance • Cut vegetation to proper height
Detector-Aided Surface Survey	• Surface Survey to locate MEC/MPPEH • Record Location (GPS and Photograph) MEC/MPPEH • UXO Escort duties
Geophysical Equipment Calibration, Maintenance, Testing and Inspection	• Set up and test geophysical instruments • Daily EFT
ITS	• Perform ITS • Report results of ITS • Obtain approval of ITS results
Geophysical Data Collection	• Geophysical Survey • Data Download • Data Upload
Geophysical Data Processing and Interpretation	• Data Processing • Initial Target Selection • Peer QC • Final Target Selection • Provide Anomaly Mapping to Stakeholders to aid in MC Sampling Location Selection

Definable Feature of Work	Tasks
Demobilization	• Remove ITS • Remove Temporary Survey Markers • Verify Site Restoration • Complete all Field Forms • Close-Out Field Log Books • Return Equipment • Provide all Field Documentation (verify requirements established in the Work Plan)
Site Specific Final Report Preparation and Approval	• Close-out MEC tracking log • Collect all documentation from the field activities • Prepare Site-Specific Final Report • Receive approval of Final Report

SAP Worksheet #15 – Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

☑ **Worksheet Not Applicable**

This worksheet applies to chemical analysis and reporting, and is not applicable to this UFP SAP for MEC geophysics surveys/investigations.

SAP Worksheet #16 -- Project Schedule / Timeline Table (optional format)

(UFP-QAPP Manual Section 2.8.2)

See Worksheet 16 in MC portion of the UFP SAP.

SAP Worksheet #17 -- Project Design and Rationale

(UFP-QAPP Manual Section 3.1.1)

SAMPLING DESIGN AND RATIONALE

This section describes in detail the approach, methods, and operational procedures TtNUS will use to conduct UXO detector-aided surface surveys and collect geophysical data to identify anomalies potentially related to MEC. The data collected will be used to evaluate suspected anomalies in the accessible portions of the survey areas. Specifically, this SAP worksheet documents the site-specific application of geophysical sensors, navigation equipment, data analysis, data management, and associated equipment and personnel in a manner capable of meeting the site-specific project performance goals as presented in Worksheet #11.

The MC SI SAP associated with the MEC areas discussed in this MEC SI SAP is being addressed under separate cover. MC field work will not be initiated until the MEC investigation is completed.

Definable Feature of Work	SOP	Supporting Document(s)
Site Preparation (including mobilization)	MRP SOP 01 MRP SOP 03	UFP-SAP
Site Survey	MRP SOP 05	UFP-SAP
Vegetation Management	MRP SOP 06	UFP-SAP
Detector-Aided Surface Survey	MRP SOP 01 MRP SOP 02 MRP SOP 05	UFP-SAP
Geophysical Equipment Calibration, Maintenance, Testing and Inspection	MRP SOP 03	UFP-SAP
ITS	MRP SOP 03 MRP SOP 05	UFP-SAP
Geophysical Data Collection	MRP SOP 03 MRP SOP 05	UFP-SAP
Geophysical Data Processing and Interpretation	MRP SOP 04 MRP SOP 05	UFP-SAP
Demobilization		UFP-SAP
Site Specific Final Report Preparation and Approval		UFP-SAP

17.1 SITE PREPARATION (INCLUDING MOBILIZATION)

Mobilization, Set-up, and Preliminary Activities

TtNUS will schedule the arrival of its workforce in a manner that is most effective and that allows for immediate productivity. All personnel mobilized to the site will meet the Occupational Safety and Health Administration (OSHA) training and medical surveillance requirements specified in the HASP. The UXO Technicians will have the appropriate level of training and experience as stated in DDESB TP-18. As part of the mobilization process, site-specific training for all on-site personnel will be performed. The purpose of this training will be ensure that personnel fully understand the operational procedures and methods to be used at the MCRD Parris Island, to including individual duties and responsibilities, and all safety and environmental concerns associated with these MEC operations. The training will include, but is not limited to, a review of this MEC UFP SAP and the HASP/Accident Prevention Plan (APP). Any personnel arriving at the site after this initial training session will be trained when they arrive. Training will be conducted by the project geophysicist and SUXOS.

Project equipment for the UXO survey will come from TtNUS sources and local leases/purchases. All equipment, regardless of source, will be checked to ensure its completeness and operational readiness. Any equipment found damaged or defective will be returned to the point of origin, and a replacement will be secured. All instruments and equipment that require routine maintenance and/or calibration will be checked initially upon arrival and then prior to use each day. This system of checks will ensure that the equipment is functioning properly. If an equipment check indicates that any piece of equipment is not operating correctly and field repair cannot be made, the equipment will be tagged and removed from service, and a request for replacement equipment will be placed immediately. Replacement equipment will meet the same specifications for accuracy and precision as the equipment removed from service.

Site Accessibility and Traffic Control

MCRD Parris Island is a controlled area accessible only through an access gate. Safety requirements dictate that an active exclusion zone be established and maintained at each site before any MEC activities occur because of the potential for encountering explosively configured/fuzed munitions. For this project, the exclusion zones will be established at 200 feet. If non-site personnel or non-essential non-UXO personnel enter an exclusion zone, all MEC operations will cease until the exclusion zone is re-established.

Both routine and emergency response actions dictate the need for prevention of unauthorized site access and for the protection of vital records and equipment. All equipment will be brought to a designated secure location each day.

Site Security

Site security will be maintained to ensure that non-essential personnel do not access the exclusion zones during the UXO detector-aided surface surveys or other UXO avoidance operations at the sites. Barricades will be positioned on access routes a minimum of 200 feet from the edges of the sites. Notification procedures will be posted on the barricades to ensure that non-essential personnel notify the team working in the area prior to entering the area during active operations. Barricades will be removed when operations stop for the day.

Out-of-Box Tests

The following out-of-box tests will be conducted before the pre-seed geophysical survey of the ITS area begins and at the start of each day of surveying.

- Inventory and inspect all equipment to confirm that all components are present and in good condition.
- Assemble the equipment and power up.

Governing Regulations/Guidance and ESS Determination

The work planned for this SI does not require an ESS because MEC avoidance measures will be practiced during the investigation. No MEC or MPPEH will be moved or disturbed during this phase of the project. An ESS Determination Request has been prepared describing the general operations planned at each site. In accordance with Naval Ordnance Safety and Security Activity (NOSSA) guidance, COMMARSYSCOM has reviewed the request and issued an ESS Determination for the planned operations (see Attachment 3).

MEC activities will be performed in accordance with all local, state, and federal regulations and will include all applicable DoD requirements including those in Engineer Pamphlet EP-75-1-2 (USACE, 2004) and data item description (DID) OE 005 (USACE, 2002). Activities involving work in areas potentially containing MEC hazards will be conducted in full compliance with the MCRD Parris Island, Munitions Mandatory Center of Expertise (MMCX), Department of the Navy, NOSSA, COMMARSYSCOM, and DoD

requirements regarding personnel, equipment, and procedures. Navy requirements include OP-5 and NOSSAINST.8020.15B

This work is being conducted as part of the Defense Environmental Restoration Program (DERP) MMRP. The SI will be performed in accordance with CERCLA Sections 104 and 121.

The sites where surveys will be conducted may contain live munitions, and caution should always be exercised while working on the sites.

17.2 SITE SURVEY

Survey transect locations described in the UFP-SAP will be established in the field. The UXO team will establish the transects using hand-held GPS units or, if GPS signal reception is inadequate, through the use of compass, tape measures, survey wheel, or survey equipment (transit or total station). Easy-to-see temporary markings (e.g., plastic flagging, pin flags etc.) will be used to mark locations of transects for vegetation management and surveying.

17.3 VEGETATION MANAGEMENT

Brush cutting/vegetation management is anticipated prior to performing detector-aided surface surveys and subsurface geophysical investigations at UXO 04 and UXO 07. The other sites are not expected to require vegetation management. Brush cutting and vegetation management will be conducted according to MRP SOP 06. Brush and grass can present impediments to positioning the metal detectors and geophysics detectors in close proximity to the ground surface. The following are the types of equipment/techniques that may be used.

- Handheld brush cutters (string or blade) will be used to cut light vegetation and small grassy areas.
- Chain saws will be used in heavier brush areas and to cut small trees up to 2 inches in diameter.
- Brush/vegetation debris will be left on site at the edge of the area cleared. If this is impractical or if the base requires, brush may be disposed of or a wood chipper will be utilized.

Brush cutting/vegetation management operations will be conducted by the UXO staff. If it is necessary to utilize subcontractors, a UXO escort will be provided during subcontractor brush/vegetation management operations.

Some brush/vegetation management may be required prior to conducting the detector-aided surface survey. Geophysical survey operations will require a minimum ground clearance of 6 to 12 inches and 3-foot wide paths. It is expected that the volume of brush cut will not require shredding and disposal or other special treatment, and will remain on site. The degree of brush/vegetation management will be determined by the current site conditions and will be accomplished as described above in the general Site Preparation section of Worksheet #17 and in accordance with MRP SOP 06.

17.4 UXO DETECTOR-AIDED SURFACE SURVEY

During the initial setup at each site and prior to bringing non-UXO personnel or mechanized equipment on site, the UXO team will survey the surface in the area of interest, remove non-munitions-related metallic debris, and flag all munitions-related debris and suspect MEC/MPPEH. After all surface non-munitions related metallic debris has been removed, and all munitions related debris and suspect MEC/MPPEH have been flagged for UXO avoidance, the SUXOS will allow non-UXO personnel and mechanized equipment on site in cleared areas.

UXO Detector-Aided Surface Surveys and Positioning

Data will be collected in the accessible portions of the established survey areas. Detector-aided surface survey data collected by an operator will be from one survey instrument. The UXO team will establish a coordinate system for the detector-aided surface surveys by creating a labeled system of survey stakes. If possible, detector-aided surface survey areas will be divided into approximately 100-foot by 100-foot survey grids. These grids will be further divided into 5 foot wide survey lanes to ensure maximum coverage with the survey instrument. Where individual survey transects are required, detector-aided surface surveys will be performed along the proposed survey lines to establish approximately 5 foot wide transects. Detector-aided survey operations will be conducted in accordance with MRP SOP 01. MEC/MPPEH will be managed in accordance with MRP SOP 02 (MEC Management and Accountability).

Data will be collected when the ground surface is exposed and a detector-aided surface survey will generally precede geophysical surveying (exception will be where a detector-aided survey is not required). Non-munitions related debris may be removed by the UXO Technicians to aid in the geophysical surveying effort if allowed by the ESS Determination. This will prevent mapping of anomalies that are not of concern. No MEC or MPPEH will be moved during this SI.

Detector-aided surveys will be used to locate surface items of concern (munitions items or munitions debris), and will generally provide a qualitative assessment of the amount of shallow buried metal (small,

moderate or large). Locations of surface items will be collected using a GPS and/or compass/tape measure from a known location. The location information will be stored in the GPS or entered into the field log. If poor satellite reception in an area prohibits GPS use, then data will not be collected until more satellites are available and the accuracy criteria are met or an alternative positioning technique will be employed (e.g., tape-measured grid or total stationing). If necessary, when wooded conditions do not allow GPS or a satisfactory alternative positioning technique to be used, a professional survey firm may be employed to provide absolute coordinate points as needed.

Data will be provided in an SI Report and will consist of tables reporting the survey results in North American Datum (NAD) 83 South Carolina State Plane coordinates in US survey feet and plots of the results on plans or aerial maps for each of the MRP areas. A summary of methods used and discussion of the survey results will also be included in the report. Descriptive data will be recorded in the UXO team logbook, and a copy of these data will be provided in the report.

UXO Escort Operations

All activities involving work in areas potentially containing MEC hazards will be conducted in full compliance with this UFP-SAP regarding personnel, equipment, and procedures as follows:

1. If any MEC, MPPEH, or munitions-related debris is encountered the item will be avoided. The UXO escort will not attempt to identify the type or condition of the ordnance. Its location will be reported to the UXO team leader. MEC avoidance procedures will be practiced at all times.

2. The UXO escort will clearly mark any area with visible ordnance or MEC, and the area will be avoided. The visible ordnance or MEC will be noted on the field log sheets or in the field logbook. The UXO escort will report the MEC to the UXO team leader.

3. No ordnance, munitions, explosives, or ordnance-related materials will be moved, removed, or disposed of during UXO escort duties.

4. The UXO escort will conduct UXO avoidance surveys for all proposed survey stake locations using a metal detector to check for possible MEC/MPPEH. If an anomaly is encountered or if the UXO Technician suspects the presence of MEC, the proposed stake location will be relocated to an area free of concerns/anomalies.

All geophysical crews will be accompanied by a UXO Technician II or higher during all fieldwork and geophysical mapping. Before the geophysical crew enters an area potentially containing MEC, the UXO Technician will conduct a detector-aided surface survey and visual survey for surface ordnance and mark each surface MEC anomaly. The UXO Technician will not be required on a full-time basis for non-intrusive activities after the site(s) has been cleared.

UXO Detector-Aided Surface Survey Instrumentation, Methods and Standards.

The Schonstedt GA-52Cx or equivalent will be used as the primary survey instrument to conduct the surveys. Given the nature of the sites and known use of mostly ferrous munitions, this is the best technology for this operation based on industry standards. In addition to the Schonstedt, a White's Spectrum XLT all-metals detector, or equivalent, will be used during the ITS set-up and in surface survey areas to assist in the location of metal targets with little or no ferrous metal content. The Schonstedt will be the primary survey instrument and the White's will be used as a backup instrument in areas suspected to contain nonferrous metals.

The metal detectors to be used by the UXO team during detector-aided surface surveys have a detection depth that is limited by the size and orientation of the target and the soil characteristics of the work area. These instruments provide an audio signal for response but do not store data. The magnetic locator (magnetic gradiometer) does not need to be calibrated. To ensure that each detector is operating properly, the operator will turn on the instrument and slowly move the locator towards metal. As the probe advances toward the target, the audio signal will increase. Failure to detect the object is reason to reject the instrument. The detector will be checked daily before starting MEC activities and after any battery change. UXO Technicians will also conduct random checks during daily operations.

The calibration setting for the Schonstedt magnetic locator instrument is 2; setting the instrument to 3 or 4 will make it more sensitive and setting the instrument to 1 will make it less sensitive. The Schonstedt instrument will not detect non-ferrous munitions such as those made of copper, brass, or aluminum.

Discovery of Chemical Warfare Materiel

Potential exposure to Chemical Warfare Material (CWM) on this site is not anticipated. In the event that CWM is located or suspected, TtNUS personnel will evacuate the area immediately in an upwind direction from the CWM, secure the site, and request assistance from the Navy POC.

Upon discovery of suspect materials, the responsible UXO Technician III will:

- Ensure that all personnel are clear of the area
- Maintain security of the area until relieved

After the area is clear and secured, the responsible UXO Technician III will:

- Notify the UXO Program Manager
- Notify the Navy POC
- Stop all field operations
- Assemble the crew at a designated assembly point
- Standby to provide assistance as required

If directed, UXO personnel will take emergency non-invasive actions such as covering the item with plastic sheeting or placing sandbags around the item.

In the event that Hazardous, Toxic, or Radiological Waste (HTRW) is encountered on site, the work site will be evacuated until the Project HSM, with concurrence of the Navy POC, identifies and implements appropriate protective measures.

Suspect MEC/MPPEH

If suspect MEC, MPPEH or munitions-related debris are encountered, the location of each will be recorded and/or marked using a GPS, tape measure, or other grid coordinate location system. The UXO team will attempt to determine its condition without moving or disturbing the item. Each item will be marked with flagging tape and assigned a unique number starting with the grid ID label followed by the item number (e.g., MBT-01-01). All available information about the item will be recorded in the logbook, including location, identification, item number, and whether the item is suspect MEC or MPPEH. A digital photograph will be taken of each item. The UXO team will not move or otherwise disturb the item in an attempt to collect information. After all available information is recorded and the item is determined not to be MEC, the UXO team will resume the detector-aided surface survey.

Every effort will be made to identify each suspect MEC item encountered. Under no circumstances will any suspect MEC be moved in an attempt to make a definitive identification. Munitions will be visually examined for markings and other external features such as shape, size, and external fittings. If MEC/MPPEH are encountered, the MCRD POC and TtNUS UXO Manager will be notified immediately

and work within the exclusion zone for the identified MEC will temporarily stop. Proper notifications and request for response to the MEC item will be coordinated through the MCRD POC and TtNUS UXO Manager. Work within the exclusion zone for the MEC item will resume after the removal/disposal of the item has occurred or upon notification by the TtNUS UXO Manager to resume operations.

Only UXO-qualified personnel will perform MEC identification procedures. As an exception, a UXO Technician I may assist in the performance of MEC identification procedures when under the supervision of a UXO Technician III or higher. All personnel engaged in field operations will be thoroughly trained and capable of recognizing the specific hazards of the procedures being performed. To ensure that these procedures are performed to standards, all field personnel will be under the direct supervision of a UXO Technician III or higher. All suspect MEC items will be recorded following the requirements of this UFP SAP, the project site-specific HASP, applicable ordnance operations procedural safety guidelines, and industry-accepted safe work practices and procedures.

MEC Disposal

In the event that MEC are discovered that pose an immediate threat to operations, UXO personnel will mark the location of the item and avoidance procedures will be followed. The MCRD Parris Island POC will be notified and Military EOD will be contacted for treatment. Based on EOD's assessment of the situation, the MCRD Parris Island POC may also contact SCDHEC to obtain a permit prior to destruction of MEC. The area around the MEC will be blocked off and access restricted, the area will be under the control of the UXO Technician until relieved by the Navy POC or Military EOD.

Anomaly Avoidance

Anomaly avoidance will be performed by UXO Technicians for site workers by locating potentially hazardous anomalies (whether identified by visual means or through detector-aided surface surveys).

PLANNED MEC FIELD PROGRAM FOR AERIAL BOMB TARGET AT PARADE DECK (UXO 03)

Survey Rationale

Detector-aided surface surveys will not be conducted at this site because the investigation area is developed, and MEC are not suspected to be present on the surface in this area.

PLANNED MEC FIELD PROGRAM FOR FIELD ARTILLERY WEST MAIN RANGE (UXO 04)

Survey Rationale

In 1937, the Marines established the West Main Range impact area for field artillery firing (see Figure 17-2). This range had a concrete observation point and a total of nine firing positions. The impact area was 9,000 feet in length, and the range fan extended 16,500 feet. Artillery use is known to have included HE and shrapnel rounds from the 75mm gun, Model 1897, known as the "French 75," as well as the 75mm pack Howitzer, M1. Other calibers such as 2.95-inch Mountain gun, 37mm anti-tank and 105mm Howitzer may have been fired, but no evidence was found to support this. Direct evidence was not found regarding this impact area being used for aerial bombing or artillery training prior to 1937. The location and footprint of the former range was identified using historical maps (Figures G-9 and G-10 of the ASR, presented in Attachment 1).

The focus of this SI will be the impact area and firing points of the former range. The impact area target locations would have received most of the dud ammunition, and the firing line could potentially contain complete rounds of ammunition. There may have been instances when complete rounds/residue may have been discarded around the firing points after exercises. Hence, a 100-foot area around the former firing points in undeveloped areas (five total) will be investigated with a UXO detector-aided surface survey.

Former impact area target locations are unknown, and the impact area as it is referred to in the ASR is very large (greater than 1000 acres of marsh and flat land). Sandy high topographic points near the center of the impact area are considered to be the most likely areas for the former impact area targets. These higher areas would have allowed visual observation, kept targets out of tidal wash, and provided access to targets for periodic maintenance. Furthermore, these areas are present at the center of the impact area (where impact area targets would be expected). Therefore, they are surmised to be the most likely location for the impact area targets based on what is known. Furthermore, these high points are also relatively distant to Page Field, Page Field Road, the estuary, and more recently developed areas on the western side of the impact area. Consequently, the high point areas are considered to be the suspected impact area target locations that will be investigated in this SI.

A detector-aided surface survey will be conducted along 100-foot spaced transects of the dry, accessible portions within the suspect impact area target locations. This transect spacing will be small enough to detect impact areas described in the ASR and, at the same time, will limit the surveying done within the large wooded areas that are laborious and costly to survey. The planned land survey areas

are mostly wooded, and will require vegetation clearing. Figure 17-2 shows planned land-based and aquatic survey areas. The expected munitions density is moderate according to the USACE Range Identification and Preliminary Range Assessment (1999).

PLANNED MEC FIELD PROGRAM FOR FIELD ARTILLERY EAST SHRAPNEL RANGE (UXO 05 AND UXO 06)

Survey Rationale

Established in 1937 as one of two field artillery ranges at MCRD Parris Island, the East Shrapnel Range consisted of a single firing position at Ballast Creek with a southerly direction of fire (see Figure 17-3). The surface danger zone was approximately 17,000 feet long and extended along the marshes of Parris Island, east of Page Field. No specific records of weapons fired or impact area target locations are known. Presumably, the ordnance used included 75mm projectiles (high explosive and shrapnel rounds), which was the most common caliber during this time. These munitions consist of a significant ferrous metal component. The location of this range is shown on historical maps from the ASR (Figures G-9 and G-10 located in Attachment 1).

The focus of this SI will be the impact end of the range and the firing point as they are defined in the CSM and ASR. Most of the impact area is located in low-lying wetlands with waterways meandering through the site. The area is subject to tidal surges, has very limited accessibility by foot, and cannot be easily accessed with survey instruments; therefore, a boat-based aquatic geophysical survey combined with a limited detector-aided surface survey of selected dry accessible areas is planned for the UXO 06 area of the site. Two potentially dry areas within the impact end of the range fan have been selected for the UXO detector-aided surface survey using recent aerial photographs of the site; however, actual accessibility to survey these areas will need to be determined in the field. Additional areas may be added (where possible) if the UXO team observes indications of potential impact area target locations or suspect MEC areas during the aquatic geophysical surveying or during the UXO detector-aided surveying in the two specified dry areas.

There is potential for complete rounds to exist at the firing point (UXO 05); there may have been instances when projectiles detonated inside field guns or complete rounds/residue may have been discarded around the firing point after exercises. Therefore, a 100-foot area around the former firing point will be investigated with a UXO detector-aided survey. Surface and sub-surface anomalies will be marked, located, and mapped around the former firing point to characterize the site and to aid in the

planning of future investigations. The expected munitions density is moderate according to the USACE Range Identification and Preliminary Range Assessment (1999).

The UXO detector-aided surface survey will consist of:

- A limited meandering path UXO detector-aided surface survey using hand-held GPS unit to locate survey walking paths of specified land areas shown on Figure 17-3 (if accessible and dry enough to permit surveying).

- A limited meandering path UXO detector-aided surface survey using hand-held GPS unit to locate survey walking paths of possible areas where, during the course of the surveying, the UXO team observes indications of potential impact area target locations or suspect MEC areas.

- Investigation of a 100-foot area around the former firing point with a UXO detector-aided survey along 5-foot spaced survey lines in the accessible area (see Figure 17-3).

PLANNED MEC FIELD PROGRAM FOR AERIAL BOMBING TARGET AT GOLF COURSE (UXO 07)

Survey Rationale

The Aerial Bombing Target at Golf Course was established as a replacement for the Aerial Bombing Target at Page Field in 1942. Figure 17-4 depicts the site and the planned MEC investigation. Small 3-pound practice bombs have been recovered in the area by EOD units, and there is no evidence that other types of bombs were used. Range use is thought to have ended around the time Page Field was placed on caretaker status in July 1946. The construction of the Golf Course was completed over the bombing target in 1948.

The configuration of the Aerial Bombing Target at Golf Course is unknown; however, Page Field had target circle diameters of 50, 100 and 200 feet. It is assumed that the two bomb targets used a similar design. To ensure coverage of the bomb target and account for bombing runs that may have missed their target, a 600-foot radius centered on the former Golf Course target center was used to help define the investigation area. The golf course elevation is to 5 or 6 feet higher than the grade, which existed during the site's military use because of fill placed during its construction; however, it is not known how much fill was placed in the planned survey area and how the fill depths vary across the area. The regular maintenance performed at the golf course makes a UXO detector aided-surface survey unnecessary in the developed areas of the site. A UXO detector-aided surface survey will be performed in the

undeveloped areas of the Golf Course bomb target area along 5-foot spaced survey lines (in accessible areas). The area surveyed will extend approximately 200 feet into the wood-line to the west and to the edge of the creek to the east. The majority of the northern and southern areas of this site will not undergo a UXO detector-aided surface survey. The expected munitions density is low according to the USACE Range Identification and Preliminary Range Assessment (1999).

PLANNED MEC FIELD PROGRAM FOR AERIAL BOMBING TARGET AT SOUTHERN TIDAL FLATS (UXO 08)

Survey Rationale

Although not identified on any of the historical site plans, a bombing target is known to have existed on the tidal flats south of the Golf Course (see Figure 17-5 for an aerial of the site). Presumably, the range was used during WW II, though the target is barely discernable on 1945 aerial imagery. The ASR site inspection located two 10-foot-tall metal posts that formed the target's center. The inspection team also found rusty sheet metal debris apparently from 100-pound practice bombs scattered around the target. This rusty sheet metal debris is considered MD and not MEC. Miniature practice bombs may also have been dropped on the site. No debris from 2.25-inch SCAR or HE bombs was observed at this location, although the Parris Island Air Station had these items and used them at other locations in the Port Royal Sound area. The bombing target is depicted in the ASR as being 450 feet in diameter.

A 650-foot-diameter survey area, centered on the bombing target circle, is planned for investigation. A detector-aided surface survey along 5-foot spaced survey lines of the accessible area will be conducted. The survey area is relatively small and open allowing the planned thorough survey coverage. The expected munitions density is low according to the USACE Range Identification and Preliminary Range Assessment (1999).

17.5 GEOPHYSICAL EQUIPMENT CALIBRATION, MAINTENANCE, TESTING AND INSPECTION

Equipment Standardization

Geophysical sensors and support equipment, navigation equipment, and operator performance will be tested at specific intervals and must meet the appropriate acceptance criteria. One of these tests will be a daily EFT (described in detail below). Worksheet #12 lists additional tests or checks, their required frequencies, and acceptance criteria. Additionally, calibrations and other equipment setup information are

detailed in Worksheet #22. Initially, before the ITS is performed, out-of-box tests are planned and detailed below.

Equipment Function Test (EFT)

The EFT will be implemented on a daily basis once the ITS is completed. The EFT will provide a test of equipment functionality over a few metallic targets representing suspected MEC items for the project. The primary objective is to demonstrate that the survey equipment is responding normally to a controlled set of objects (equipment is functioning properly); the objective is not to duplicate the ITS. To make the test practical three targets will be placed on the ground, each spaced 10 feet apart and in the same orientation for each test. This will allow the objects to easily be laid out and transported between subject sites. Site conditions (i.e., soils) may differ between sites, and this could create differences in response; however, responses should be similar when tests are conducted at the same site, as care will be taken to lay out the same objects in the same locations and orientations (i.e., use field marks to help with object placement). All tests will be conducted in an area free of metal. Pre-screening with the geophysical instrument will be necessary to find such an area when work begins at a new site. Field notes will be kept on each test, and all data will be included in the SI report.

The seeded ITS may be used in lieu of the EFT metallic targets, if the geophysical team prefers to test the equipment over the ITS each day. Either way, the survey equipment must be tested daily over the EFT items or the ITS plot to show the equipment is operating normally.

17.6 INSTRUMENT TEST STRIPS

Personnel Qualifications

The ITSs and geophysical investigations will be managed and performed by a qualified Project Geophysicist and Site Geophysicist who meet the requirements stated in USACE DID OE-025.01 (USACE, 2002). At least one UXO Technician II or higher will be present throughout the ITSs and geophysical investigations to provide UXO avoidance support. Worksheet #7 describes the personnel qualifications and experience for these positions. A land-based and an aquatic-based ITS will be developed and utilized to evaluate geophysical surveying techniques and personnel to represent all of the subject sites. The ITS will provide a simple test over several buried metallic objects meant to represent potential MEC targets for the subject sites. The ITS need only be surveyed once if operator(s) and equipment are approved. If new equipment or new operators are necessary, then both operator and equipment will need to be tested on the ITS.

Objectives and Scope

The specific objectives of the ITS are as follows:

- Demonstrate that the geophysical investigation systems and navigational equipment are operating properly.

- Provide a safe area with a known set of isolated objects (for example, a single inert UXO or UXO surrogate) for testing detection with the survey equipment.

- Assess the operators' performance and update related procedures to assist in the development of operator measurement techniques.

- Evaluate average speed, minimum along track sampling, and line separation distance in detecting target items.

- Evaluate detection of land seed items (30mm diameter and larger) buried within the maximum detection depth determined from USACE 11 times (11x) rule (maximum detection depth = 11 times the diameter of the munitions). Evaluate detection of aquatic seed items. The Project Geophysicist and TOM will determine whether the ITS performance is acceptable, and consequently when survey work may begin.

ITS Survey Procedure

Land Based: A test strip will be established in a clear (un-vegetated) area, which, if possible, will be close to the site being investigated. The test area will be chosen in cooperation with the MCRD Parris Island POC to avoid cultural areas potentially containing clutter, utilities, or landfill materials that might interfere with the ability of the geophysical instrument to definitively detect the seed items. A suitable location would be in an area that can be left seeded for the duration of the project in the event that different equipment or operators need to be tested. The operators and equipment used for geophysical survey work must be tested and approved first in the ITS. The test strip location will be identified by TtNUS and approved by the Navy prior to the ITS mobilization. A utility clearance and/or Dig Permit will be requested from the Navy prior to conducting ITS operations.

The UXO team will start with a detector-aided surface survey of the selected test strip location. A geophysical survey will be conducted prior to seeding the test area with inert or simulated test items to

evaluate the instrument response of the site background. Afterwards, geophysical data will be collected along several survey lines across the seeded test strip. An initial survey line will be conducted directly overtop of the seed items (that will be arranged in a straight line), and two more parallel survey lines will be surveyed at 12 inches and 24 inches from the initial survey line on both sides of the initial survey line. The initial survey line will be used to evaluate the ITS for approval (detections), and the subsequent survey lines will be used for informational purposes on the lateral detection capabilities of the geophysical methods. The ITS surveying is planned with integrated GPS because it is expected that site conditions should permit its use on all or most of the sites, and this will also test the setup with the most equipment operated by the geophysical operator. If GPS cannot be used because of poor satellite reception, then an alternate positioning technique such as total stationing or fiducials will be employed.

The locations of the test strip, survey data stations, and test seed items will be accurately documented. Depths, orientations, and physical descriptions of each of the test seed items will also be noted and provided to the Site Geophysicist after the targets are selected by the geophysical team to provide understanding of the seed items in relation to their resultant anomaly signatures. Photographs of the seed items will also be taken and made available to the survey team.

Aquatic Based: To best represent the conditions of the survey site, a waterway near the survey area in UXO 06 will be seeded with surrogate items. Three seed items will be placed in a line at the bottom of a waterway and marked with buoys. The seed items will be placed on the bottom of the waterway and given enough time to settle on the bottom to ensure as much downward migration as possible. The seed items will be located away from areas of clutter (metal). The locations of the seed items will be coordinated with the MCRD Parris Island POC in order to avoid any conflicts with facility operations.

To establish a transect for the aquatic ITS, two prospective transect endpoints will marked by buoys. The Geophysical Team will screen the length of the prospective transect. If the transect appears to be free of ferrous metal, background geophysical data will be recorded. Once the geophysical team determines that the area is suitable to use, seed items will be placed and located along the transect. Geophysical data will be collected along the seeded transect with a few passes (survey lines) until the geophysical team is satisfied the seeded transect has been covered. Once the area has been seeded and surveyed, it will be left seeded until the geophysical project work is complete in the event that it must be used again to test different personnel, equipment or techniques. GPS is planned for positional surveying.

The locations of the test plot, survey data stations and test seed items must be accurately documented. Depths, orientations and physical descriptions of each of the test seed items must also be noted. Photographs of the seed items will also be taken and made available to the survey team.

ITS Seeding

The test strip will be seeded by TtNUS. TtNUS will have at least one UXO Technician II (or higher) on site during the intrusive seeding to perform anomaly avoidance. The UXO Technician(s) will utilize a Schonstedt GA-52 Cx or similar equipment and a water proof "down-hole" magnetometer in water to provide MEC avoidance. Each seed item will be labeled with a unique identifier, photographed (open hole), and located in relation to the ITS survey plot corners ends that will also be located.

Land Based

Six types of land seed items are planned to be buried blind to the geophysical team in the ITS. Inert munitions and surrogate seed items suspected for the sites will be buried in various orientations at depths within the typical maximum detection depth of 11 times the diameter (11x D) of the munitions (following the USACE 11x rule). The six seed items will be buried 10 feet apart to distinguish each item's anomaly signature to aid in later interpretation of survey data, and at the following depths bgs:

Item and Burial Depth	11x depth
One 3-inch/50 steel projectile at 22 inches bgs	(11x D = 33 inches)
One aluminum projectile fuze at 6 inches bgs	NA
One 30mm steel projectile at 8 inches bgs	(11x D = 13 inches)
Ten brass cartridge cases at 12 inches bgs	NA
One 40mm steel projectile at 10 inches bgs	(11x D = 17.3 inches)
One 40mm steel projectile at 16 inches bgs	(11x D = 17.3 inches)

Notes: mm – millimeter, 11x D is 11 times the diameter (USACE rule)

Aquatic Based

The aquatic based ITS will be seeded along the floor of the waterway with 75mm ferrous surrogate rounds. The three surrogate rounds will be spaced approximately 20 feet apart.

Geophysical Data Analysis and Interpretation

The ITS activities will generate geophysical contour and profile maps depicting the area surveyed and the anomalies detected in relation to the locations of the seed items. The geophysical maps will be transmitted electronically and will be compatible with ArcView Version 8 or the specific GIS platform in use. TtNUS will perform data file QC review and correction as necessary. ITS results will be submitted to the Project Geophysicist or his/her designee for approval and authorization before site work begins. The

SI report will also document the ITS and will include an as-built drawing of the ITS plot geophysical data and a summary of ITS results including techniques and equipment used.

ITS Disassembly

The ITS will be seeded for the project duration to allow additional testing of a new operator or new pieces of equipment if necessary for the project geophysical work. After the project field work is complete, the ITS items will be removed from the test plot, and the holes will be backfilled and restored.

17.7 GEOPHYSICAL DATA COLLECTION

Geophysical Surveys and Positioning

Subsurface MEC is possibly present at each of the investigation sites. Geophysical data will be collected at each site in the accessible portions of the established survey areas to search for and locate anomalies that could potentially represent MEC. While the planned geophysical methods are feasible for detecting anomalies created by small to large metallic objects such as MEC items, the methods cannot identify target items associated with detected anomalies. The planned geophysical methods alone cannot differentiate whether MEC or some other metallic object is present at the location of a detected anomaly on the investigation sites.

The terrestrial and aquatic geophysics surveys planned were designed with depth in mind. Estimated penetration depths are presented in within the UFP-SAP; however, actual penetration depth ranges for munitions at these sites are unknown. Generally, the terrestrial geophysical sensors can typically detect projectile MEC to a maximum depth of 11 times its diameter (for individual munitions 20mm or larger). Concentrations (multiple items) can be detected deeper. The aquatic geophysical sensors are similar in detection distance, but with the aquatic sensor there will be somewhat less detection "depth" because of the greater distance of the sensor to the waterway bottom as compared to the distance of a terrestrial sensor to the ground surface. This greater distance is necessary in order to keep the aquatic sensor safe from potential snags or bottoming the sensor out on the waterway bottom. Although it may be unlikely that individual munitions items can be detected in aquatic areas where munitions may have penetrated a few feet or more into the sediment, or in terrestrial areas where the ground surface may have been built up with fill material, concentrations of munitions items may be detectable if penetration depths or ground surface elevation buildup are not too great. While geophysical methods and equipment have limitations and individual items or concentrations of items at these sites may be buried too deep for detection, the geophysical surveys will provide information to a certain detection distance or depth.

Bathymetric information on the aquatic sites is not known at this time; however, given the nature of the sites, shallow water depth is expected in the waterways at UXOs 4, 5, and 6. Attempts will be made to maintain the position of the underwater magnetometer as close as 2 feet above the waterway bottom using bottom information that will be acquired during surveying. An exact magnetometer height above the waterway bottom cannot be guaranteed because the waterway bottom is variable and the magnetometer will have to be raised and lowered during surveying to compensate for the bottom change. Remaining at least 2 feet above the waterway bottom is critical to reduce the risk of bottoming out or snagging the sensor on the waterway bottom, or encountering an obstruction within the waterway channel or a potential MEC item.

Geophysical survey data collected along transects will be from a single operator using one survey instrument, unless otherwise noted. A 3-foot survey width is expected for geophysical surveys; however, the lateral detection capability will be generally dependent on the size, orientation, and depth of the buried item in the vicinity of the survey line. Larger shallower items can be detected further to the side of a survey line than smaller deeper items. Data station intervals will be determined with the suspected MEC sizes in mind to provide adequate sampling for the smallest suspected MEC sizes. These intervals are normally controlled by survey speed and acquisition rate (readings per second) but may also be controlled by a survey wheel in some cases.

Data will be collected when the ground surface is exposed and a UXO detector-aided surface survey will generally precede geophysical surveying. Non-munitions related debris may be removed by the UXO Technicians to aid in the geophysical surveying effort if allowed by the ESS Determination. This will avoid mapping of anomalies that are not of concern. No MEC or MPPEH will be moved during this SI.

Geophysical data anomalies and relative locations or absolute locations (only when using GPS) can be stored automatically. A sub-meter accuracy differential GPS unit is planned for geophysical surveying; however, GPS signal reception will need to be monitored while data are being collected using the GPS criteria specified in Worksheet #12 because site conditions (e.g., tree canopy) may prohibit accurate positioning with GPS, and it may be necessary to use an alternative positioning technique (e.g., tape-measured grid or total stationing). The GPS survey will utilize third order or better monumentation. The monuments or markers (such as geodetic monuments or survey monitoring wells) will be visited at the start of each day and toward the end of each day. If necessary, when wooded conditions that do not allow GPS or a satisfactory alternative positioning technique to be used, a professional survey firm may be employed to provide absolute coordinate points as needed. Gaps in the geophysical data from unusable data or data that could not be positioned will be evaluated to determine whether they are sufficiently large enough to warrant data recollection in those areas. The geophysical team will be

responsible for positional data for non-munitions cultural features at the site that might affect geophysical data interpretation (to include culverts, power lines, fencing, etc.).

Data will be provided in an SI Report and will consist of tables reporting the geophysical anomaly locations. Additionally, data contour and profile maps depicting the geophysical results in NAD83 South Carolina State Plane coordinates in US survey feet on plans or aerial maps for each of the MRP areas will be provided. A summary of methods used and discussion of the survey results will also be included in the report. Descriptive data will be recorded in the UXO team logbook, and a copy of these data will be provided in the report.

All geophysical crews will be accompanied by a UXO Technician II or higher during all fieldwork and geophysical mapping. Before the geophysical crew enters an area potentially containing MEC, the UXO Technician will conduct a detector-aided surface survey and visual survey for surface ordnance and mark each surface MEC anomaly. Before the crew sets monuments or drives stakes, the UXO Technician will conduct a detector-aided surface survey and visual survey for surface ordnance (a magnetic locator or electromagnetic survey of the site to ensure that it is free of anomalies). The UXO Technician will not be required on a full-time basis for non-intrusive activities after the site(s) has been cleared.

Anomaly Reacquisition

No anomaly reacquisition is planned for this SI.

PLANNED MEC FIELD PROGRAM FOR AERIAL BOMB TARGET AT PARADE DECK (UXO 03)

Survey Rationale

This former bombing target is not depicted on historical maps but was within the limits of the parade deck. The approximate location of the former bomb target is shown on Figure 17-1 based of historical information in the ASR. Bomb target use ended with the paving of the parade field, which was completed in the early 1940s. Small practice bombs (ferrous and non-ferrous types) are reported to have been the ordnance used during target use. According to the ASR and CSM, suspect MEC (if present) will be shallow (maximum of about 2 feet bgs). Extensive construction has taken place over the years in this area and it is believed that the developed areas of the parade deck were previously investigated during construction efforts.

A geophysical survey using 2.5-foot survey line spacing is planned for the largest of the undeveloped or minimally developed grassy areas in the vicinity of the former bomb target because areas are relatively

small and can be surveyed easily with a high density of data coverage. A Geonics EM61-MK2 will be used for the survey. The Project Team believes it is likely that the paved sections of the parade deck were investigated during construction to a depth equal to or exceeding the detection depth capabilities of geophysical instruments or the expected MEC penetration depth. The site is mostly paved, surrounded by buildings, and regularly maintained. A UXO escort will remain with the geophysics team for anomaly avoidance and to confirm the absence of surface MEC. The expected munitions density is low according to the USACE Range Identification and Preliminary Range Assessment (1999).

PLANNED MEC FIELD PROGRAM FOR FIELD ARTILLERY WEST MAIN RANGE (UXO 04)

Survey Rationale

Land

A Geometrics G-858G is planned for the geophysical survey in the dry accessible areas along the same 100-foot spaced transects planned for the UXO detector-aided survey. Suspect MEC consists of 75mm projectiles (high explosive and shrapnel rounds) that would consist of a significant ferrous metal portion. The G-858G is a UXO industry-standard magnetometer that is portable in a wooded setting and can detect ferrous metal including MEC. According to the ASR, suspect MEC (if present) may be relatively deep (greater than 4 feet bgs), possibly deeper than the geophysical equipment can detect (maximum detection depth for an individual 75mm sized projectile is about 2.5 feet).

Aquatic

Because significant areas of marsh surround the suspect impact area target locations and firing misses might have landed in the marsh, an aquatic geophysical survey will be performed along the navigable waterways within the range fan. Data will be collected in accessible waterways within the impact area range fan using a small boat towing an underwater G-882 (marine) magnetometer. The tide will influence boat navigation in the aquatic survey areas (water depths), but is expected to have minimal effect on movement of the geophysical sensor. Salt water is not expected to interfere with magnetic fields that magnetometers measure.

PLANNED MEC FIELD PROGRAM FOR FIELD ARTILLERY EAST SHRAPNEL RANGE (UXO 05 AND UXO 06)

Survey Rationale

Former impact area target locations are unknown; therefore, an aquatic geophysical survey of accessible waterways within the UXO 06 range fan is planned using a small boat towing an underwater magnetometer (because suspect MEC are expected to be of steel construction). The former firing point in UXO 05 is located near Ballast Creek, and a similar aquatic geophysical survey is planned in the waterway around the former firing point location to search for anomalies that might indicate possible disposal. The amount of aquatic surveying that can be performed will need to be determined based on boat accessibility in the field. The tide will influence boat navigation in the aquatic survey areas (water depths), but is expected to have minimal effect on movement of the geophysical sensor. Salt water is not expected to interfere with magnetic fields that magnetometers measure. Figure 17-3 displays the former firing point and impact area range fan where aquatic surveying is planned.

Land-based geophysical surveys are not planned at this site.

PLANNED MEC FIELD PROGRAM FOR AERIAL BOMBING TARGET AT GOLF COURSE (UXO 07)

Survey Rationale

A Geonics EM61-MK2 will be used for the geophysical survey in the open area. A handheld EM61-MK2 will be used for the wooded portion because it is portable and practical in this type of wooded setting and the standard EM61-MK2 trailer is not. The geophysical survey will be performed using 10-foot spaced parallel survey lines in the accessible portions of the specified survey area (see Figure 17-4). This transect spacing will provide good data representation of the survey area, while keeping labor and costs substantially lower than a survey designed for full coverage of the site. Suspect MEC are small practice bombs (ferrous or non-ferrous). The EM-61 is anticipated to be highly effective at mapping small shallow metallic objects in the undeveloped areas of the site. However, the developed areas of the golf course have been covered with perhaps as much as 5 to 6 feet of fill above the historical grade that was present when the bomb target was active. Because of the potential thickness of the fill material in some areas, detection of individual practice bombs within certain developed areas of the golf course may not be possible at the current grade level. It may be possible to detect larger items, clusters of small practice bombs, or impact target debris in these areas. For 3-pound practice bombs, the maximum detection depth capability of the EM61 is approximately 2 feet. Clusters of items could be detected deeper.

Maximum penetration for the suspected MEC is estimated in the ASR to have been about 2 feet bgs (below historical ground surface).

PLANNED MEC FIELD PROGRAM FOR AERIAL BOMBING TARGET AT SOUTHERN TIDAL FLATS (UXO 08)

Survey Rationale

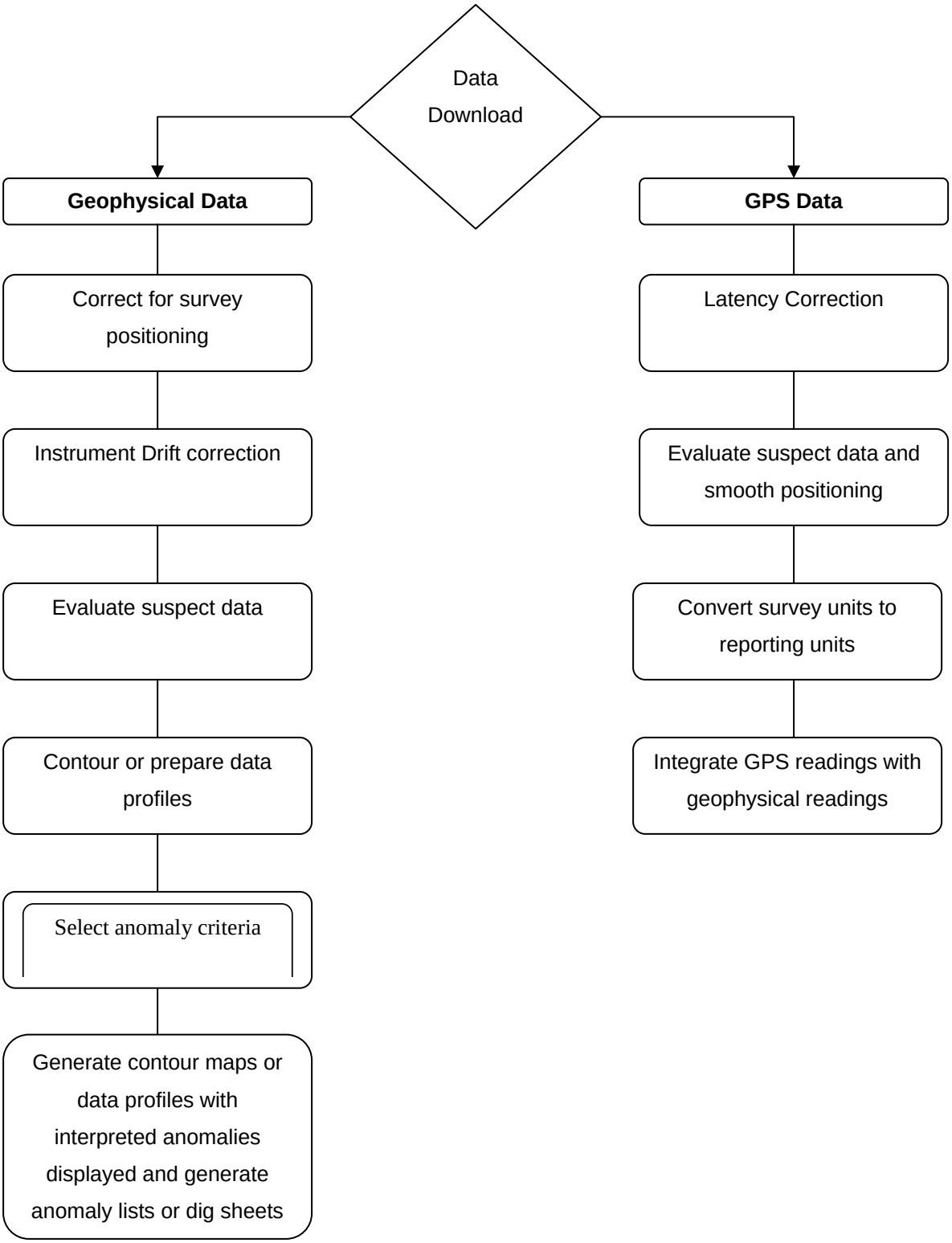
A geophysical survey will be performed in the same boundary as the UXO detector-aided surface survey using 5-foot-spaced parallel survey lines in the accessible portions of the investigation area (see Figure 17-5). A Geonics EM61-MK2 and a Geometrics G-858 magnetometer will be used for the geophysical survey. The site is tidally influenced, and as a result salty conditions (high electrical conductivity) could limit the ability of the EM61-MK2 to detect possible MEC because the EM field that the unit generates can be prematurely attenuated in such conditions. Alternatively, tidal influence would not be expected to interfere with the magnetometer's detection capabilities. The geophysical survey will be performed using parallel transects spaced 5 feet apart in the accessible portions of the impact target area. Suspect MEC are believed to be 100-pound bombs and possibly miniature practice bombs (ferrous or non-ferrous). According to the ASR and the expected soil/sediment type, suspect MEC maximum penetrations are expected to be shallow (down to about 2 feet bgs) for smaller items and deeper (down to about 4 feet bgs) for larger items.

17.8 GEOPHYSICAL DATA PROCESSING AND INTERPRETATION

Geophysical Software

All geophysical data will be processed as soon as possible. After the geophysical data have been backed up, the data will be copied to the processing computer and imported into geophysical data processing and mapping software (Geosoft Oasis montaj). This software will be used to process, analyze, and present the findings of the geophysical surveys. The processing and analysis will consist of applying standard corrections to the data, producing data profiles to interpret the data, and identifying responses that could be associated with individual anomalies that represent MEC. This process is depicted in the following Geophysical Data Processing Flowchart. The geophysical team will prepare a detailed map and anomaly target list for each site that depicts the northing and easting locations of all anomalies that meet the identification criteria of potential ordnance items. Each anomaly will be assigned a unique reference number for tracking and reporting.

GEOPHYSICAL DATA PROCESSING FLOWCHART



17.9 DEMOBILIZATION

When fieldwork is complete, the sites will be restored, and temporary survey markers will be removed. All field forms and field logbooks will be completed, field documentation will be provided to recipients, and equipment will be returned to providers.

17.10 SITE-SPECIFIC FINAL REPORT PREPARATION AND APPROVAL

Team Decision Points

The detector-aided surface surveys and geophysical surveys will be used to establish specific locations for MC sampling (documented under separate cover). The MC UFP-SAP is being written to allow flexibility in establishing locations based on data from the detector-aided surface surveys and/or geophysical surveying and allows for input from the Project Team.

The decision points are defined as follows:

- Any MEC, suspect MEC, or MPPEH discovered on site will be brought to the attention of the Navy, MCRD Parris Island POC, and TtNUS (UXO Manager and Program Management).

- Any unanticipated findings that warrant modification of the UFP-SAP will be brought to the attention of those individuals stated above and the stakeholders.

The decision point with stakeholders to determine MC locations is important to the overall project schedule for the MRP sites. When the detector-aided surface surveys and/or geophysical surveys are completed and data are evaluated, TtNUS will prepare recommendations and supporting documentation that will be provided to the Navy and project team stakeholders via mail or e-mail. A conference call (or meeting) will then be arranged to achieve Navy and regulator consensus. Quick resolution will be needed to facilitate initiation of the MC fieldwork.

An SI report will be prepared summarizing the investigation, and will as contain summary of site backgrounds, personnel utilized, objectives and scope, equipment, description of survey activities, results, and discussion of the project data. The report will contain noted munitions-related discoveries, geophysical anomaly lists, site photos, field notes, checklists and QC data.

SAP Worksheet #18 -- Sampling Locations and Methods/SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Sampling Location / ID Number	Exclusion Areas	Matrix	Approximate Depth (bgs)	Survey Methodology	Degree of Investigation	SOP Name[1]
Aerial Bombing Target at Parade Deck (UXO 3)	Paved Areas	Surface and Subsurface Soil	0 to 2 feet, or deeper if multiple items are buried together	Geonics EM61-MK2	2.5-foot line spaced geophysical survey of accessible undeveloped areas.	MRP SOP 02 MRP SOP 03 MRP SOP 04 MRP SOP 05
Field Artillery West Main Range (UXO 4)	Low-lying wetlands areas	Surface and Subsurface Soil and Aquatic	0 to 2.5 feet depends on target MEC size	Geometrics G-858 Marine Magnetometer Schonstedt	100-foot spaced transect survey of accessible portions of specified suspect target areas (UXO detector-aided and geophysical survey). Aquatic geophysical survey of accessible waterways within the impact area range fan. UXO detector-aided survey of undeveloped former firing point locations.	MRP SOP 01 MRP SOP 02 MRP SOP 03 MRP SOP 04 MRP SOP 05 MRP SOP 06
Field Artillery East Shrapnel Range (UXO 5/ UXO 6)	Low-lying wetlands areas	Surface Soil and Aquatic	0 to 2.5 feet, depends on target MEC size	Marine Magnetometer Schonstedt	• Aquatic survey of accessible waterways within the UXO 6 range fan and the firing point location in UXO 5 using an underwater magnetometer. The amount of aquatic surveying that can be performed will need to be determined based on boat accessibility in the field. • Limited meandering path	MRP SOP 01 MRP SOP 02 MRP SOP 03 MRP SOP 04 MRP SOP 05 MRP SOP 06

Sampling Location / ID Number	Exclusion Areas	Matrix	Approximate Depth (bgs)	Survey Methodology	Degree of Investigation	SOP Name[1]
					UXO detector-aided surface survey using hand-held GPS unit to locate survey walking paths of specified land areas shown on Figure 17-3 (if accessible and dry enough to permit surveying). • Star pattern UXO detector-aided surface survey using hand-held GPS unit to locate survey walking paths of areas where, during the course of the abovementioned surveying, the UXO team observes indications of potential target areas or suspect MEC areas.	
Aerial Bombing Target at Golf Course (UXO 7)	None (survey accessible areas)	Surface and Subsurface Soil	0 to 2 feet, or deeper if multiple items are buried together	Geonics EM61-MK2 Schonstedt	• UXO detector-aided surface survey of accessible undeveloped areas with 5-foot survey line spacing (as accessible). • Geophysical survey using parallel transects nominally spaced 10 feet apart in the accessible portions of the specified survey area.	MRP SOP 01 MRP SOP 02 MRP SOP 03 MRP SOP 04 MRP SOP 05 MRP SOP 06

Sampling Location / ID Number	Exclusion Areas	Matrix	Approximate Depth (bgs)	Survey Methodology	Degree of Investigation	SOP Name[1]
Aerial Bombing Target at Southern Tidal Flats (UXO 8)	None (survey accessible areas)	Surface and Subsurface Soil	0 to 2 feet miniature bombs, 0 to 9 feet 100-pound bombs, deeper if multiple items buried together	Geonics EM61-MK2 Geometrics G-858 Schonstedt	• UXO detector-aided surface survey of accessible areas with 5-foot survey line spacing (as accessible). • Geophysical survey using parallel transects spaced 5 feet apart in the accessible portions of the investigation area.	MRP SOP 01 MRP SOP 02 MRP SOP 03 MRP SOP 04 MRP SOP 05

(1) Standard Operating Procedures (SOPs) can be found in Attachment 2 of the MEC SAP.

SAP Worksheet #19 -- Analytical SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

☑ **Worksheet Not Applicable**

No laboratory samples are proposed for collection/analysis during this MEC geophysics survey investigation.

SAP Worksheet #20 -- Field Quality Control Sample Summary Table

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	QC Survey Requirements	Field Duplicates/Repeat Data Collection	Sample	Quality Control
Surface Soil	Detector-aided surface survey	Resurvey 25% of first four grids and after any failure, then 10% of remaining grids after four grids in a row pass QC. If any grid does not pass QC, UXO team will resurvey entire grid and another QC check will be performed.	Not Applicable	Detect all metallic debris 20mm or larger on surface; non-detection of metallic objects would result in failure of QC.	Resurvey transects to perform a direct comparison to field data collected during detector-aided surface sweep.

SAP Worksheet #21 – Project SOP References Table

(UFP-QAPP Manual Section 3.1.2)

Reference Number	Title	Originating Organization of SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
MRP SOP 01	UXO Detector-Aided Surface Surveys	TtNUS	Magnetic detector All metals detector	N	Describes detector-aided surface surveys
MRP SOP 02	MEC Management and Accountability	TtNUS	GPS Digital Camera	Y	Describes actions to be taken if suspect MEC are encountered
MRP SOP 03	Geophysical Survey	TtNUS	Electromagnetic (EM), Magnetometer	N	Describes geophysical survey activities
MRP SOP 04	Geophysical Data Processing and Analysis	TtNUS	Software, Computer	N	Describes geophysical data processing procedures
MRP SOP 05	Global Positioning System	TtNUS	GPS	N	Describes usage of hand-held GPS units
MRP SOP 06	Vegetation Management at MEC Sites	TtNUS	Hand-held brush cutters, mowers, chain saws, brush hog, wood chipper	N	Describes brush cutting and vegetation clearance activities to take place at MEC sites

SOPs are contained in Attachment 2 of the MEC SAP.

SAP Worksheet #22 -- Field Equipment Calibration, Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.1.2.4)

Field Equipment	Activity[1]	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference	Comments
EM61-MK2, G-858, and Marine Magnetometer	Warm-up	Power on	5 Minutes	NA	Site Geophysicist	MRP SOP 03	None
EM61-MK2	Null	EM61 Null: Power on	Per manufacturer recommendations	NA	Site Geophysicist	MRP SOP 03	None
EM61-MK2 and G-858	Record sensor positions	First day and configuration or equipment change	+/- 2 inches	NA	Site Geophysicist	MRP SOP 03	None
EM61-MK2 and G-858	Personnel test	Beginning of day	EM61: +/- 2 mV, G-858: +/- 2 nT	Remove interference source from operator	Site Geophysicist	MRP SOP 03	None
EM61-MK2 and G-858	Static background and static spike	Beginning of day or equipment change	Acceptance criteria determined from data review. Guidance Criteria: EM61: +/- 3 mV, G-858: +/- 5 nT Spike: +/- 20% of standard item response	Fix or replace unit or filter noise – evaluate site noise for survey feasibility	Site Geophysicist	MRP SOP 03	None

Field Equipment	Activity[1]	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference	Comments
EM61-MK2 and G-858	Pull-away test	First day on site and when there is a configuration or equipment change	Minimal effect	Increase distance of GPS to EM61 or G-858	Site Geophysicist	MRP SOP 03	None
GPS	Positioning	Daily	Accuracy: sub-meter HDOP <3, number of satellites at least six	Wait for better signal, replace unit, or choose alternate location technique	Site Geophysicist/UXO Technician	MRP SOP 05	None
Marine Magnetometer	Interferences Test	At the start of fieldwork	Minimal effect	Increase distance of sensor from interfering item	Site Geophysicist	Subcontractor will be performing work	None
Marine Magnetometer	Sensor Travel	Daily	Determined in field	Buoy the sensor or increase or decrease survey speed	Site Geophysicist	Subcontractor will be performing work	None
Magnetic Locator	Operational	Beginning of day and after battery change	Operating properly	Replace battery, replace instrument	UXO Technician	MRP SOP 01	None
All-Metal Detector	Calibration	Beginning of day	Detect inert surface segregate	Recalibrate, replace instrument	UXO Technician	MRP SOP 01	None

GPS – Global Positioning System
HDOP – Horizontal Dilution of Precision
mV – Millivolt
nT – nanoTesla
NA – Not Applicable
SOP – Standard Operating Procedure
UXO – Unexploded Ordnance

22.1 REGULAR TESTS FOR GEOPHYSICAL SURVEYING EQUIPMENT

Equipment/Electronics Warm-Up. This test minimizes sensor drift caused by thermal stabilization. Most instruments need a few minutes to warm up before data collection begins. All manufacturer instructions will be followed, or if none are given, data readings will be observed until they stabilize. Acceptance Criterion: Equipment Specific (typically 5 minutes). This test will be conducted each time the unit is started.

Equipment Null. The EM61-MK2 equipment will be nulled according to manufacturer's recommendations. The G-858 must also be set up according to manufacturer's recommendations prior to surveying.

Record Sensor Positions. The purpose of recording sensor positions is to document relative navigation and sensor offsets, detector separation, and detector heights above the ground surface. This information will ensure that the detector offset corrections and gradient calculations can be done correctly and that the surveys are repeatable. Acceptance Criterion: ±2 inches. This test will be conducted at the beginning of the first day and after an equipment configuration change is made.

Personnel Test. This test ensures that survey personnel have removed all potential interference sources (metal) from their bodies. Common interference sources are ballpoint pens, steel-toed boots, or large metallic belt buckles, which can produce data anomalies similar to investigation targets. All personnel who will be coming near the sensor during survey operations should remove metallic items from themselves, and if this is not possible, readings should be monitored and recorded to judge the effect of the metallic items to meet the following acceptance criteria: EM61 ±2 mV, G-858 ±2 nT. This test will be conducted at the beginning of each day if the operator is wearing metallic items that could interfere with equipment operation.

Static Background and Static Spike (or Standard Response) Test. This test quantifies instrument background readings and electronic drift, locates potential interference spikes in the time domain, and determines impulse response and repeatability of the instrument to a standard test item (typically a 2-inch-diameter steel trailer hitch ball). Improper instrument function, the presence of local sources of ambient noise (such as EM transmissions from high-voltage electric lines), and faulty equipment are all potential causes of inconsistent non-repeatable readings. A minimum 3-minute static background test after instrument warm-up, followed by a 1-minute standard response test, followed by an additional 1-minute static background test will be performed. The Site Geophysicist must review the readings to confirm that the data are usable. Acceptance criteria will be determined from this data review. Guidance Criteria: Static Background Test EM61 ± 3 mV, G-858 ±5 nT; Static Response Test ±20

percent of standard item response after background correction. Ideally, the test data would meet the guidance criteria; however, in the event they do not, data must be evaluated to see if an equipment change is needed and whether the data are acceptable to achieve project goals. This test will be conducted at the beginning of each day and after equipment changes.

Pull-Away Test. This test demonstrates the effects of the navigational equipment. All equipment will be powered up and operating as it would be during the survey. Acceptance Criterion: document the effects of navigational equipment on geophysical readings. Effects should be small. The test will be performed before the geophysical survey begins and after an equipment configuration change is made.

GPS Positioning. The GPS will be tested at the start of the project and after equipment is changed daily by surveying two survey control points and comparing the GPS coordinates to the documented coordinates for the control points. Acceptance Criterion: Sub-meter. GPS survey instruments should also be closely monitored during field acquisition by using HDOP criteria, or as a minimum, the number of satellite signals being received. HDOP should normally be less than three to obtain high-quality results, and at least six satellites should also indicate high-quality results.

Latency is an issue when a separate GPS controller (from the geophysical controller) is used to acquire GPS data. If a separate controller is used, care will be taken to synchronize the clocks in both the GPS and geophysical units, and a test must be set up to measure the latency inherent in using two different accuracy clocks. The test will consist of positioning oneself over a linear metallic object (e.g., pipe) at several points and recording data with all of the survey equipment, and then repeating the same measurements using only the GPS equipment to compare the results and determine any necessary adjustment.

Interferences Test. This test is to determine if the sensors are interfered with by other survey support equipment such as the boat, motor, etc. This test will result in no or minimal interference to the instrumentation towards detecting targets. The test will be performed before the geophysical survey begins and after an equipment configuration change is made.

Sensor Travel. This test is to determine the ideal setup for the towed sensors. Before the ITS is conducted, the equipment must be configured through testing to optimize the attitude, orientation, and position of the sensor under the water surface. The magnetometer sensor will travel within about 4 feet above the creek bottom. Sensor travel will be monitored during the survey.

22.2 DATA COLLECTION VARIABLES FOR GEOPHYSICAL SURVEYING EQUIPMENT

The same equipment and procedures will be used for the ITS (Worksheet #12) and the geophysical survey. In addition, only personnel who have been tested on the ITS plot will perform the geophysical surveys. Multiple surveys using the planned geophysical instruments will be performed. Some elements of data collection are subject to modification and evaluation. Data collection variables subject to modification and optimization may include, but not necessarily be limited to, instrument height, instrument orientation and direction of travel, instrument channel selections, measurement interval along survey lines, and survey line spacing.

22.3 GEOPHYSICAL AND POSITIONING INSTRUMENTS

A Geonics EM61-MK2 is a time-domain EM system. The EM61 generates 150 EM pulses per second and measures during the off time between pulses. After each pulse, secondary EM fields are induced briefly in moderately conductive soil and for a longer time in metallic objects. The EM61 pauses between each pulse until the response from the conductive earth dissipates and then measures the prolonged buried metal response. This response is recorded in milli Volts (mV). By sensing only the buried metal response, the EM61 detects metallic targets that might otherwise be missed. The EM61 is able to detect all types of metallic objects (not just ferrous material). This capability is important for detection of potential targets at the sites that are likely to contain more aluminum than iron or steel (such as pyrotechnics). The EM61 measures multiple time gates (216, 366, 660, and 1,266 microseconds) to provide a more complete measurement of the response decay rate. The EM61 can record up to 12 records per second, four time gates per record, or three time gates of better channel data coupled with one reading for the top channel per second. The sampling rate for the EM61 will be at least five times per second and as high as ten times per second.

The G-858 cesium-vapor magnetometer and the marine magnetometer measure the Earth's magnetic field at selected time increments. As magnetic bodies above and below ground add to or subtract from the Earth's magnetic field, anomalies can be identified by the increases and decreases measured. Diurnal changes in the Earth's magnetic field must be accounted for to correct for potential data shifts that might otherwise be attributed to survey anomalies (ferrous metal objects). Diurnal effects will be measured either by returning to a base location or by setting up a base station magnetometer. The geophysicist will then determine if the diurnal changes are significant and need to be corrected, gradiometer data may not be significantly affected by the diurnal changes in the Earth's magnetic field.

The marine magnetometer sensors are positioned within a streamlined housing that is equipped with a tail fin assembly to allow the unit to travel smoothly under the water surface. The data are passed through a cable attached to a field personal computer (PC) in which the data are stored and processed. An estimate of the approximate sensor position can be calculated using a built-in depth sensor, amount of cable deployed, and GPS positioning data (collected simultaneously). The altitude of the sensor can be determined in real time from a built-in altimeter.

TtNUS will use a sub-meter accuracy GPS unit where possible during geophysical data collection to provide precise location coordinates for the data collected. The anticipated tree cover at some of the survey areas at the base may dictate that only certain grid nodes are surveyed with GPS in open locations (no or limited tree cover), and the remainder of the survey grid be tied to these locations. If the GPS accuracy is not sub-meter, data will not be collected until more satellites are available and the accuracy criteria are met, or surveying with alternate positioning techniques will be employed.

22.4 QUALITY ASSURANCE/QUALITY CONTROL

Operational and test procedures will conform to the manufacturers' standard instructions. QC of the instruments' data will be achieved daily by field testing, consisting of checking the sensor and navigation system against a known target to ensure that they are operating properly. All geophysical instruments and equipment used to gather and generate field data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of the results are consistent with the manufacturers' specifications. Calibration, repair, or replacement records will be filed and maintained by the Site Geophysicist and may be subject to audit by the TtNUS QAM. Potential data problems include source data errors, data entry errors, data editing errors, and user errors. All data will be reviewed to identify and correct any of these errors if they occur.

SAP Worksheet #23 -- Analytical SOP References Table

(UFP-QAPP Manual Section 3.2.1)

☑ **Worksheet Not Applicable**

No project sampling is proposed for this SI to support MEC geophysics surveys/investigations (See Worksheet 21 for project SOPs).

SAP Worksheet #24 -- Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

☑ **Worksheet Not Applicable**

No analytical instrument calibration data will be required for this SI to support MEC geophysics surveys/investigations (See Worksheet 22 for geophysical equipment calibrations).

SAP Worksheet #25 -- Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.2.3)

☑ **Worksheet Not Applicable**

No analytical instrument equipment maintenance, testing, or inspections will be required for this SI to support MEC geophysics surveys/investigations. Field instrumentation maintenance, testing, and inspection for geophysics sensors and magnetometers are presented in Worksheet 22.

SAP Worksheet #26 -- Sample Handling System

(UFP-QAPP Manual Appendix A)

☑ **Worksheet Not Applicable**

This worksheet is not applicable because this investigation is an SI, and no samples will be handled.

SAP Worksheet #27 – Sample Custody Requirements Table

(UFP-QAPP Manual Section 3.3.3)

☑ **Worksheet Not Applicable**

No samples are proposed for collection/analysis and no MPPEH will be handled during this SI.

SAP Worksheet #28 -- Laboratory QC Samples Table

(UFP-QAPP Manual Section 3.4)

☑ **Worksheet Not Applicable**

No analytical laboratory QC sampling will be required for this SI to support MEC geophysics surveys/investigations.

SAP Worksheet #29 -- Project Documents and Records Table

(UFP-QAPP Manual Section 3.5.1)

Document/Record	Generator	Definable Feature of Work	Frequency of Completion	Location/Where Maintained
Project Personnel Sign-off Record	TOM	Mobilization/Site Preparation	One time	UFP SAP/SI Report, Project File
ESS Determination	UXO Manager	Mobilization/Site Preparation	One time	UFP-SAP/SI Report, Project File
Field Checklists	Field UXO and Geophysical Personnel	UXO Detector-Aided Surface Survey Geophysical Survey	Field collection days	UFP-SAP/SI Report, Project File
MEC Accountability Log	SUXOS	UXO Detector-Aided Surface Surveys	As needed	MRP SOP 01, MRP SOP 02/SI Report, Project File
Daily Reports	SUXOS and Site Geophysicist	UXO Detector-Aided Surface Survey Geophysical Survey	Field collection days	UFP-SAP/Project File
Medical and OSHA Clearance Letter	HSM and TOM	Mobilization/Site Preparation	As needed	HASP/Project File
Daily Safety Meeting Sign-In	SSO	UXO Detector-Aided Surface Survey Geophysical Survey	Daily	HASP/Project File
Medical Data Sheet	SUXOS	Mobilization/Site Preparation	As needed	HASP/Project File

Document/Record	Generator	Definable Feature of Work	Frequency of Completion	Location/Where Maintained
Surface Survey Grid Map	SUXOS	UXO Detector-Aided Surface Survey Site Survey	Field collection days	UFP-SAP/SI Report, Project File
Detector-Aided Surface Survey Data	UXO Personnel	UXO Detector-Aided Surface Survey Site Survey	Field collection days	MRP SOP 01/Field Log Books, SI Report, Project File
Field notes (detailing equipment and procedure)	Field UXO and Geophysical Personnel	UXO Detector-Aided Surface Survey Geophysical Survey	Field collection days	MRP SOP 01, MRP SOP 03/SI Report, Project File
Raw Geophysical Survey Data	Site Geophysicist	Geophysical Survey Geophysical Data Collection	Provided at end of project	UFP-SAP/SI Report
Assessment findings and corrective actions	Various (see Worksheet #31)	All	As needed	UFP-SAP/SI Report

Document/Record	Generator	Definable Feature of Work	Frequency of Completion	Location/Where Maintained
Quality Control Surveillance Report	UXOQC and Project Geophysicist	UXO Detector-Aided Surface Survey Geophysical Survey	UXOQC - Minimum of once per phase for each definable feature of work Project Geophysicist - Minimum of daily during ITS performance	UFP-SAP/ QC Log Book, Project File
Daily Quality Control Report	UXOQC and Site Geophysicist	UXO Detector-Aided Surface Survey Geophysical Survey	Daily	UFP-SAP/QC Log Book, SI Report, Project File
Processed final format files (maps) compatible with ArcView Version 8 or specified GIS platform	Site Geophysicist or Project Geophysicist	Geophysical Data Processing and Interpreting	One time	MRP SOP 04/SI Report, NIRIS, Project File
Photographs (may be included in report)	Field UXO and Geophysical Personnel	UXO Detector-Aided Surface Survey Geophysical Survey	As needed	MRP SOP 01, MRP SOP 02, MRP SOP 03/SI Report, Project File
FTMR forms	SUXOS and Project Geophysicist	UXO Detector-Aided Surface Survey Geophysical Survey	As needed	UFP-SAP/ SI Report, Project File

Document/Record	Generator	Definable Feature of Work	Frequency of Completion	Location/Where Maintained
Field Audit Checklist (if an audit is conducted)	TOM	UXO Detector-Aided Surface Survey Geophysical Survey	As needed	UFP-SAP/Project File
SI Report	TtNUS Personnel	All	One time	UFP-SAP/Project File, Long-term third party professional document storage firm utilized

SI – Site Inspection
NIRIS – Naval Installation Restoration Information Solution

Project documentation will be maintained in the TtNUS project file. Processed final format files (maps) compatible with Arcview Version 8 or specified GIS platform will be maintained in the TtNUS GIS server and Naval Installation Restoration Information Solution (NIRIS).

Note: For any MEC MRP site in which, upon completion of the SI fieldwork, a recommendation of No Further Investigation is made, per direction from SCDHEC, Land Use Controls (LUC) will be added to the No Further Investigation recommendation. LUCs are to be included to facilitate documentation of former range use for future land use planning.

SAP Worksheet #30 -- Analytical Services Table

(UFP-QAPP Manual Section 3.5.2.3)

☑ **Worksheet Not Applicable**

No analytical services will be required for this SI to support MEC geophysics surveys/ investigations.

SAP Worksheet #31 -- Planned Project Assessments Table

(UFP-QAPP Manual Section 4.1.1)

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment[1] (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings[1] (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions[1] (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions[1] (title and organizational affiliation)
Personnel Qualifications	One time for all field personnel	Internal	TtNUS	SUXOS Project Geophysicist	UXO Manager Project Geophysicist	UXO Manager Project Geophysicist	QAM TOM
Accident/Incident Reporting	Per event	Internal	TtNUS	SSO	Project Safety Officer	HSM TOM	HSM
Preventive Maintenance	Daily	Internal	TtNUS	UXOQC	SUXOS	UXO Manager	TOM
Communications Equipment Inspection	Daily	Internal	TtNUS	UXO Team Leader Site Geophysicist	SUXOS Site Geophysicist	SUXOS Site Geophysicist	UXO Manager TOM
Safety Inspections	Daily (inspection); Weekly (formal surveillance)	Internal	TtNUS	SSO	SUXOS Site Geophysicist	SUXOS	UXO Manager TOM

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment(1) (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings(1) (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions(1) (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions(1) (title and organizational affiliation)
Brush Cutting and Vegetation Management	As needed to support operations	Internal	TtNUS	SUXOS Site Geophysicist	UXO Team Leader	UXO Team Leader	TOM
ITS – Field Oversight	once	Internal	TtNUS	Project Geophysicist	Site Geophysicist	Site Geophysicist Project Geophysicist	Project Geophysicist
Daily field checklists, geophysical	Daily during survey performance	Internal	TtNUS	Project Geophysicist	Site Geophysicist	Project Geophysicist	Project Geophysicist
Geophysical Survey – Field Notes Audit	Once during start of fieldwork, and after survey completion	Internal	TtNUS	Project Geophysicist	Site Geophysicist	Project Geophysicist Site Geophysicist	TOM
Geophysical Survey – SOP Conformance (MRP SOP 03 and MRP SOP 04)	Monthly during survey performance	Internal	TtNUS	Project Geophysicist	Site Geophysicist	Project Geophysicist Site Geophysicist	TOM

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment(1) (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings(1) (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions(1) (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions(1) (title and organizational affiliation)
Geophysical Data – General Appearance Assessment	Daily/after data are processed	Internal	TtNUS	Project Geophysicist	Site Geophysicist	Project Geophysicist Site Geophysicist	TOM
Detector-Aided Surface Survey	25% of first four transects / grids or after any failure; 10% thereafter	Internal	TtNUS	UXOQC	SUXOS	SUXOS	UXO Manager TOM
Surveying and Mapping Operations	Initial, then Weekly	Internal	TtNUS	UXOQC	SUXOS	SUXOS	UXO Manager
UXO/MEC Accountability	Weekly	Internal	TtNUS	UXOQC	SUXOS	SUXOS	UXO Manager TOM
Visitor Briefing	Initial, then as needed to support operations	Internal	TtNUS	Project Safety Officer	SSO	SSO	HSM

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment(1) (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings(1) (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions(1) (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions(1) (title and organizational affiliation)
Site-Specific Training	Once at start of fieldwork and at start of each definable feature of work	Internal	TtNUS	SUXOS UXO Manager TOM	As designated by TOM	As designated by TOM	TOM
Hazard Assessment – Risk Analysis	At start of each definable feature of work, then as needed to support operations	Internal	TtNUS	Project Safety Officer UXOSO	UXOSO SUXOS	UXOSO SUXOS	HSM
Field Work Systems Audit	1 per contract year	Internal	TtNUS	QAM	Project Geophysicist UXO Manager TOM	QAM Project Geophysicist UXO Manager	QAM TOM

1 TtNUS personnel unless otherwise noted. Site geophysicist support will be provided by TtNUS and subcontractor personnel.

SAP Worksheet #32 -- Assessment Findings and Corrective Action Responses

(UFP-QAPP Manual Section 4.1.2)

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Personnel Qualifications	e-mail	Mark Sladic – TOM, TtNUS	Immediately upon discovery	e-mail	Mark Sladic – TOM, TtNUS	Prior to initiation of task
Accident/Incident Reporting	Accident/Incident Report Form	Mark Sladic – TOM, TtNUS Matt Soltis – HSM, TtNUS	Immediately	Dependant upon accident/incident	Mark Sladic – TOM, TtNUS Ralph Brooks - UXO Manager, TtNUS Matt Soltis – HSM, TtNUS	Within 24 hours
Preventive Maintenance	Field Forms	Ralph Brooks - UXO Manager, TtNUS Mark Sladic – TOM, TtNUS	Within 24 hours	Field Forms	Ralph Brooks - UXO Manager, TtNUS Mark Sladic – TOM, TtNUS	Within 24 hours
Communications Equipment Inspection	Field Forms	Ralph Brooks - UXO Manager, TtNUS Mark Sladic – TOM, TtNUS	Within 24 hours	Field Forms	Ralph Brooks - UXO Manager, TtNUS Mark Sladic – TOM, TtNUS	Within 24 hours

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Safety Inspections	Field Forms	Ralph Brooks - UXO Manager, TtNUS Jim Coffman - Project Geophysicist, TtNUS Mark Sladic – TOM, TtNUS	Within 24 hours	Field Forms	Ralph Brooks - UXO Manager, TtNUS Jim Coffman - Project Geophysicist, TtNUS Mark Sladic – TOM, TtNUS	Within 24 hours
Brush Cutting and Vegetation Management	Field Forms	Ralph Brooks - UXO Manager, TtNUS Mark Sladic – TOM, TtNUS	Within 24 hours	e-mail	Ralph Brooks - UXO Manager, TtNUS Mark Sladic – TOM, TtNUS	Within 24 hours
ITS – Field Oversight	QC Surveillance Report Form	William Randall/ Erica Love - Site Geophysicist Mark Sladic – TOM, TtNUS	Within 24 hours	e-mail	Jim Coffman - Project Geophysicist ,TtNUS Mark Sladic – TOM, TtNUS	Within 24 hours

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Daily Field Checklists, geophysical	Oral and e-mail or fax	William Randall/ Erica Love - Site Geophysicist Mark Sladic – TOM, TtNUS	Within 24 hours after assessment	Updated Geophysical Field Checklist and Forms	Jim Coffman - Project Geophysicist ,TtNUS Mark Sladic – TOM, TtNUS	Within 48 hours
Geophysical Survey – Field Notes Audit	Letter/e-mail	William Randall/ Erica Love - Site Geophysicist Mark Sladic – TOM, TtNUS	Within 5 business days of receipt	Complete Field Notes	Jim Coffman - Project Geophysicist, TtNUS Mark Sladic – TOM, TtNUS	Within 5 business days of receipt
Geophysical Survey – Conformance to SOPs (MRP SOP 03 and MRP SOP 04)	Letter/e-mail	William Randall/ Erica Love - Site Geophysicist Mark Sladic – TOM, TtNUS	Within 5 business days of assessment	Justification or clarification of procedure to be provided in letter correspondence	Jim Coffman - Project Geophysicist ,TtNUS Mark Sladic – TOM, TtNUS	Within 5 business days of receipt
Geophysical Data – General Appearance Assessment	e-mail	William Randall/ Erica Love - Site Geophysicist Mark Sladic – TOM, TtNUS	Within 24 hours	e-mail	Jim Coffman - Project Geophysicist ,TtNUS Mark Sladic – TOM, TtNUS	Within 48 hours

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Detector-Aided Surface Survey	QC Checklist	Ralph Brooks - UXO Manager, TtNUS Mark Sladic – TOM, TtNUS	Within 1 business day of assessment	Updated QC Checklist	Ralph Brooks - UXO Manager, TtNUS Mark Sladic – TOM, TtNUS	Within 24 hours
Surveying and Mapping Operations	e-mail	Ralph Brooks - UXO Manager, TtNUS Mark Sladic – TOM, TtNUS	Within 24 hours	Updated e-mail	Ralph Brooks - UXO Manager, TtNUS Mark Sladic – TOM, TtNUS	Within 24 hours
UXO/MEC Accountability	Field Forms	Ralph Brooks - UXO Manager, TtNUS Mark Sladic – TOM, TtNUS	Within 24 hours	Updated field forms	Ralph Brooks - UXO Manager, TtNUS Mark Sladic – TOM, TtNUS	Within 24 hours
Visitor Briefing	e-mail	James Rossi – SUXOS, TtNUS Mark Sladic – TOM, TtNUS	Within 24 hours	Updated e-mail	James Rossi – SUXOS, TtNUS Mark Sladic – TOM, TtNUS	Within 24 hours

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Site-Specific Training	e-mail	Ralph Brooks - UXO Manager, TtNUS Mark Sladic – TOM, TtNUS	Upon Completion of Training	Updated e-mail	Ralph Brooks - UXO Manager, TtNUS Mark Sladic – TOM, TtNUS	Within 24 hours
Hazard Assessment – Risk Analysis	e-mail	Mark Sladic – TOM, TtNUS Matt Soltis – HSM, TtNUS	Within 24 hours	Updated e-mail	Mark Sladic – TOM, TtNUS Matt Soltis – HSM, TtNUS	Within 24 hours
Field Work Systems Audit	Letter Report	Mark Sladic – TOM, TtNUS Kelly Carper – QAM, TtNUS	Within 5 business days of assessment	Letter Report	Mark Sladic – TOM, TtNUS Kelly Carper – QAM, TtNUS	Within 10 business days of receipt

SAP Worksheet #33 -- QA Management Reports Table

(UFP QAPP Manual Section 4.2)

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (title and organizational affiliation)	Report Recipient(s) (title and organizational affiliation)
Project monthly progress report	Monthly (written) for duration of the project	Monthly	TOM TtNUS	Navy RPM NAVFAC
Field Status Reports	Daily (oral or email), during the course of fieldwork	TBD	Site Geophysicist TtNUS SUXOS TtNUS	TOM TtNUS Project Geophysicist TtNUS UXO Manager TtNUS
Daily QC Report (Detector-Aided Survey)	Daily (e-mail)	TBD	UXOQC TtNUS	TOM TtNUS UXO Manager TtNUS
Daily QC Report (Geophysics)	Daily (e-mail)	TBD	Site Geophysicist TtNUS	TOM TtNUS Project Geophysicist TtNUS
QC Meeting Minutes	Twice per month, during project performance	TBD	Project Geophysicist TtNUS	TOM TtNUS

Type of Report	**Frequency** (daily, weekly monthly, quarterly, annually, etc.)	**Projected Delivery Date(s)**	**Person(s) Responsible for Report Preparation** (title and organizational affiliation)	**Report Recipient(s)** (title and organizational affiliation)
Rework Items List	Twice per month, during project performance Daily for UXO work	TBD	Site Geophysicist TtNUS UXOQC	TOM TtNUS
Project QC Report	Internal draft, draft, and final (Appendix to SI MEC Report)	TBD	TOM TtNUS Project Geophysicist TtNUS	Navy RPM NAVFAC

This worksheet will be modified to include the project delivery dates after fieldwork is scheduled.

SAP Worksheet #34 -- Verification (Step I) Process Table - Preparatory and Initial Inspection

(UFP-QAPP Manual Section 5.2.1)

Definable Feature of Work	Description	Responsible for Verification (name, organization)
Site Preparation (including mobilization)	Project readiness review to be performed by TtNUS TOM and Navy RPM including UFP-SAP review.	Mark Sladic - TOM, TtNUS Charles Cook - Navy RPM
	Prior to field crew(s) mobilizing to the field for on-site data collection, the TtNUS TOM will review resumes and training records, including those for UXO and geophysical field personnel, to ensure that all required training and experience requirements identified in Worksheet #7 have been completed for each crew member.	Mark Sladic – TOM, TtNUS
	Review of mobilization and site preparation activities such as: equipment setup and checkout; installation of ITS, and grid survey and layout.	Mark Sladic – TOM, TtNUS Jim Coffman – Project Geophysicist, TtNUS Ralph Brooks – UXO Manager, TtNUS
	Review of MRP SOP 01 (UXO Detector-Aided Surface Surveys) and MRP SOP 02 (MEC Management and Accountability) which document methodology to be utilized during surveys and quality control procedures.	Ralph Brooks, - UXO Manager, TtNUS James Rossi – SUXOS Glen Childers – UXOQC

Definable Feature of Work	Description	Responsible for Verification (name, organization)
Site Preparation (including mobilization)	Review of MRP SOP 03 (Geophysical Survey) which documents methodology to be utilized during geophysical surveying and includes checklists and field forms.	Jim Coffman - Project Geophysicist, TtNUS William Randall/ Erica Love - Site Geophysicist
	Prior to geophysical crews initiating on-site geophysics investigations, the Project Geophysicist will review the fieldwork procedures and results of the ITS to verify that performance criteria have been satisfactorily attained per Worksheet #12. The TOM will review the recommendation of the Project Geophysicist and provide final approval.	Mark Sladic - TOM, TtNUS Jim Coffman - Project Geophysicist, TtNUS
Site Survey	Prior to start of field work the site boundaries will be established. Prior to the start of the geophysical survey or detector aided survey the grids and/or transects will be established.	James Rossi – SUXOS James Rossi/ William Randall/ Erica Love – SUXOS/Site Geophysicist
Vegetation Management	Brush clearing and vegetation management will be conducted in accordance with MRP SOP 06.	Preparatory: Ralph Brooks – UXO Manager, TtNUS Initial Inspection: Glen Childers - UXOQC

Definable Feature of Work	Description	Responsible for Verification (name, organization)
UXO Detector-Aided Surface Survey	Review of MRP SOP 01 (UXO Detector-Aided Surface Surveys) and MRP SOP 02 (MEC Management and Accountability) which include procedures for data collection and transcription. The SUXOS will verify that the data collected during the first lot of field work contains all the elements required by the scope of work and do not contain questionable data or error points.	Ralph Brooks, - UXO Manager, TtNUS James Rossi – SUXOS
	Review of MRP SOP 05 (Global Positioning System) which documents procedures to be utilized in the collection of GPS positional data. The SUXOS will verify that the UXO detector-aided data collected during the first lot of field work contains all the elements required by the scope of work and do not contain questionable data or error points.	Jim Coffman – Project Geophysicist, TtNUS Ralph Brooks – UXO Manager, TtNUS
Geophysical Equipment Calibration, Maintenance, Testing and Inspection	Prior to collection of field data, review UFP-SAP Worksheet #22 and MRP SOP 03	Jim Coffman - Project Geophysicist, TtNUS
ITS	Prior to collection of data at ITS review MRP SOP 03	Jim Coffman - Project Geophysicist, TtNUS
Geophysical Data Collection	Prior to geophysical crews initiating on-site geophysics, the Project Geophysicist will verify items required for EFT and oversee the initial EFT.	Jim Coffman - Project Geophysicist, TtNUS

Definable Feature of Work	Description	Responsible for Verification (name, organization)
Geophysical Data Processing and Interpretation	Review of MRP SOP 04 (Geophysical Data Processing and Analysis). The Project Geophysicist will verify that the data collected during the first lot of field work contains all the elements required by the scope of work and do not contain questionable data or error points.	Jim Coffman - Project Geophysicist, TtNUS William Randall/ Erica Love - Site Geophysicist
Demobilization	Review of demobilization activities such as: removal of ITS; completion of field forms, return or equipment; and, forwarding all field documentation to TOM.	Mark Sladic – TOM, TtNUS Jim Coffman – Project Geophysicist, TtNUS Ralph Brooks – UXO Manager, TtNUS
Site Specific Final Report Preparation and approval	Verify that all data and documentation has been acquired for report preparation	TtNUS

SAP Worksheet #35 -- Validation (Steps IIa and IIb) Process Table

(UFP-QAPP Manual Section 5.2.2) (Figure 37 UFP-QAPP Manual) (Table 9 UFP-QAPP Manual)

Definable Feature of Work	Frequency of Inspection	Supporting QC Document(s)	Responsible for Validation (name, organization)
Site Preparation (including mobilization)	NA/upon completion of SI field work	No follow-up required. Verify that the UFP-SAP was implemented and carried out as written and that any deviations are documented.	Mark Sladic - TOM, TtNUS Charles Cook - Navy RPM
Site Survey	Daily	Checklist and field log books which document equipment utilization and progress.	James Rossi – SUXOS
Vegetation Management	Daily	Checklist and field log books which document equipment utilization and progress.	James Rossi – SUXOS Ralph Brooks - UXO Manager, TtNUS

Definable Feature of Work	Frequency of Inspection	Supporting QC Document(s)	Responsible for Validation (name, organization)
UXO Detector-Aided Surface Survey	Once per week activity is conducted	Checklists and field forms which document equipment utilized and progress.	Ralph Brooks - UXO Manager, TtNUS
	Minimum of once per day surveys are conducted or more frequently as necessary	Checklists and field forms which document equipment utilized, grids/transcripts surveyed and grids/transcripts checked for quality control purposes.	Ralph Brooks - UXO Manager, TtNUS James Rossi – SUXOS Glen Childers – UXOQC
	As needed, prior to data entry	Prior to entering data (field forms and electronic data) from the detector-aided surface surveys into the permanent project database, the UXO Manager or designated representative will review the field forms to ensure that all required information is provided as required by SOPs MRP SOP 01 (UXO Detector-Aided Surface Surveys) and MRP SOP 02 (MEC Management and Accountability). Verify all data have been transferred correctly and completely during collection. Ensure that data are downloaded and backed up at least once per day to prevent accidental loss of data/field efforts.	Ralph Brooks - UXO Manager, TtNUS James Rossi - SUXOS
ITS	Once during each team	Review data results of ITS	Jim Coffman - Project Geophysicist, TtNUS

Definable Feature of Work	Frequency of Inspection	Supporting QC Document(s)	Responsible for Validation (name, organization)
Geophysical Equipment Calibration, Maintenance, Testing and Inspection	Checklists: once per day after data is collected. Data from tests: project completion	Daily function tests which may be documented on checklist, field forms, or via e-mail. Daily EFT	Jim Coffman - Project Geophysicist, TtNUS
Geophysical Data Collection	Data Review: Once per day survey is conducted	Daily reports, general data appearance which document equipment utilized, areas surveyed. Verify GPS positional accuracy (Worksheet #22)	Jim Coffman - Project Geophysicist, TtNUS William Randall/ Erica Love - Site Geophysicist
Geophysical Data Processing and Interpretation	After fieldwork is completed Once per day data is collected	Prior to entering data (field forms and electronic data) from the geophysics investigation into the permanent project database, the Project Geophysicist or designated representative will review the forms and data to ensure that all required information is provided as required by MRP SOP 03 (Geophysical Survey) and MRP SOP 04 (Geophysical Data Processing and Analysis). Verify all data have been transferred correctly and completely during collection. Ensure that data are downloaded and backed up at least once per day to prevent accidental loss of data/field efforts.	Jim Coffman - Project Geophysicist, TtNUS William Randall/ Erica Love - Site Geophysicist

Definable Feature of Work	Frequency of Inspection	Supporting QC Document(s)	Responsible for Validation (name, organization)
Demobilization	Once upon completion of each phase of project/site	Verify that all demobilization activities, as applicable to phase of work, have been completed.	Mark Sladic - TOM, TtNUS Jim Coffman - Project Geophysicist, TtNUS Ralph Brooks - UXO Manager, TtNUS
Site Specific Final Report Preparation and approval	Once upon completion of the project/site activities	Verify that all activities have been documented and reported as applicable to each phase of work, have been included in the report.	Mark Sladic - TOM, TtNUS Charles Cook - Navy RPM

SAP Worksheet #36 –Analytical Data Validation (Steps IIa and IIb) Summary Table

(UFP-QAPP Manual Section 5.2.2.1)

Step IIa / IIb[1]	Matrix	Analytical Group	Validation Criteria	Data Validator (Title and organization)
IIa	Surface Soil	Detector-Aided Surface Survey	a) Satisfactory rechecks of 25% of first four grids/transects by the UXOQC, or SUXOS if no UXOQC. b) Satisfactory rechecks of 10% of the grids/ transects by the UXOQC, or SUXOS if no UXOQC, after achievement of satisfactory rechecks on four grids/transects in a row	James Rossi SUXOS TtNUS Glen Childers UXOQC TtNUS
IIa	Subsurface Soil	Geophysics Investigation	a) Achievement of goals established for the ITS.	Jim Coffman Project Geophysicist TtNUS

1 IIa = compliance with methods, procedures, and contracts (see Table 10, page 117, UFP-QAPP manual, V.1 March 2005).
IIb not applicable for MEC investigation.

SAP Worksheet #37 -- Usability Assessment
(UFP-QAPP Manual Section 5.2.3)

DATA USABILITY ASSESSMENT

The usability of the data directly affects whether project objectives can be achieved. The following characteristics will be evaluated at a minimum. The results of these evaluations will be included in the project report. To the extent required by the type of data being reviewed, the assessors will consult with other technically competent individuals to render sound technical assessments of these data characteristics:

Certification of Proper Operation of Detection and Positioning Systems

The project geophysicist, acting on behalf of the project team, will prepare a table listing planned calibration and QC checks, their occurrence and the results (acceptable or not acceptable) for each type of metal detector, geophysics instrument, and positioning system equipment that was used on the project will be prepared. Data collected by any improperly operating equipment will be identified. A determination will be made as to whether the affected data adversely impacted the ability to meet project objectives. If the project objectives have been adversely impacted, the TtNUS TOM will consult with the Navy RPM and other project team members, as necessary (determined by the Navy RPM), to develop appropriate corrective actions.

Qualification / Certification of Survey Team

The project manager, acting on behalf of the project team, will prepare a table listing each member of the detector-aided surface sweep team and subsurface geophysics team, which will list required certifications and training and required demonstrations of competency. Any deviations will be identified. Data collected by team members not meeting the required training and demonstrations of competency will be identified. A determination will be made as to whether affected data impacted the ability to meet project objectives. If the project objectives have been adversely impacted, the TtNUS TOM will consult with the Navy RPM and other project team members, as necessary (determined by the Navy RPM), to develop appropriate corrective actions.

Coverage of Areas to be Investigated

A project scientist, identified by the TtNUS TOM and acting on behalf of the project team, will determine whether data were collected in all areas planned to be investigated. Data gaps will be identified. The

TtNUS TOM will consult with the project team to determine the extent to which it is necessary to fill these data gaps in the RI phase

Interpretation of Geophysical Data

A project scientist, acting on behalf of the project team, will analyze the geophysical interpretation and maps to check for completeness of anomaly interpretation (target picking), and whether acceptable anomaly selection criteria were applied in the interpretation of the data. Any deficiencies in anomaly interpretation will be identified, and their impact on the Project Quality Objectives (PQOs) will be summarized.

Identify the personnel responsible for performing the usability assessment:

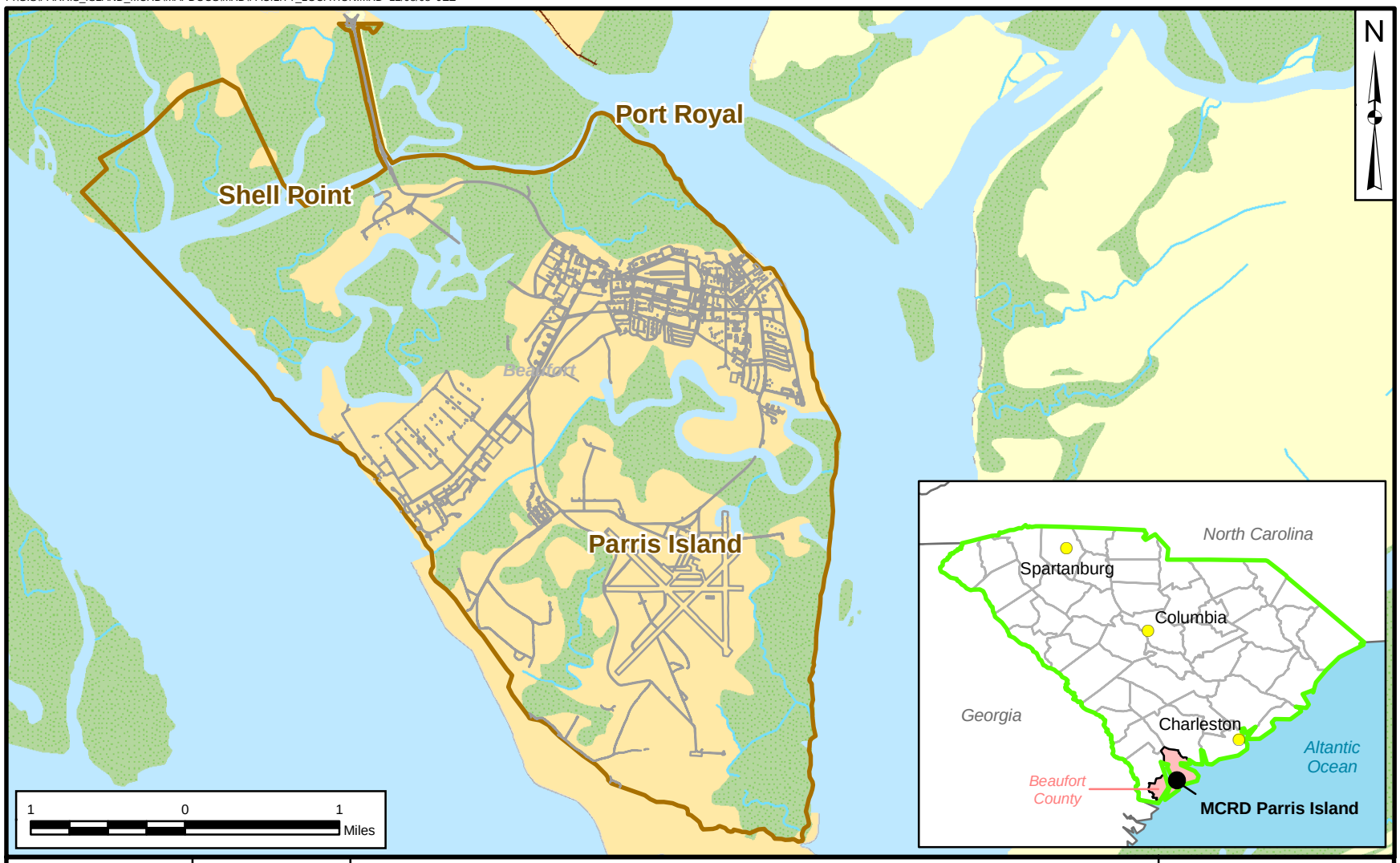
The TtNUS TOM, Project Geophysicist, and Project Scientist will be responsible for conducting the listed data usability assessments. The data usability assessment will be reviewed with the Navy RPM, U.S. EPA, and SCDHEC. The review will take place either in a face to face meeting or a teleconference depending on the extent of identified deficiencies. If no significant deficiencies are identified, the data usability assessment will simply be documented in the project report and reviewed during the normal document review cycle.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented:

Written documentation will support the non-compliance estimated or rejected data results. The project report will identify and describe the data usability limitations and suggest re-surveying or other corrective actions, if necessary.

Usability Checklist Table			
Phase of Work	**Item to be checked/verified**	**Verified (Yes or No)**	**Comments or Deviations**
Pre-Survey	Qualification of Survey Team evaluated		
	Personnel reviewed and signed-off on relevant SAP section(s)		
Survey	QC evaluation of survey equipment (tests and checklists satisfactorily completed)		
	ITS met requirements specified in SAP		
	Conformance to SAP requirements and procedures for all survey work and rework (including documentation requirements), and all deficiencies documented		
	Coverage of Areas to be Investigated fulfilled and located within accuracy levels required for the SI		
	Interpretation and Summary of Geophysical Data satisfies SAP requirements and conformance with Data Processing Flowchart (Worksheet 17)		

P:\GIS\PARRIS_ISLAND_MCRD\MAPDOCS\MXD\FACILITY_LOCATION.MXD 12/08/08 JEE



DRAWN BY J. ENGLISH	DATE 12/08/08	FACILITY LOCATION MAP MCRD PARRIS ISLAND PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NUMBER CTO 0089
CHECKED BY M. BLANKEN	DATE 12/08/08		APPROVED BY ___ DATE ___
REVISED BY ___	DATE ___		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE ES-1 / REV 0

P:\GIS\PARRISISLAND_MCRD\MAPDOCS\MXD\UXOS_BV_ALT.MXD 09/11/09 JEE

DRAWN BY T. WHEATON	DATE 08/24/09	UXO 1, 2, 3, 4, 5, 6, 7, & 8 LOCATION MAP MCRD PARRIS ISLAND PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NUMBER CTO 089
CHECKED BY M. BLANKEN	DATE 09/11/09		APPROVED BY ___ DATE ___
REVISED BY ___	DATE ___		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE ES-2 / REV 0

P:\GIS\PARRIS_ISLAND_MCRD\MXD\UXO3_PARADE_DECK_MC.MXD 09/11/09 JEE

DRAWN BY	DATE
J. ENGLISH	12/08/08
CHECKED BY	DATE
M. BLANKEN	09/11/09
COST/SCHED AREA	
SCALE AS NOTED	

AERIAL BOMBING TARGET AT PARADE DECK - UXO 3

SITE LOCATION

MCRD PARRIS ISLAND

PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NUMBER	
CTO 089	
APPROVED BY	DATE
—	—
APPROVED BY	DATE
—	—
FIGURE NO.	REV
FIGURE 10-1	0

P:\GIS\PARRIS_ISLAND_MCRD\MAPDOCS\MXD\UXO4_WEST_MAIN_RANGE_CENTER_SITE_LOC.MXD 10/29/09 KM

DRAWN BY J. ENGLISH	DATE 09/09/09	FIELD ARTILLERY WEST MAIN RANGE - UXO 4	CONTRACT NUMBER CTO 0089
CHECKED BY M. BLANKEN	DATE 10/29/09	SITE LOCATION	APPROVED BY ___ DATE ___
REVISED BY ___	DATE ___	MCRD PARRIS ISLAND	APPROVED BY ___ DATE ___
SCALE AS NOTED	NAVFAC	PARRIS ISLAND, SOUTH CAROLINA	FIGURE NO. FIGURE 10-2 / REV 0

P:\GIS\PARRIS_ISLAND_MCRD\MAPDOCS\MXD\UXO6_EAST_SHRAPNEL_RANGE_SITE_LOCATION.MXD 09/11/09 JEE

DRAWN BY J. ENGLISH	DATE 09/09/09	FIELD ARTILLERY EAST SHARPNEL RANGE - UXO 5 / UXO 6	CONTRACT NUMBER CTO 089
CHECKED BY M. BLANKEN	DATE 09/11/09	SITE LOCATION	APPROVED BY ___ DATE ___
REVISED BY ___	DATE ___	MCRD PARRIS ISLAND	APPROVED BY ___ DATE ___
SCALE AS NOTED		PARRIS ISLAND, SOUTH CAROLINA	FIGURE NO. FIGURE 10-3 / REV 0

P:\GIS\PARRIS_ISLAND_MCRD\MXD\UXO7_AERIAL_BOMBING_GOLF_COURSE_MC.MXD 09/11/09 JEE

DRAWN BY	DATE
J. ENGLISH	12/08/08
CHECKED BY	DATE
M. BLANKEN	09/11/09
COST/SCHED AREA	
SCALE AS NOTED	

AERIAL BOMBING TARGET AT GOLF COURSE - UXO 7

SITE LOCATION

MCRD PARRIS ISLAND

PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NUMBER	
CTO 089	
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO. FIGURE 10-4	REV 0

P:\GIS\PARRIS_ISLAND_MCRD\MXD\UXO8_BOMBING_TARGET_TIDAL_FLATS_MC.MXD 09/11/09 JEE

DRAWN BY J. ENGLISH	DATE 12/08/08	AERIAL BOMBING TARGET AT SOUTHERN TIDAL FLATS - UXO 8 SITE LOCATION MCRD PARRIS ISLAND PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NUMBER CTO 089
CHECKED BY M. BLANKEN	DATE 09/11/09		APPROVED BY ___ DATE ___
COST/SCHED AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 10-5 / REV 0

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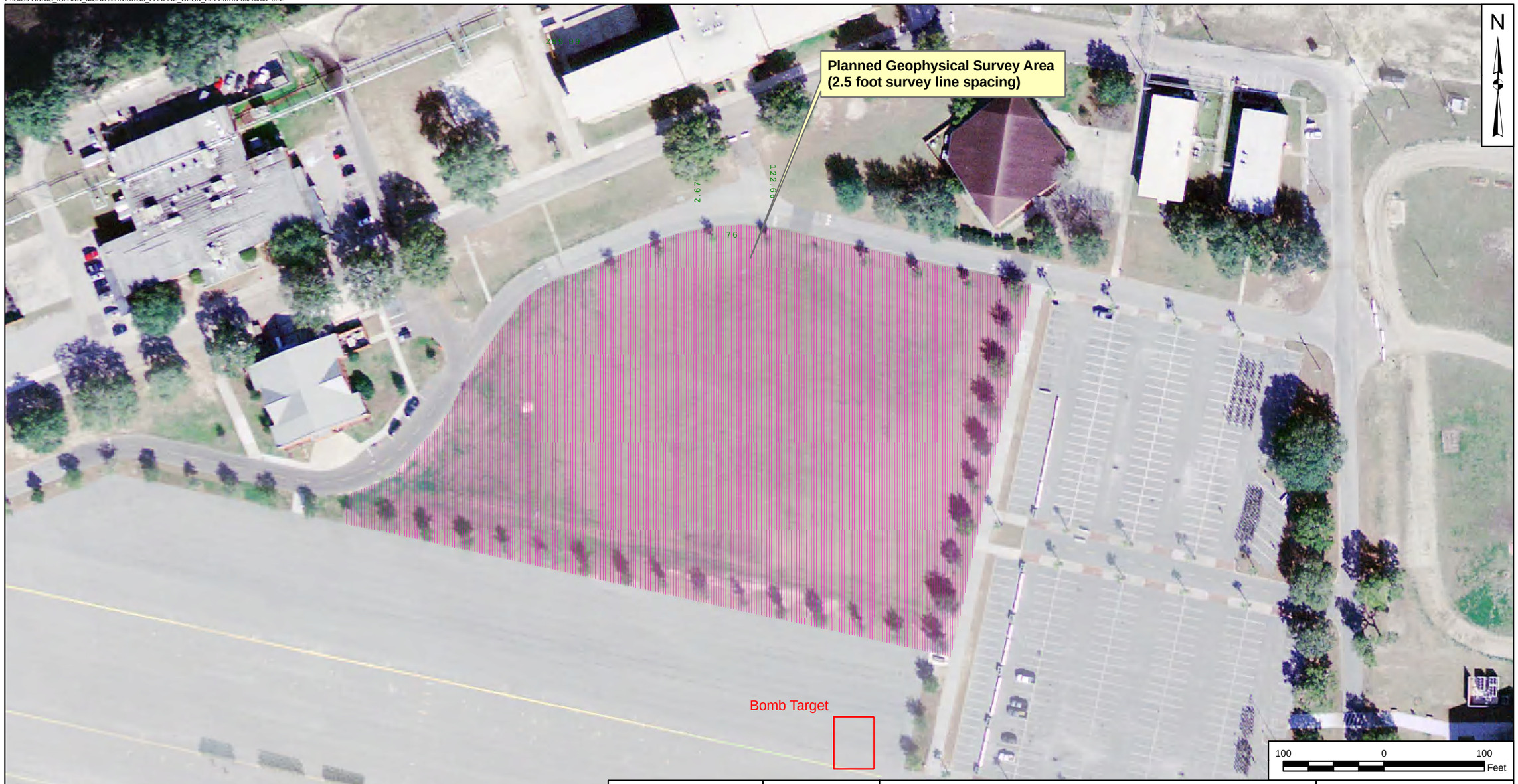

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T. WHEATON	08/24/09
CHECKED BY	DATE
J. COFFMAN	09/10/09
COST/SCHED AREA	
SCALE	
AS NOTED	

AERIAL BOMBING TARGET AT PARADE DECK - UXO 3

MEC INVESTIGATION LOCATION

MCRD PARRIS ISLAND

PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NUMBER	
CTO 089	
APPROVED BY	DATE
___	___
APPROVED BY	DATE
___	___
FIGURE NO.	REV
FIGURE 17-1	0

P:\GIS\PARRIS_ISLAND\MAPDOCS\MXD\UXO4_WEST_MAIN_RANGE_CENTER_MC2_ALT.MXD 09/10/09 JEE

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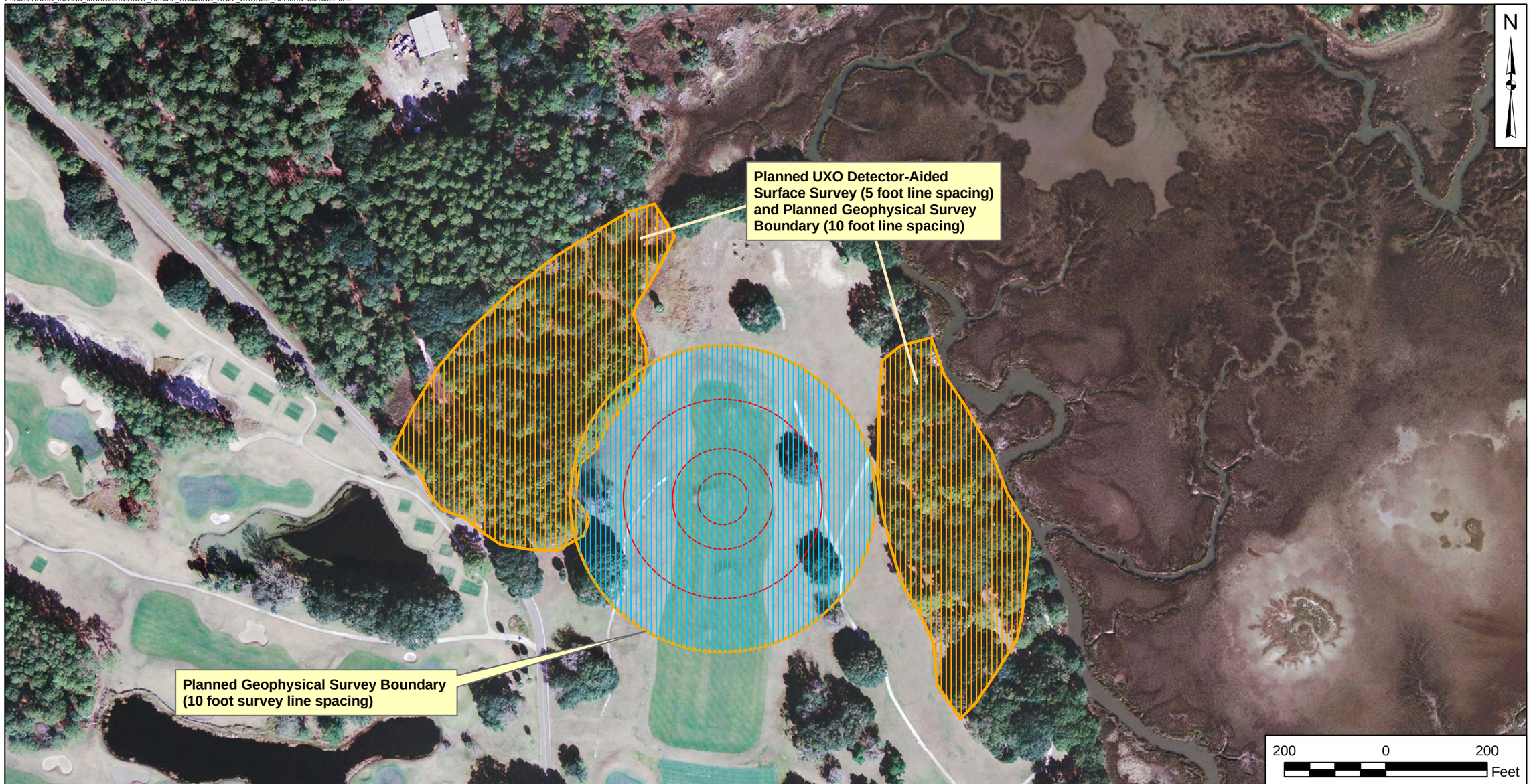
CHECKED BY M. BLANKEN	DATE 09/10/09	MEC INVESTIGATION AREA	APPROVED BY ___ DATE ___
REVISED BY ___	DATE ___	MCRD PARRIS ISLAND	APPROVED BY ___ DATE ___
SCALE AS NOTED	NAVFAC	PARRIS ISLAND, SOUTH CAROLINA	FIGURE NO. FIGURE 17-2 / REV 0

P:\GIS\PARRIS_ISLAND_MCRD\MXD\UXO6_EAST_SHRAPNEL_RANGE_MC1.MXD 09/11/09 JEE

DRAWN BY T. WHEATON	DATE 08/25/09	FIELD ARTILLERY EAST SHRAPNEL RANGE - UXO 5 / UXO 6 MEC INVESTIGATION AREA MCRD PARRIS ISLAND PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NUMBER CTO 089
CHECKED BY M. BLANKEN	DATE 09/11/09		APPROVED BY ___ DATE ___
COST/SCHED AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 17-3 / REV 0

P:\GIS\PARRIS_ISLAND_MCRD\MXD\UXO7_AERIAL_BOMBING_GOLF_COURSE_ALT.MXD 09/10/09 JEE



DRAWN BY	DATE
T. WHEATON	08/25/09
CHECKED BY	DATE
J. COFFMAN	09/10/09
COST/SCHED AREA	
SCALE 1:2,400 1"= 200' at 11x17	

AERIAL BOMBING TARGET AT GOLF COURSE - UXO 7

MEC INVESTIGATION LOCATION

MCRD PARRIS ISLAND

PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NUMBER CTO 089	
APPROVED BY ___	DATE ___
APPROVED BY ___	DATE ___
FIGURE NO. FIGURE 17-4	REV 0

P:\GIS\PARRIS_ISLAND_MCRD\MXD\UXO8_BOMBING_TARGET_TIDAL_FLATS_ALT1.MXD 09/10/09 JEE

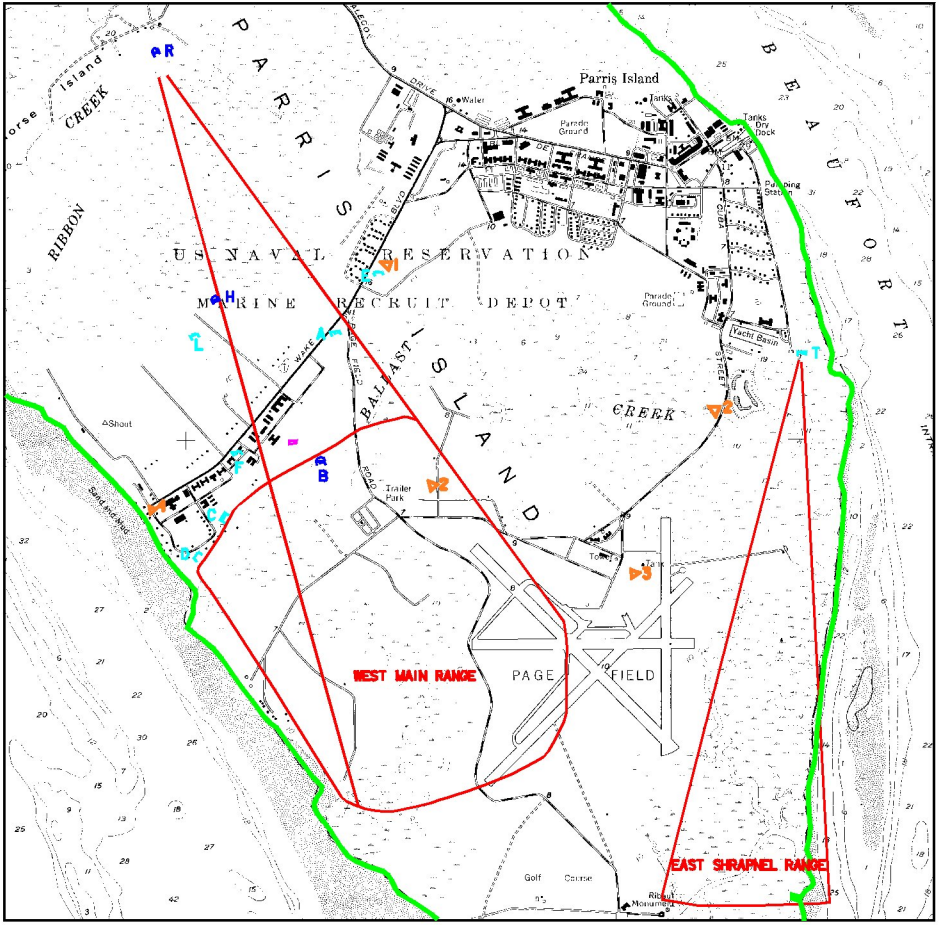
DRAWN BY T. WHEATON	DATE 8/24/09	AERIAL BOMBING TARGET AT SOUTHERN TIDAL FLATS - UXO 8 MEC INVESTIGATION LOCATION MCRD PARRIS ISLAND PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NUMBER CTO 089
CHECKED BY M. BLANKEN	DATE 09/10/09		APPROVED BY ___ DATE ___
COST/SCHED AREA			APPROVED BY ___ DATE ___
SCALE 1:3,000 1"= 250' at 11x17			FIGURE NO. FIGURE 17-5 / REV 0

ATTACHMENT 1

PROJECT SUPPORT INFORMATION

ATTACHMENT 1-1

TECHNICAL SITE INFORMATION



LEGEND

- PROJECT BOUNDARY
- RANGES
- OBSERVATION POINT
- NON-PERMANENT FIRING POSITION
- CONCRETE FIRING POSITION
- CONCRETE OBSERVATION POST

0 2000 4000

APPROXIMATE SCALE IN FEET

N

U.S. ARMY CORPS OF ENGINEERS
ST. LOUIS DISTRICT

MARINE CORPS RECRUIT DEPOT
EASTERN RECRUITING REGION
PARRIS ISLAND, SC
BEAUFORT COUNTY

RANGES 1937 FIELD ARTILLERY

PROJ. DATED APRIL, 1999	DATE OF PHOTO: 1937	PLATE NO. 2
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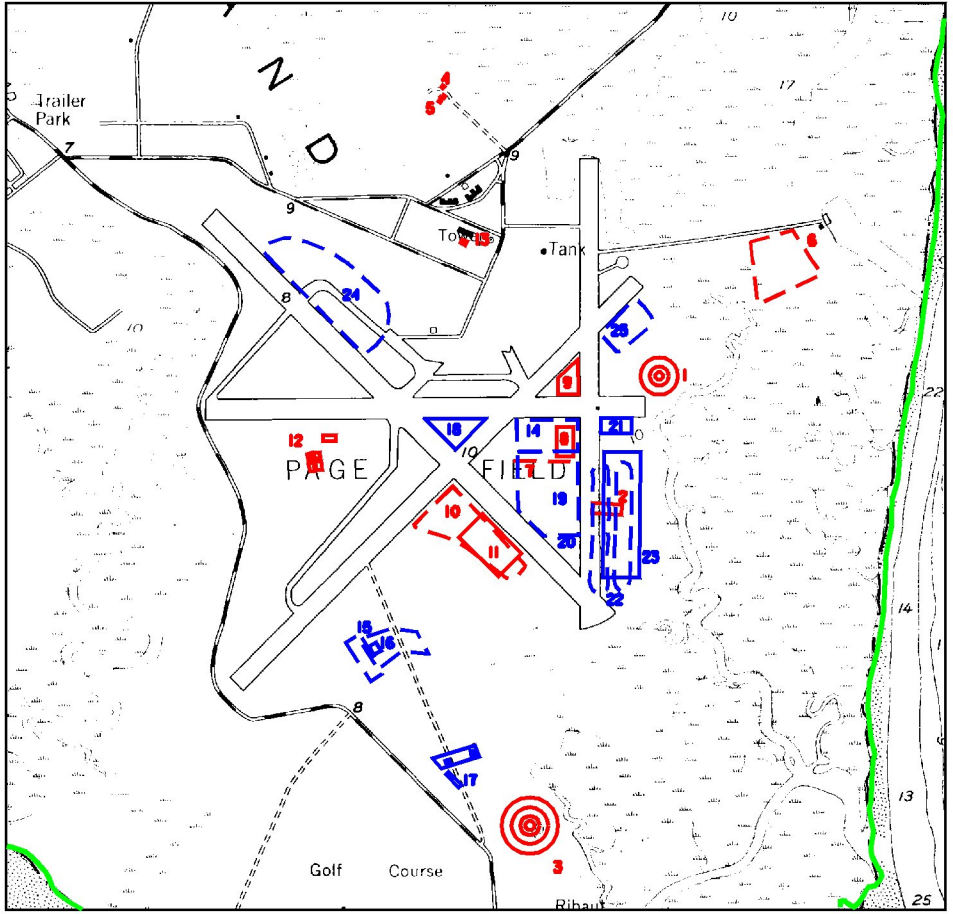


KEY TO FEATURES:

FEATURE NUMBER	FEATURE DESCRIPTION
1	AERIAL BOMBING TARGET AT PAGE FIELD 1937)
2	STRAFING RANGE AT PAGE FIELD (1937-1940) (EST. LOCATION)
3	AERIAL BOMBING TARGET AT GOLF COURSE (1946)
4	SKEET RANGE, BUILDING A548 AT PAGE FIELD (1946-53)
5	TRAP RANGE, BUILDING A547 AT PAGE FIELD (1946-53)
6	GUADALCANAL HAND GRENADE RANGE (1987-92)
7	MINE/BOOBY TRAP (1994)
8	BLDG. 4119, PRACTICE GRENADE AND MINE FIELD (1983)
9	PRACTICE GRENADE RANGE (1987)
10	CAC (COMBAT ASSAULT COURSE) (1994)
11	INFILTRATION COURSE (1987)
12	COMBAT TOWN (1994)
13	GAS CHAMBER, T95 (1988)
14	NBC MOVEMENT COURSE (1987)
15	FIELD FORTIFICATION COURSE II (1994)
16	INFILTRATION COURSE, SOUTH OF PAGE FIELD (1983) BUILDING 4024
17	NIGHT MOVEMENT COURSE SOUTH OF PAGE FIELD (1983) BUILDING 4022
18	WIRE ENTANGLEMENT DISPLAY (1987)
19	DAY MOVEMENT STATIONS (1994)
20	SQUAD OFFENSE COURSE (1987)
21	NIGHT MOVEMENT COURSE (1987)
22	DAY MOVEMENT 1 AND DAY MOVEMENT 2 (1994)
23	FIRE TEAM/NBC MOVEMENT COURSE (1987)
24	NBC FIELD COURSE (1994)
25	BOOBY TRAP COURSE (1994)

LEGEND

- PROJECT BOUNDARY
- RANGES
- MISC. TRAINING STATIONS AND COURSES

0 1000 2000

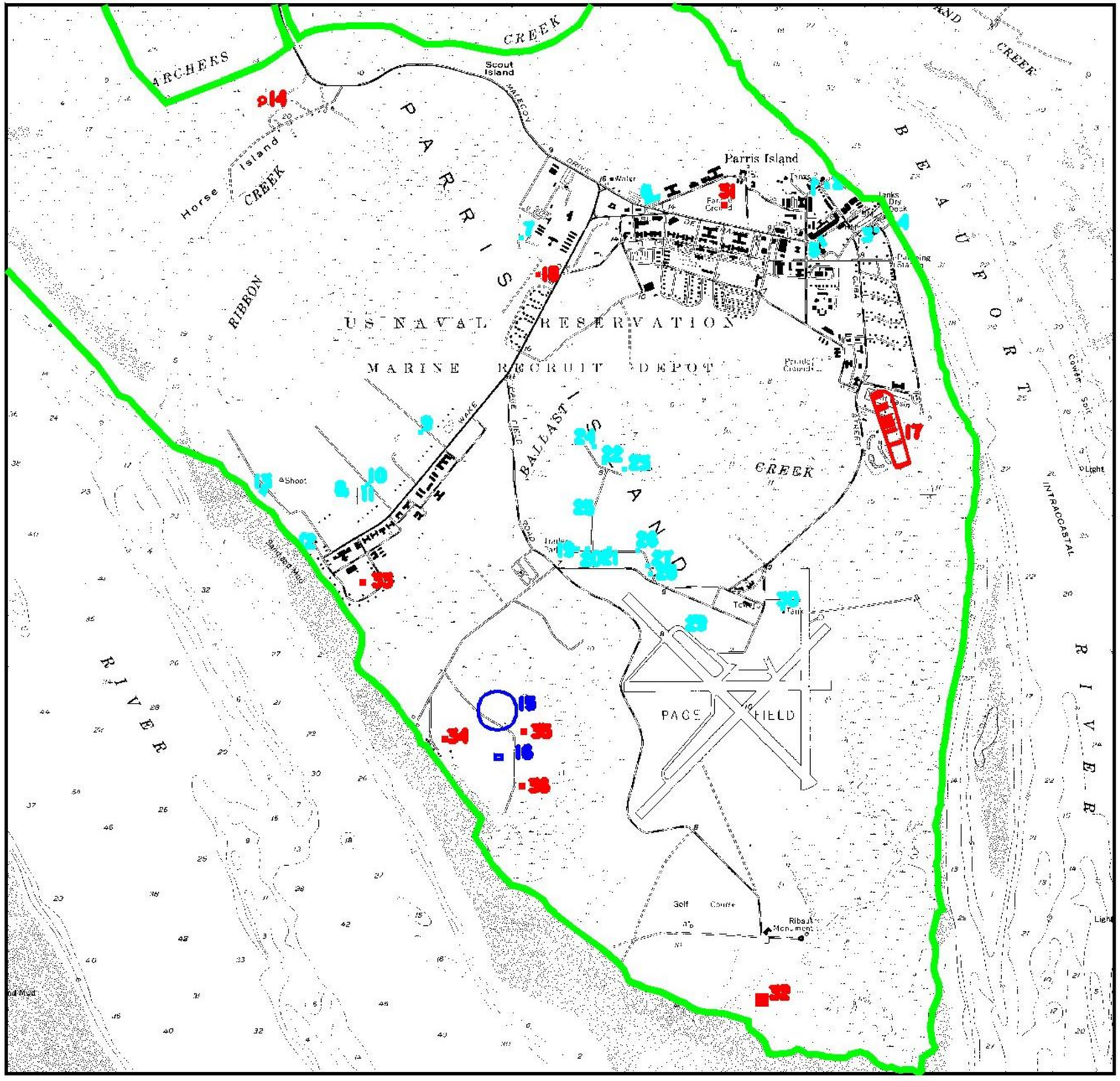
APPROXIMATE SCALE IN FEET

N

U.S. ARMY CORPS OF ENGINEERS
ST. LOUIS DISTRICT

MARINE CORPS RECRUIT DEPOT
EASTERN RECRUITING REGION
PARRIS ISLAND, SC
BEAUFORT COUNTY
RANGES
PAGE FIELD TRAINING AREA

PROJ. DATED APRIL, 1999	DATE OF MAP: 1943	PLATE NO. 4
07-JUN-1999 09:02	[illegible]	



KEY TO FEATURES

FEATURE NUMBER	FEATURE DESCRIPTION
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2	FORT MARION
3	FORT MACKAY
	TEMPORARY UNKNOWN USE [illegible] – not specifically located
4	BLDG. 2, AMMUNITION [illegible] – probable location – not specifically located
5	BLDG. 65 AMMUNITION SMALL STORAGE [illegible]
6	[illegible]
7	BLDG. [illegible] WAX STORAGE BLDG. [illegible]
8	BLDG. 30 AMMUNITION STORAGE [illegible]
9	BLDG. 724, HEAVY AMMUNITION STORAGE [illegible]
10	BLDG. 726, HEAVY AMMUNITION STORAGE [illegible]
11	BLDG. 724, HEAVY AMMUNITION STORAGE [illegible]
12	BLDG. 724, HEAVY AMMUNITION STORAGE [illegible]
13	BLDG. 726, AMMUNITION STORAGE [illegible]
14	RECREATIONAL FIRING RANGE AT RIFLE [illegible]
15	TACTICAL BIVOUAC AREA
16	BLDG. [illegible], FIELD FORTIFICATION DISPLAY
17	RIFLE RANGE AT BALLAST CREEK [illegible]
18	BLDG. [illegible] CHAMBER
19	BLDG. 41, SMALL ARMS UNKNOWN USE [illegible]
20	BLDG. 42, SMALL ARMS UNKNOWN USE [illegible]
21	BLDG. 43, SMALL ARMS UNKNOWN USE [illegible]
22	BLDG. 44, HIGH EXPLOSIVES UNKNOWN USE [illegible]
23	BLDG. 45, HIGH EXPLOSIVES UNKNOWN USE [illegible]
24	BLDG. 46, HIGH EXPLOSIVES UNKNOWN USE [illegible]
25	BLDG. 47, FREE UNKNOWN USE [illegible]
26	BLDG. 48, BLACK POWDER UNKNOWN USE [illegible]
27	BLDG. 49, SHOT UNKNOWN USE [illegible]
28	BLDG. 50, HEAVY UNKNOWN USE [illegible]
29	BLDG. 51, HEAVY UNKNOWN USE [illegible]
30	BLDG. [illegible] [illegible]
31	AERIAL BOMB TARGET AT PARRIS ISLAND [illegible] – approximate boundaries interviews
32	AERIAL BOMB TARGET AT [illegible] TOILE PLATE [illegible] [illegible] as located by [illegible]
33	POSSIBLE [illegible] [illegible]
	[illegible] FOR MARINE BATTALION TRAINING AREA
34	GAS CHAMBER AT ELLIOTT'S BEACH
35	POSSIBLE FIRE RANGE AT ELLIOTT'S BEACH
36	POSSIBLE HAND GRENADE RANGE AT ELLIOTT'S BEACH

LEGEND

- PROJECT BOUNDARY
- RANGES
- ORDNANCE STORAGE AND HISTORICAL FORTIFICATIONS
- MISCELLANEOUS TRAINING STATIONS, ORDNANCE AND UNKNOWN AREAS

0 2500 5000

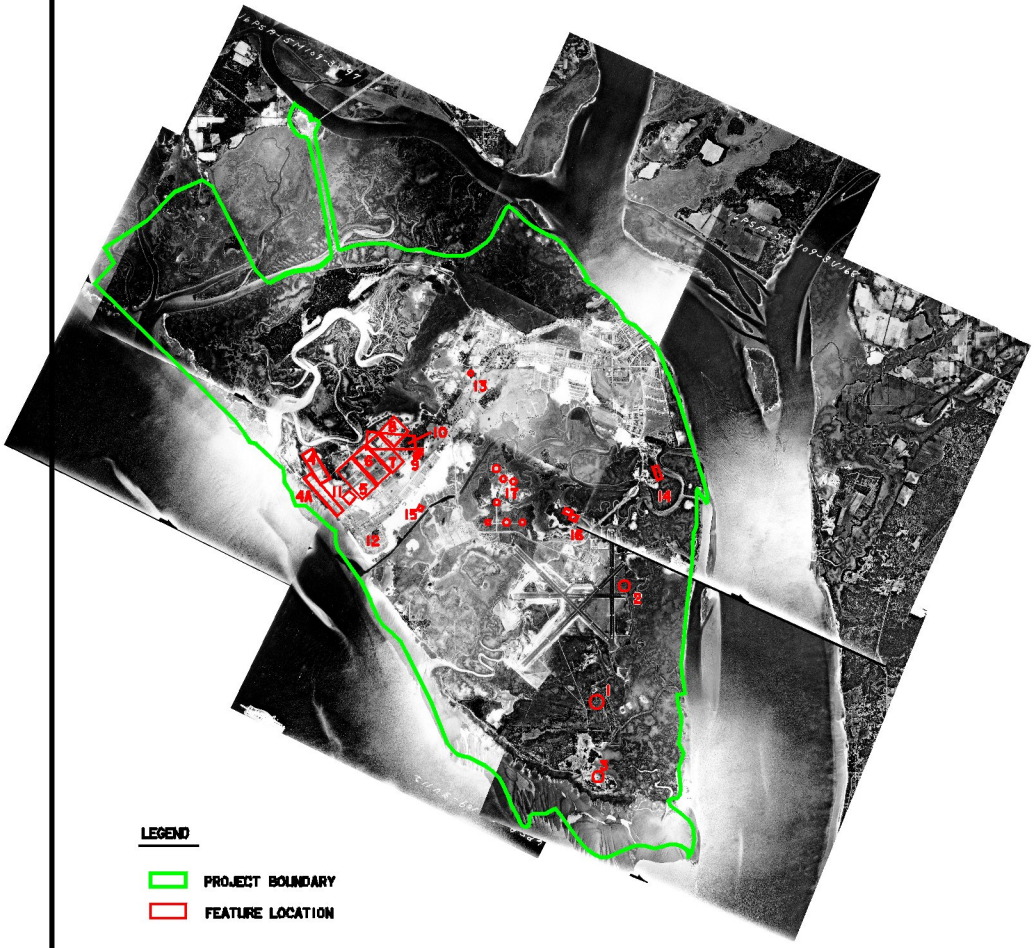
APPROXIMATE SCALE IN FEET

N

U.S. ARMY CORPS OF ENGINEERS
ST. LOUIS DISTRICT

MARINE CORPS RECRUIT DEPOT
EASTERN RECRUITING REGION
PARRIS ISLAND, SC
BEAUFORT COUNTY
RANGES MISCELLANEOUS AREAS, ORDNANCE STORAGE & HISTORIC FORTIFICATION

PROJ. DATE: APRIL 1999	DATE OF MAP: 1978	PLATE NO. 5
07-JUN-1999 [illegible]	[illegible]	



KEY TO FEATURES:

FEATURE NUMBER	FEATURE DESCRIPTION
1.	AERIAL BOMBING TARGET, AT GOLF COURSE
2.	AERIAL BOMBING TARGET AT PAGE FIELD
3.	AERIAL BOMBING TARGET AT SOUTHERN TITLE FLATS
4.	RANGE A
4A.	SMALL BORE RANGES 1-8
5.	RANGE B
6.	RANGE C
7.	RANGE D
8.	350 YARD WIDE TARGET BERM AND FIRING LINES AT APPROXIMATELY 100, 200, AND 300 YARDS VISIBLE ON THE HAND GRENADE PRACTICE AREA WHICH BECOMES RANGE E
9.	TWO CIRCULAR FEATURES APPROXIMATELY 150 FEET IN DIAMETER, WHICH RESEMBLES SNAP IN OR DRY FIRE RANGES
10	POSSIBLE EARLIER RANGE WITH A WESTERN DIRECTION OF FIRE, WHICH CUTS ACROSS BOTH RANGES E AND D; 300 YARDS WIDE AND POSSIBLY 600 YARDS LONG
11.	GROUND SCARRING EVIDENT AT THE LOCATION OF THE 1942 RIFLE GRENADE CIRCLES
12.	NO EVIDENCE ON THE REPORTED GRENADE COURT SOUTH OF THE SWIMMING POOL
13.	TREES OBSCURE GAS CHAMBER, BUILDING 673
14.	BUILDING DEVELOPMENT ON NORTHERN PORTION OF THE RIFLE RANGE AT BALLAST CREEK
15.	FIELD ARTILLERY CONCRETE OBSERVATION POST
16.	TRAP AND SKEET RANGES AT PAGE FIELD
17.	ORDNANCE STORAGE STRUCTURES

0 4000 8000

APPROXIMATE SCALE IN FEET

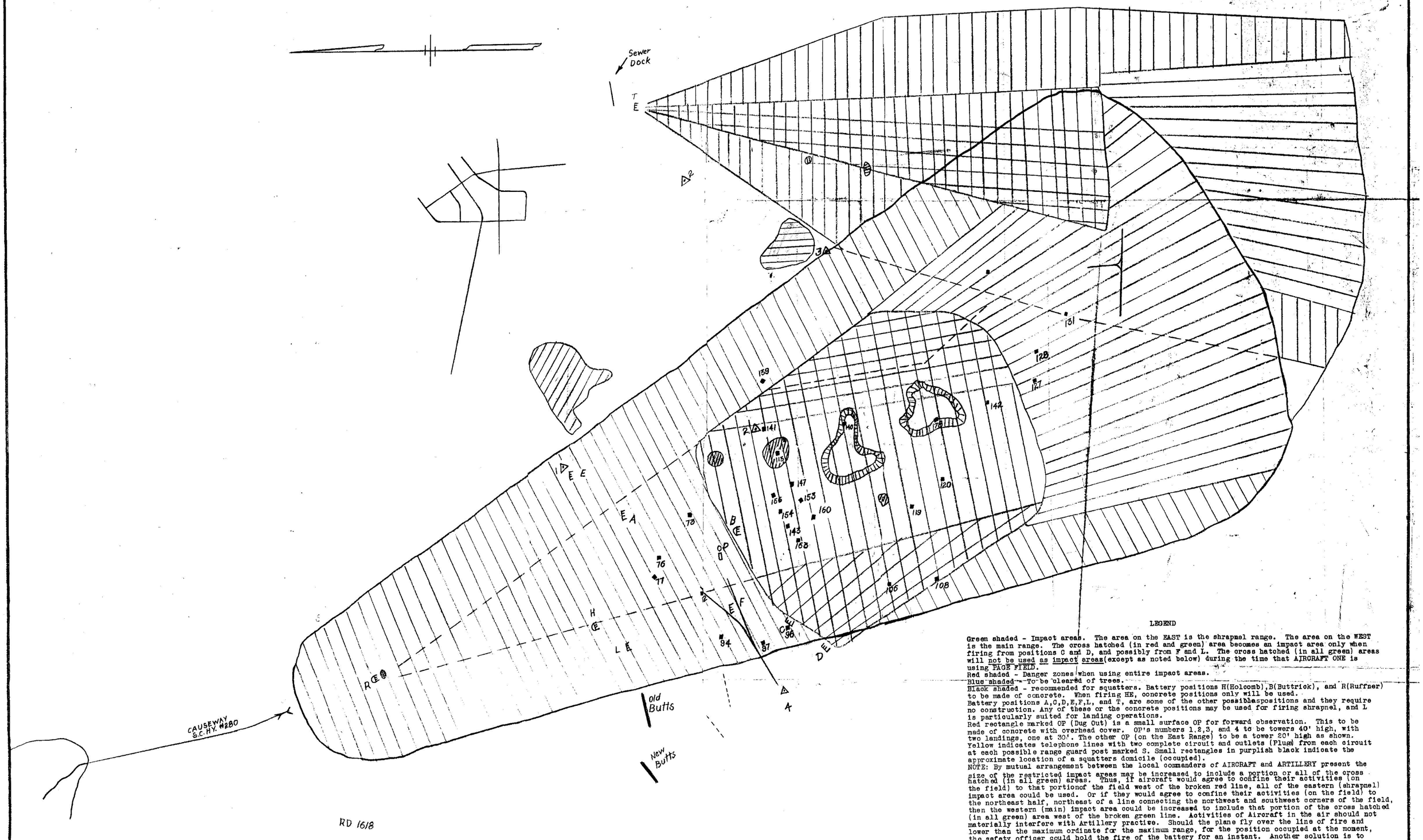
N

U.S. ARMY CORPS OF ENGINEERS
ST. LOUIS DISTRICT

MARINE CORPS RECRUIT DEPOT
EASTERN RECRUITING REGION
PARRIS ISLAND, SC
BEAUFORT COUNTY

1945 AERIAL PHOTOGRAPHY

PROJ. DATE: APRIL, 1999	DATE OF PHOTO: 1945	PLATE NO. 7
07-JAN-1999 10:46	/usacoe/cecw95/eco/dr/par/ts/phot/45parris.dgn	



LEGEND

Green shaded - Impact areas. The area on the EAST is the shrapnel range. The area on the WEST is the main range. The cross hatched (in red and green) area becomes an impact area only when firing from positions C and D, and possibly from F and L. The cross hatched (in all green) areas will not be used as impact areas(except as noted below) during the time that AIRCRAFT ONE is using PAGE FIELD.
Red shaded - Danger zones when using entire impact areas.
Blue shaded - To be cleared of trees.
Black shaded - recommended for squatters. Battery positions H(Holcomb),B(Buttrick), and R(Ruffner) to be made of concrete. When firing HE, concrete positions only will be used.
Battery positions A,C,D,E,F,L, and T, are some of the other possible spositions and they require no construction. Any of these or the concrete positions may be used for firing shrapnel, and L is particularly suited for landing operations.
Red rectangle marked OP (Dug Out) is a small surface OP for forward observation. This to be made of concrete with overhead cover. OP's numbers 1,2,3, and 4 to be towers 40' high, with two landings, one at 30'. The other OP (on the East Range) to be a tower 20' high as shown.
Yellow indicates telephone lines with two complete circuit and outlets (Plugs from each circuit at each possible range guard post marked S. Small rectangles in purplish black indicate the approximate location of a squatters domicile (occupied).
NOTE: By mutual arrangement between the local commanders of AIRCRAFT and ARTILLERY present the size of the restricted impact areas may be increased to include a portion or all of the cross hatched (in all green) areas. Thus, if aircraft would agree to confine their activities (on the field) to that portionof the field west of the broken red line, all of the eastern (shrapnel) impact area could be used. Or if they would agree to confine their activities (on the field) to the northeast half, northeast of a line connecting the northwest and southwest corners of the field, then the western (main) impact area could be increased to include that portion of the cross hatched (in all green) area west of the broken green line. Activities of Aircraft in the air should not materially interfere with Artillery practice. Should the plane fly over the line of fire and lower than the maximum ordinate for the maximum range, for the position occupied at the moment, the safety officer could hold the fire of the battery for an instant. Another solution is to use field 5 miles to northeast. Particularly when the only mission of the aircraft present is to observe for Artillery.

TRACED FROM:
OVERLAY FOR
KEY MAP (BLUEPRINT)
OF PARRIS ISLAND S.C.
SCALE: 1/12,000, DATED 30 JUNE, 1936
SHOWING PROPOSED ARTILLERY RANGES

TRACED BY BELL
CHECKED BY FARMER

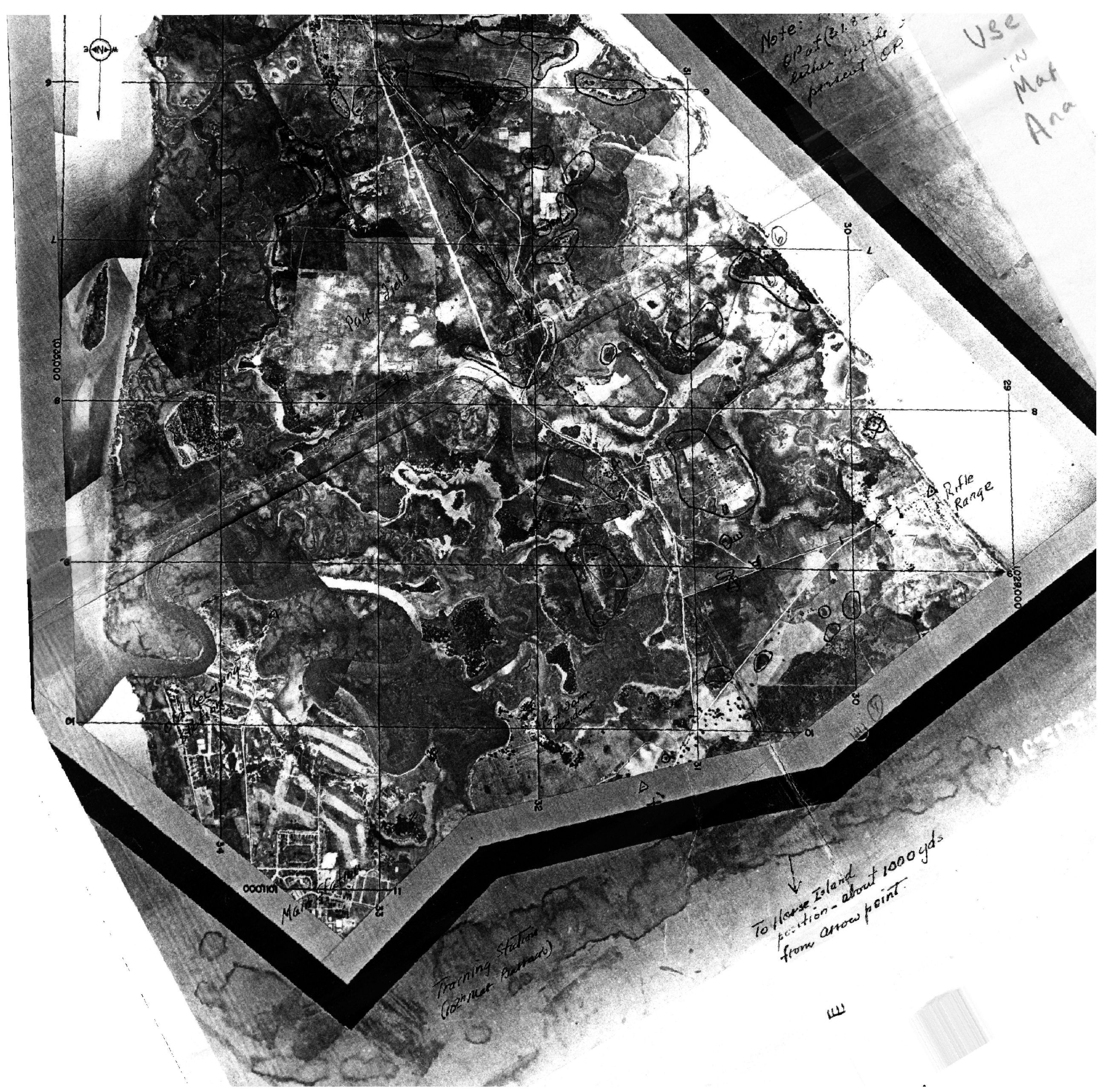
U S MARINE BARRACKS
PARRIS ISLAND S.C.

FIELD ARTILLERY RANGE

APPROVED: 1 DEC. 1937

H. MacT. Sylvester
LIEUT CDR USN.
PUBLIC WORKS OFFICER

SCALE 1 IN = 1000 FT.


Use in Mat Ana
Note: OP at (31.8 - 3 below middle present OP
Page field
Rifle Range
Training Station (102nd Mat Battalion)
To Horse Island position - about 1000 yds from arrow point
Mat
1029000
1028000

ATTACHMENT 1-2

REFERENCES

REFERENCES

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USEPA, 2005. Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP), Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs (Final Version 1), EPA-505-B-04-900A. March.

ATTACHMENT 2

MEC FIELD STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE
MRP SOP 01
UXO DETECTOR-AIDED SURFACE SURVEYS

1.0 SCOPE AND APPLICABILITY

This document is designed to set a standard operating procedure (SOP) for the detector-aided surface Survey field operations during activities performed under the Munitions Response Program (MRP). This SOP is not site-specific, but rather is intended as a general guidance document for a variety of sites and conditions.

2.0 BACKGROUND

Detector-aided surface Survey activities will be performed in accordance with all local, State, and federal regulations and will include all applicable DoD requirements. The scope of the detector-aided surface Survey activities for a specific site will be defined in the project-specific work plans. Generally, all areas identified as suspect for munitions and explosives of concern (MEC) will receive an Unexploded Ordnance (UXO) detector-aided surface Survey UXO detector-aided surface Survey operations may be used as a stand-alone method for site survey and assessment or in preparation for geophysical survey operations. UXO escort operations will be required during site visits (initial site assessments, planning, and stakeholders meetings), geophysical operations, and MC sampling operations and any other time where non-UXO trained personnel are conducting work in an MEC site. This SOP does not address UXO escort operations. UXO escort operations are addressed in the Munitions and Explosives of Concern and Chemical Warfare Agents Activities SOP which will be attached to the site-specific health and safety plans (HASPs) for those activities.

3.0 PERSONNEL QUALIFICATIONS

UXO personnel conducting detector-aided surface Surveys shall be graduates of a military Explosive Ordnance Disposal (EOD) School of the United States, Canada, Great Britain, Germany, or Australia or a graduate of a formal training course of instruction or EOD assistant course as stated in DDESB TP-18.

UXO Senior UXO Supervisor (SUXOS)

The SUXOS will have a minimum of ten years experience in all aspects of munitions response actions or range clearance activities. A minimum of five years of the experience shall be in supervisory positions.

UXO Team Leader (UXO Technician III)

The UXO Team Leader will have a minimum of 8 years of EOD/UXO experience including prior military EOD and/or commercial UXO experience in munitions response actions, and/or range clearance activities. The UXO Team Leader may supervise up to six UXO technicians.

The UXO Team Leader will conduct detector-aided surface Survey activities as directed by the project manager (PM) and UXO Manager. The UXO Team Leader will be under the direct supervision of the UXO Manager.

UXO Quality Control Specialist (UXOQC)

The UXOQC specialist shall have a minimum of 8 years experience in all phases of munitions response actions and/or range clearance activities.

UXO Safety Officer (UXOSO)

The UXOSO shall have a minimum of 8 years experience in all phases of munitions response actions and/or range clearance activities.

UXO Technicians II

The UXO Technicians II will have prior military EOD experience or a minimum of 3 years of experience in munitions response actions and/or range clearance activities. The UXO technician will conduct detector-aided surface Survey activities as directed by the UXO Team Leader.

UXO Technician I

The UXO Technician I will have training as specified in DDESB TP-18. The UXO technician I will be directly supervised by a UXO Technician III or higher when conducting UXO activities.

4.0 DETECTOR-AIDED SURFACE SURVEY OPERATIONS

Equipment

A magnetic locator such as the Schonstedt, GA-52Cx instrument or equivalent and/or an all-metal detector such as the White's XLT or equivalent will be used for detector-aided surface Survey operations. The detection depth of the instrument is limited by size and orientation of a target and soil characteristics of the work area. The locators provide an audio signal for response, but do not store data. The magnetic locator does not need to be calibrated. The all-metal detector has field calibration. Calibration settings are specific to the make and model of the all metals detector. Table 1 lists the calibration settings for the White's spectrum XLT.

To ensure each detector is operating properly, the operator turns on the instrument and slowly moves the locator towards metal. As the probe advances toward the target, the audio signal will increase. Failure to detect the object is reason to reject the instrument.

The detector will be checked daily before starting detector-aided surface Survey activities and after any battery change. The normal daily check for detector-aided surface Survey operations is the blanket test. To conduct the blanket test, an area near the work site and free of anomalies will be identified. The senior UXO Technician or UXOQC will position several inert munitions, or surrogate munitions items on the surface and cover the items with a tarpaulin or similar cover so the items are not visible the UXO technician. Each UXO technician will conduct a detector aided surface Survey of the blanket test area and locate the test items. The senior UXO technician or UXOQC will compare the results of the test to the actual placement of the items

and make corrections as necessary. UXO Technicians will also conduct random checks during daily operations.

The normal setting for the Schonstedt instrument is 2; setting the instrument to 3 or 4 will make it more sensitive and setting the instrument to 1 will make it less sensitive. The instrument will not detect copper, brass, or aluminum munitions. The normal setting for the White's all-metal detector will vary according to site conditions.

UXO Detector-Aided Surface Survey

The objective of the UXO detector-aided surface Survey is to locate suspect MEC. Materials potentially presenting an explosive hazard (MPPEH) and munitions debris (MD) on the ground surface in a munitions response site, (MRS). Early in the planning for the field activities, usually during the DQO process with the regulators and the client, the level of effort is determined for each MRS within a munitions response area, MRA). The level of effort can vary from a 100% UXO investigation where the entire foot print of the MRS receives a UXO detector-aided surface Survey, to transects where five foot wide lanes receive a UXO detector-aided surface Survey and each lane is separated by a set number of feet depending on the budget and size of the MRS, or even a meandering path where a UXO detector-aided surface Survey is conducted as the UXO technician meanders across the MRS. Each of these will be discussed in some detail below:

100% UXO Detector-Aided Surface Survey

The first step in conducting a 100% UXO detector-aided surface Survey is to identify the boundaries of the MRS. This can be done with a GPS with preloaded grid coordinates, or surveyed by a land surveyor.

The next step is to remove brush and small trees within the MRS to allow access to the locations where the surface Survey is to be conducted. The degree of removal will depend on site-specific conditions. This can be accomplished with a bush cutting crew and a UXO escort, or the UXO team can conduct the brush cutting themselves depending on the size of the area and the amount of brush removal needed. Care must be taken to ensure that personnel do not disturb suspect MEC, MPPEH or munitions debris on the surface that may be obscured by vegetation

The next step is to establish a grid system across the MRS. The normal grid is 100ft X 100ft but may be larger or smaller if the MRS would be better covered with a different size. The grid is established using a GPS with preloaded grid corners, or surveyed by a land surveyor to establish the grid corners.

The next step in the set-up process is to divide each grid into search lanes. This is normally done by running a tape measure between the bottom and top east/west corner stakes. Then the UXO team will run rope lines from the 0 point on one tape to the 0 point on the other tape, from the 5ft point on one tape to the 5ft point on the next tape, and so on until the entire 100 ft grid has been divided in to lanes.

The UXO team members will now start the UXO detector-aided surface Survey of each lane. Each UXO team member will start at one of the tapes and using the metal detector, proceed toward the other tape and locate any surface MEC within their lane. If suspect MEC is

encountered, its location will be recorded and/or marked using a GPS, tape measure, or other grid coordinate location system. The UXO Team will attempt to determine its condition without moving or disturbing the item prior to proceeding with the surface Survey. Each item will be marked with engineer flagging and given a unique ID number (See MEC Management and Accountability SOP). All available information about the item will be recorded in the logbook/MEC Accountability Log, including suspect MEC location, identification, and ID number. A digital photograph will be taken of each item. The UXO Team will not move or otherwise disturb the item in an attempt to collect information. After all available information is recorded; the UXO Team will resume the detector-aided surface Survey.

When the UXO detector-aided surface Survey of a grid is complete and all items have been located with coordinates and digitally photographed, the tape measures, ropes and other equipment will be moved to the next grid and reestablished as stated above. This process will continue until the entire MRS has been investigated with as close as possible to 100% UXO detector-aided surface Survey.

Transect UXO Detector-Aided Surface Survey

The first step in conducting a transect UXO detector-aided surface Survey is to identify the boundaries of the MRS. This can be done with a GPS with preloaded grid coordinates, or surveyed by a land surveyor.

The next step is to establish the end stakes of each transect across the MRS. The transect end stakes are established using a GPS with preloaded end stake locations, or surveyed by a land surveyor. The distance between transects will be established in the site-specific work plan. The direction should be either north/south, or east west although other directions may be appropriate in specific circumstances.

If necessary, each transect may require some brush cutting to aide in the surface Survey. If brush cutting is determined to be necessary, the transect should be at least 5 ft. wide. This can be accomplished with a bush cutting crew and a UXO escort, or the UXO team can conduct the brush cutting themselves depending on the size of the area and the amount of brush removal needed. Care must be taken to ensure that personnel do not disturb suspect MEC items on the surface that may be obscured by brush and tall grass.

The UXO team members will now start the UXO detector-aided surface Survey of each transect. Each UXO team member will start at one of the end stakes and using the metal detector proceed in a deliberate pattern to locate any surface MEC within their 5ft wide transect, toward the other corresponding end stake. The UXO team member will use a GPS or compass to maintain a generally straight transects during the investigation. If suspect MEC is encountered, its location will be recorded and/or marked using a GPS, tape measure, or other grid coordinate location system. The UXO Team will attempt to determine its condition without moving or disturbing the item prior to proceeding with the surface Survey. Each item will be marked with engineer flagging and given a unique ID number (See MEC Management and Accountability SOP). All available information about the item will be recorded in the logbook/MEC Accountability Log, including suspect MEC location, identification, and ID number. A digital photograph will be taken of each item. The UXO Team will not move or otherwise disturb the item in an attempt to

collect information. After all available information is recorded; the UXO Team will resume the detector-aided surface Survey.

When the UXO detector-aided surface Survey of a transect is complete and all items have been located with coordinates and digitally photographed, the UXO team member may proceed to the next transect. This process will continue until the transects have been completed over the entire MRS as planned in the WP.

Meandering Path UXO Detector-Aided Surface Survey

Generally the meandering path UXO detector-aided surface Survey is very similar to the transect UXO detector-aided surface Survey. The main difference is there is very little need to cut brush as the UXO team members will meander around heavy brush and other obstacles.

The GPS will have information about the MRS preloaded so as to ensure that the path stays within the MRS. Again the meandering path will be approximately 5ft wide and proceed across the MRS until the objective, (a set amount of time, distance, or suspect MEC items) have been investigated with the UXO detector-aided surface Survey. The site-specific work plans will establish the area within the MRS to be covered with the meandering transects.

If suspect MEC is encountered, its location will be recorded and/or marked using a GPS, compass, and/or tape measure, or other grid coordinate location system. The UXO Team will attempt to determine its condition without moving or disturbing the item prior to proceeding with the surface Survey. Each item will be marked with engineer flagging and given a unique ID number (See MEC Management and Accountability SOP). All available information about the item will be recorded in the logbook/MEC Accountability Log, including suspect MEC location, identification, and ID number. A digital photograph will be taken of each item. The UXO Team will not move or otherwise disturb the item in an attempt to collect information. After all available information is recorded; the UXO Team will resume the detector-aided surface Survey.

Every effort will be made to identify each suspect MEC or MPPEH item located. Under no circumstances will any suspect MEC be moved in an attempt to make a definitive identification. The MEC item will be visually examined for markings and other external features such as shape, size, and external fittings. If unknown military munitions are encountered, the facility point of contact (POC) and Chadux Tt UXO Manager will be notified.

Only UXO-qualified personnel will perform MEC identification procedures. As an exception, a UXO Technician I may assist in the performance of MEC identification procedures when under the supervision of a UXO Technician III or higher. All personnel engaged in field operations will be thoroughly trained and capable of recognizing the specific hazards of the procedures being performed. To ensure that these procedures are performed to standards, all field personnel will be under the direct supervision of a UXO Technician III or higher. All suspect MEC items will be recorded following the requirements of this SOP, the site-specific Work Plan/QAPP, the project site-specific HASP, applicable ordnance operations procedural safety guidelines, and industry-accepted safe work practices and procedures.

All items discovered during the detector-aided surface Survey of the transects/grid will be left in place. No MEC will be moved during this part of the project. The facility POC will be notified

of the presence of MEC so that arrangements may be made through the facility for proper disposition of the item(s). If the facility initiates an emergency response or disposal action, follow-up documentation must be obtained to detail the date and method of disposition. This is also needed to ascertain the actual type and condition of the item (live or inert filled) to aid in future classification of the site.

Quality Control

During the detector aided surface Survey the UXOQC, or Senior UXO technician if there is no UXOQC, will recheck 25% of the first four units of work (grids or transects). If quality requirements are not met on any unit, that unit will be rejected and the UXO team will rework the entire unit. Once quality requirements are met for four units in a row, the UXOQC, or Senior UXO technician if there is no UXOQC may reduce the level of rechecks to 10% of each unit (grids or transects). If at any time a unit fails the quality control check, that complete unit will be reworked and the rechecks will be increased to 25% until four units in a row pass the recheck.

Detector-Aided Surface Survey for Geophysical Survey

The UXO Technician will conduct a detector-aided surface Survey of the grid or area to be surveyed and record the location of any MEC items discovered. Each item will be marked and recorded as described above. UXO avoidance will be practiced during the geophysical survey.

When allowed by the conditions of the Explosive Safety Submission (ESS) determination, any non-munitions debris may be moved to facilitate a more effective geophysical survey. Non-munitions debris may be collected and stockpiled in a designated area within the boundaries of the site. The facility must agree to take possession of this non-munitions debris and arrange the proper disposition of the material before any items may be moved or disturbed.

TABLE 1

White's Spectrum XLT Settings		
Basic Adjustments:	**UXO 1**	
Target Volume	58	
Audio threshold	23	
Tone (audio frequency)	226	
Audio Disc.	on	
Silent Search	off	
Mixed-Mode	on	
A.C. Sensitivity	60	Adjust at a test Grid. Compare with another White's
D.C. Sensitivity	30	Adjust at a test Grid. Compare with another White's
Backlight	0	
Viewing Angle	25	
Pro Options:		
"Audio"		
Ratchet Pinpointing	on	
S.A.T. Speed	7	
Tone I.D.	on	
V.C.O.	on	
Absolute Value	off	
Modulation	on	
"G.E.B/Trac"		
Autotrac	on	
Trac View	off	
Autotrac Speed	14	
Autotrac Offset	+1	
Trac Inhibit	on	
Coarse B.E.B.	54	These numbers are variable and will change automatically.
Fine G.E.B.	160	These numbers are variable and will change automatically.
"Discrimination"		
Disc. Edit	+95 Accept	
Block Edit	+95 Accept	
Learn Accept	off	
Learn Reject	off	
Recovery Speed	20	

White's Spectrum XLT Settings		
Basic Adjustments:	**UXO 1**	
Bottlecap Reject	20	
"Display"		
Visual Disc.	off	
Icons	on or off	
V.D.I. Sensitivity	55	
D.C. Phase	9on	
Graph Averaging	on	
Graph Accumulating	on	
Fade Rate	u	
"Signal"		
Transmit Boost	off	
Transmit Frequency	1 to 7	
Preamp Gain	4	

STANDARD OPERATING PROCEDURE
MRP SOP 02
MEC MANAGEMENT AND ACCOUNTABILITY

A. SCOPE AND APPLICABILITY

This document is designed to set a standard operating procedure (SOP) for the management and accountability of Munitions and Explosives of Concern (MEC) encountered during activities performed under the Munitions Response Program (MRP).

B. BACKGROUND

MEC activities will be performed in accordance with all local, State, and federal regulations and will include all applicable DoD requirements. Generally, MEC will be encountered during the performance of Unexploded Ordnance (UXO) detector-aided surface Survey operations, subsurface geophysics investigations and UXO Escort operations. UXO detector-aided surface Survey operations may be used as a stand-alone method for site survey and assessment or in preparation for geophysical survey and other operations. UXO escort operations may be required during site visits (initial site assessments, planning, and stakeholders meetings), geophysical operations, construction support during subsurface activities, and MC sampling operations.

C. PERSONNEL QUALIFICATIONS

UXO personnel shall be graduates of a military Explosive Ordnance Disposal (EOD) School of the United States, Canada, Great Britain, Germany, or Australia or a graduate of a formal training course of instruction or EOD assistant course as stated in DDESB TP-18.

D. MEC MANAGEMENT AND ACCOUNTABILITY OPERATIONS

UXO Detector-Aided Surface Survey

If suspect MEC is encountered, its location will be recorded and/or marked using a GPS, tape measure, or other grid coordinate location system. The UXO Team will attempt to determine its condition without moving or disturbing the item prior to proceeding with the surface Survey. Each item will be marked with engineer flagging and given a unique ID number. ID numbers will start with a letter(s) corresponding to the site or grid in which the item is located. This will be followed by the transect number of the site or grid specific to the location of the item. Lastly, a number will be assigned to the individual items within the transect. These numbers will start at 01 and run consecutively. For example:

*The site name is **O**pen **B**urn **P**it. The first transect within the Open Burn Pit is **A1**. The first item encountered in transect A1 is item **01**. The ID number assigned to the item is **OBP-A1-01.***

All available information about the item will be recorded in the logbook/MEC Tracking Log as presented in Attachment 1 to this SOP, including suspect MEC location, identification, and ID number. A digital photograph will be taken of each item. The UXO Team will not move or otherwise disturb the item in an attempt to collect information. After all available information is recorded; the UXO Team will resume the detector-aided surface Survey.

Every effort will be made to identify each suspect MEC item located. Under no circumstances will any suspect MEC be moved in an attempt to make a definitive identification. The MEC item will be visually examined for markings and other external features such as shape, size, and external fittings. Prior to any documentation being developed on an MEC item, all fusing will be definitively identified if it is possible to safely do so visually without disturbing the ordnance item. This identification will consist of fuse type by

function and condition (armed or unarmed) and the physical state/condition of the fuse, i.e., burned, broken, parts exposed/sheared, etc.

Only UXO-qualified personnel will perform MEC identification procedures. As an exception, a UXO Technician I may assist in the performance of MEC identification procedures when under the supervision of a UXO Technician III or higher. All personnel engaged in field operations will be thoroughly trained and capable of recognizing the specific hazards of the procedures being performed. To ensure that these procedures are performed to standards, all field personnel will be under the direct supervision of a UXO Technician III or higher. All suspect MEC items will be recorded following the requirements of this SOP, the site-specific Work Plan/QAPP, the project site-specific HASP, applicable ordnance operations procedural safety guidelines, and industry-accepted safe work practices and procedures.

Detector-Aided Surface Survey for Geophysical Survey

The UXO Technician will conduct a detector-aided surface Survey of the grid or transect to be surveyed and record the location of each MEC item discovered, if any. Each item will be marked and recorded as described above. UXO avoidance will be practiced during the geophysical survey.

When allowed by the conditions of the Explosive Safety Submission (ESS) determination, any non-munitions debris may be moved to facilitate a more effective geophysical survey. Non-munitions debris may be collected and stockpiled in a designated area within the boundaries of the site. The facility must agree to take possession of this non-munitions debris and arrange the proper disposition of the material before any items may be moved or disturbed.

UXO Escort Operations

One UXO Technician, qualified as a UXO Technician II or higher, will be required to support each field team engaged in operations in areas that might contain MEC. If any MEC is encountered, the item will be avoided during this phase of the project.

The UXO Technician will not attempt to identify the type or condition of the ordnance during escort operations. Any area with visible ordnance or MEC will be clearly marked, and the area will be avoided. The location of visible ordnance or MEC will be recorded and noted in the field logs. If more senior level personnel are present on site, MEC findings will be reported to the UXO Team Leader. No ordnance, munitions, explosives, or ordnance-related materials will be moved, removed, or disposed of during UXO Escort duties.

E. NOTIFICATIONS IF MEC IS ENCOUNTERED

Any MEC item discovered during a detector-aided surface Survey, geophysical survey, or UXO escort operation will be left in place and will not be moved. Should MEC be encountered, the following scenarios should be addressed as follows:

(1) <u>If a complete MEC item or ordnance related material is encountered that is believed to pose a hazard, is unexpectedly encountered at a given site, is encountered outside of the current established site boundaries, or is unknown</u>, the UXO Team Leader, with support by UXO Technicians on site as necessary, will document the following information, as provided on Attachment 1, for notification purposes:

- Site Name
- Date/Time Encountered
- Name and UXO Category of Person Providing Notification

- Location of Item (provide coordinates)
- Type of Item (provide digital photograph)
- Apparent Fuze Condition (armed or unarmed)
- Physical Condition (burned, broken, parts exposed/sheared, etc)
- Physical Appearance (buried, staged, etc.)
- Activity in Progress

The UXO Team Leader will attempt to identify the type and/or condition of the ordnance and its location, as described above, and will immediately report this information to the client point of contact at the facility and the Tt UXO Manager. Prior to any documentation being performed on a suspect MEC item, all fuzing will be definitively identified only if it is possible to safely do so visually without disturbing the item. If directed by the point of contact at the facility, UXO personnel may take emergency non-invasive action such as securing the area until the appropriate exclusion and safety zones have been determined.

The Navy point of contact at the facility will be responsible for notifying appropriate EOD personnel or for designating this notification task to the Tt UXO Team Leader. The notification to EOD personnel should be immediate if a live MEC item is encountered which could be a hazard to personnel, or if the item is unknown so that arrangements may be made through the facility for proper disposition of the item(s). If the facility initiates an emergency response or disposal action, follow-up documentation should be obtained to detail the date and method of disposition. This information is also needed to ascertain the actual type and condition of the item (live or inert filled) to aid in future classification of the site.

(2) If the MEC item cannot be identified by type as a conventional munition, and/or if in the unlikely event that the MEC is suspected to be potential Chemical Warfare Material (CWM), personnel will withdraw upwind from the area, assemble at a pre-designated rally point, secure the site, and immediately request assistance from the point of contact at the facility and notify the Tt UXO Manager. If so directed, UXO personnel will take emergency non-invasive actions such as covering the item with plastic sheeting and securing the area until the appropriate exclusion and safety zones have been determined.

(3) If Hazardous, Toxic, or Radiological Waste (HTRW) is encountered on-site, the work site will be evacuated until the Tt Project Health and Safety Officer, with concurrence of the client point of contact at the facility, identifies and implements appropriate protective measures.

For any of the scenarios, upon receiving notification from the Tt UXO Team Leader, the Tt UXO Manager will then immediately inform the Tt Project Manager, who will then immediately inform the client Project Manager. Tt Program Management personnel will then be notified. The client Project Manager will then make all other necessary notifications within the client's organization.

The following table lists contacts information.

Position	Name	Organization	Direct Dial Phone	Cell Phone
Project Manager	Mark Sladic	Tetra Tech	412.921.8216	
UXO Manager	Ralph Brooks	Tetra Tech	770.413.0965 - 231	404.661.4916
MCRD Parris Island POC	Tim Harrington	MCRD Parris Island	843.228.3423	
Navy RPM	Charles Cook	NAVFAC Southeast	904.542.6409	

ATTACHMENT 1

MEC TRACKING LOG
MCRD Parris Island, South Carolina
SITE:_____

ID #	ITEM IDENTIFICATION	UXO TECH NAME	ITEM COORDINATES	DATE/TIME FOUND	DIGITAL PHOTGRAPH NUMBER	ARMED / UNARMED	PHYSICAL CONDITION / APPEARANCE	DATE DESTROYED

STANDARD OPERATING PROCEDURE
MRP SOP 03
GEOPHYSICAL SURVEY

1.0 SCOPE AND APPLICABILITY

This operating procedure is designed to provide a regular set of guidelines for conducting geophysical surveys for Munitions Response Programs (MRPs). The general procedure is intended to apply to a wide variety of investigations (targets).

2.0 SUMMARY OF METHOD

Various military operations (transport, training, practice and experimental) over time have resulted in the deposition of a wide assortment of munitions of explosive concern (MEC), and a large effort is underway to search and remove such items from many of the active and inactive military sites across the country. MEC range from small objects (20mm) to large objects (bombs), and their potential abundance on a site can vary considerably as well. Geophysics is a non-intrusive approach often used to locate buried objects that could be MEC. Numerous steps are involved in selecting a geophysical approach, and they are described below.

All UXO Survey and avoidance activities and geophysical surveys will be carried out in accordance with all local, state, and federal regulations, and will include general guidance from applicable USACE Data Item Description requirements, including Engineer Pamphlet EP-75-1-2 dated 01 August 2004 (USACE 2004), Data Item Descriptions; MR-001 (USACE 2003a), MR-005-05A (USACE 2003c), MR-005-05 (USACE 2003d), and MR-005-07 (USACE 2003e). Additional guidance is provided in Ordnance and Explosives Digital Geophysical Mapping Guidance – Operational Procedures and Quality Control Manual (DGM QC Guidance) (USACE 2003f).

3.0 PERSONNEL QUALIFICATIONS

Personnel responsible for designing or conducting geophysical processes should possess education and training in geophysics to insure proper procedures are followed. Sub-contractors should possess similar personnel requirements when implementing a geophysical plan. Personnel will meet the requirements of USACE Data Item Description OE – 025.01 (USACE 2002) described below.

Project Geophysicist - This individual shall have a degree in geophysics, geology, geological engineering, or a closely related field, and shall have a minimum of 5 years of directly related geophysical experience. This individual has overall responsibility for design, implementation, and management of all geophysical investigations required for the work effort, but may not necessarily be on-site full time. This individual shall be the project geophysicist-of-record.

Site Geophysicist - This individual shall have the same education requirements as the Project Geophysicist, except the 5 years minimum experience requirement is waived, if working under the general supervision of a Project Geophysicist. This individual is responsible for day-to-day

operations of the site geophysical investigations. This individual may also be the Project Geophysicist if he/she meets the qualifications of "Project Geophysicist" above.

4.0 SURVEY DESIGN

Several considerations must be taken into account when designing a geophysical survey:

Site Preparation: Sites suspected to contain MEC must be inspected by a properly qualified UXO technician. The inspection will include, as a minimum, a visual inspection as well as possibly assisted by a hand-held magnetic or all-metals locator. This is to ensure safety for setting monuments or survey stakes, and in collecting the survey data. All movable aboveground metal should be removed from the site prior to commencement of the geophysical survey in order to obtain subsurface information (not be interfered with by the aboveground metal that could mask subsurface metal).

Vegetation can also create limitations for survey coverage. Brush cutting and vegetation clearing may be necessary to acquire geophysical data.

Equipment Selection: An understanding of the nature of the suspect MEC must be established first in order to select the proper equipment for the survey site.

Magnetometer surveys are selected when the potential MEC targets are comprised of a substantial ferrous (iron) component, and the site is expected to have low levels of cultural 'noise' (ex. power lines, scrap mixed in with the soil, numerous aboveground metallic objects that cannot be removed from the survey area). Maximum prospecting depth is limited by the strength of the magnetic field for the potential MEC (controlled by the mass, diameter and orientation of the buried metallic object). Sensor height will be determined by the Geophysicist based on the nature of site conditions and expected target sizes and depths.

EM induction surveys are selected when the potential MEC targets are comprised of a significant component of any type of metal. Normally maximum prospecting depths are limited to about 12 to 18 feet below ground surface for the largest potential targets, but will range to very shallow depths for small metallic objects.

Certain geologic conditions may be prohibitive to the success of a geophysical survey, and in such cases a pilot test or Geophysical Prove Out may be required to determine whether the survey equipment can detect the buried targets. Examples of such conditions include ultra-mafic soils or shallow bedrock, high electrically conductive soils (perhaps fill containing scrap metal) or salt water conditions which can interfere with the detection capabilities of the survey equipment.

Survey Coverage: Expected target sizes, anticipated burial depths and the target metal mass must be evaluated by the Geophysicist in order for proper selection of survey line spacing given the selection of geophysical equipment in order to possess a high level of confidence that the project goals can be accomplished. Surveys conducted using 2.5 ft line spacing with an EM61 or G-858 magnetometer will provide 100% effective survey coverage for most MEC targets. Conversely, in cases where a reconnaissance survey is needed, meandering path or non-traditional survey

geometries may be substituted to accomplish the project goals. In all cases, consideration must be given to past, current and future land uses to assure that the survey approach meets the client objectives.

Survey Location: Locating survey lines (data) can be accomplished in a few ways. The level of accuracy needed and the surrounding site features will help determine the acceptable location technique. Small survey areas may be located with a high level of accuracy using tape measures to create survey lines (grids). The grids may then be referenced directly to permanent and semi-permanent site features.

Larger survey areas or survey areas in remote areas may need a different location method to maintain a high level of accuracy. Professional surveying or integrating DGPS measurements with the geophysical data can be used in large areas to maintain high location accuracy. Numerous GPS units (DGPS) are readily available to achieve sub-meter accuracy. Specialized GPS units (Real Time Kinematic or RTK) should be employed when sub-foot accuracies are needed. GPS units do not normally operate effectively in wooded areas, and professional surveying or total stationing methods may be required for high level accuracy in those areas. Alternatively, wooded survey areas may be established by tape measure, followed by GPS (where a clear GPS signal can be received), total stationing or professional surveying of several survey grid points or corners.

Data Sampling: Data must be collected at intervals to satisfactorily sample the anticipated targets. Expected target sizes, anticipated burial depths and the target metal mass must be evaluated by the Geophysicist in order for proper selection of data sampling intervals. Data station intervals will normally be determined from the movement speed along the survey lines with respect to the data initiation interval (normally automatic or sometimes manual as a function of time). Measurements may be triggered by a survey wheel attached to the survey instrument when sufficient data density can be achieved. Calibration of the survey wheel may be needed depending on the instrument setup.

5.0 EQUIPMENT

Instrument Checks:

Equipment Standardization. Geophysical sensors and support equipment, navigation equipment, and operator performance will be checked and tested at specific intervals and must meet the appropriate acceptance criteria. Table 1 lists the tests, and their required frequencies and acceptance criteria modified from USACE Engineering Pamphlet (EP) 75-1-2 (2004). These tests plus the initial out-of-box tests are detailed below.

Out-of-Box-Tests. The following out-of-box procedures will be conducted before the pre-seed geophysical survey of the test plot area begins:

- Inventory and inspect all equipment to confirm all components are present and in good condition.
- Assemble the equipment and power up.

Regular Tests

1. **Equipment/Electronics Warm-Up.** This test minimizes sensor drift caused by thermal stabilization. Most instruments need a few minutes to warm up before data collection begins. All manufacturer instructions will be followed or, if none are given, data readings will be observed until they stabilize. Acceptance Criterion: Equipment Specific (typically 5 minutes). This test will be conducted each time the unit is started.

2. **Equipment Null.** The EM61 equipment should be nulled before data collection at each site. The units should be nulled in areas determined to represent background levels (non-anomalous areas 'quiet areas').

3. **Record Sensor Positions.** The purpose is to document relative navigation and sensor offsets, detector separation, and detector heights above the ground surface. This information will ensure that the detector offset corrections and gradient calculations can be done correctly and that the surveys are repeatable. Acceptance Criterion: ±2 inches. This test will be conducted at the beginning of the 1st day and when an equipment configuration change is made.

4. **Personnel Test.** This test ensures that survey personnel have removed all potential interference (metal) sources from their bodies. Common interference sources are ballpoint pens, steel-toe boots, or large metallic belt buckles, which can produce data anomalies similar to OE targets. All personnel who will be coming near the sensor during survey operations should remove metallic items from themselves, and if not possible then readings should be monitored and recorded to judge the effect of the metallic items in order to meet the following acceptance criteria. Acceptance Criterion: EM 61 2 mV, magnetometer 2 nT. This test will be conducted at the beginning of each day if the operator is wearing metallic items that could interfere with equipment operation..

5. **Static Background and Static Spike (or Standard Response) Test.** These tests quantify instrument background readings and electronic drift, locate potential interference spikes in the time domain, and determine impulse response and repeatability of the instrument to a standard test item (typically a 2-inch-diameter steel trailer hitch ball). Improper instrument function, the essence of local sources of ambient noise (such as EM transmissions from high-voltage electric lines), and faulty equipment are all potential causes of inconsistent, non-repeatable readings. A minimum of 3 minutes static background test after instrument warm-up, followed by a 1-minute standard response test, in turn followed by an additional 1 minute static background test, will be performed. The field geophysicist must review the readings to confirm they are stable before the geophysical survey continues. Guidance Criteria: Static Background test EM 61 ± 3 mV, magnetometer ± 5 nT; Static Response Test ±20% of standard item response after background correction. This test will be conducted at the beginning of each day.

6. **Base-Line Test.** This test is conducted in an area that has low background noise and no sources of anomalous response. The test line will be well marked to facilitate data collection over exactly the same line each time the test is performed. The test may need to be conducted at the beginning, middle and end of each day to check for instrument drift (baseline shift in data values) or in the situation where a magnetic base station is not used during a magnetometer survey in order to make any necessary data value adjustments.

7. **Pull-Away Test.** This test demonstrates the effects of the navigational equipment. All equipment will be powered up and operating as it would be during the survey. Acceptance Criterion: document the effects of the navigational equipment on the geophysical readings. Effects should be small. Test should be performed before the geophysical survey begins, and if the equipment configuration changes during the survey.

8. **GPS Positioning.** The GPS positioning system will be tested by surveying two survey control points. The GPS coordinates are compared with the documented coordinates for the control points. Acceptance Criterion: sub-meter or better (based on project requirements). Test should be performed as a minimum at the beginning of the project and if an equipment change is made. GPS survey instruments should also be closely monitored during field acquisition by using Dilution of Precision (DOP) criteria, or as a minimum # of satellite signals received criteria. DOP should normally be less than 3 to obtain high quality results, and at least 6 satellites should also indicate high quality results.

   Latency is an issue when a separate GPS controller (from the geophysical controller) is used to acquire the GPS data. If separate controllers are used, care should be taken to synchronize the clocks in both the GPS and geophysical units, and a test must be set up to measure the latency inherent in using two different accuracy clocks. The test should consist of positioning oneself overtop of a linear metallic object (ex. pipe) at several points and recording data with the all of the survey equipment, and again using only the GPS equipment to compare the results and determine the necessary adjustment.

9. **Azimuth Test.** The purpose of this test is to optimize the sensor orientation to avoid optically pumped magnetometer sensor "dead zones", and obtain a strong signal strength.

6.0 QUALITY ASSURANCE / QUALITY CONTROL

All documentation will be available to base personnel. Operational and test procedures will conform to the manufacturer's standard instructions. QC of the instruments' data will be achieved daily by field testing, checking the sensor and navigation system against a known target to ensure that they are operating properly. All geophysical instruments and equipment used to gather and generate field data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of the results are consistent with the manufacturer's specifications. Calibration, repair, or replacement records will be filed and maintained by the field geophysicist and may be subject to audit by the quality assurance (QA) manager. Potential data problems include source data errors, data entry errors, data editing errors, and user errors. All data will be reviewed to identify and correct any of these errors should they occur.

7.0 FIELD REPORTING AND RECORDS MANAGEMENT

Field data sheets/notes will be maintained for all geophysical activities. This SOP contains copies of the field forms and checklists. Project documentation will be collected and managed on-site during the life of all field activities. Geophysical data will be recorded digitally and downloaded to a field computer for review in the field. In addition to the copy of data saved on

the field computers hard drive, a copy of the data will be saved on a compact disk (CD) for backup before the data are erased from the equipment. The project geophysicist will review the downloaded data to verify that the download system is functioning properly. This review will also check the field data for QC review. The review will verify that the data are valid and useable for the intended purpose.

8.0 INSTRUMENT TEST STRIP

An instrument test strip (ITS) will be performed to evaluate geophysical surveying techniques and personnel that will apply to MEC sites. ITSs are important in testing the survey technique to determine whether it is capable of detecting the target items.

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Instrument Test Strip

The specific objectives for the Instrument Test Strip (ITS) will be:

- Determine whether the proposed geophysical technique is appropriate for this type of investigation.
- Provide a safe area with a known set of isolated objects (for example, single inert UXO). The sensor signatures from these items may be used to evaluate the equipment limitations in the site geologic setting and to optimize equipment, procedures, and data analysis.
- Assess the operators' performance and update related procedures to assist in the development of operator measurement techniques.
- Establish a baseline of performance capabilities for the selected instruments.
- Evaluate average speed and minimum along-track sampling required to detect target items.
- Evaluate all data processing (see MRP SOP 04 named Geophysical Data Processing and Analysis), including distance corrections, map production, and target selection, to produce final datasets.
- Detect items within the USACE's 11x rule, which states that generally munitions can typically be detected within a depth equal to 11 times their diameter.
- Identify horizontal positions of detected seed items to be within project specified accuracy or better (depending on investigation goals).

Test Plot/Test Strip Design. The proposed test plot/test strip layout shall be included in the work plan, and the following recommendations from USACE Data Item Description MR-005-05A, Revision 1 December 2003 should be used as guidelines for establishing the ITS:

a. Plot Size and Location. Selection of the plot area should be based upon the technical and site-specific considerations developed and finalized during the TPP process and/or project team

meetings, and follow anticipated layout for project data collection. It may be advantageous to plan the ITS location outside of areas where digging is restricted to UXO technicians and/or oversight by UXO technicians.

b. Seed Items. Describe the planned seeding methodology for known items. In addition to the known seed items. Once placed, all seeded items and corner markers should be surveyed and photographed. The planned ITS target layout plan shall be updated to reflect the "as built" configuration. The seeded items should be tagged with a non-biodegradable label identifying the items as inert and providing a contract reference, a point of contact address, phone number, and a target identifier.

   A tabulated list, available in digital format, containing the seed items, ID numbers, depths, proposed orientation (or survey information on the nose, tail, and center point of the item) shall be included. Inert munition items should be used whenever possible.

c. Site Preparation. Describe any preparation that may be necessary to allow accessibility with geophysical instruments. This may include vegetation removal and/or surface clearance. After this step, the test plot should duplicate, as closely as possible, the conditions under which the geophysical surveys will be conducted.

d. Location Surveying. Describe the location methods to be employed. The location of the test plot corners and seed items shall be surveyed to a horizontal accuracy established during the TPP process and/or project team meetings.

e. Pre-Seeding (Background) Geophysical Mapping. Describe background geophysical mapping. After a site has been selected and the surface prepared, pre-seeding geophysical surveys shall be performed with each detector type in order to determine and document base-line geophysical conditions at the site.

f. Quality Control. Describe Quality Control measures to be implemented.

g. Anomaly Avoidance. Anomaly avoidance will be performed by all site workers for all anomalies located, visually or with metal detectors, during preparation of the test plot site. A statement that the contractor shall use anomaly avoidance techniques shall be included. This is to ensure the location of each excavation and corner marker/stake is clear of metallic anomalies before placing seed items or site corner markers, and includes utilizing the background geophysical data.

h. Data Collection Variables. It is important to collect and analyze test plot data using the same equipment and procedures that are planned for field use. It is strongly recommended that key personnel from the ITS perform the production survey to minimize the learning curve and provide project continuity. Some data collection elements are subject to modification and evaluation and multiple geophysical surveys using each proposed geophysical instrument may be performed. These elements include: instrument height, instrument orientation and direction of travel, instrument channel selections, measurement interval along survey line, lane width, etc.

i. Data Analysis and Interpretation. All data collected from each geophysical instrument will be post-processed and analyzed. It is required that all data channels are analyzed to ensure the best methodology is established for each site.

j. Data Evaluation. The geophysical data must be evaluated and scored so that the different geophysical approaches can be compared and ranked. No single geophysical system is likely to achieve maximum scores in all evaluated areas. Therefore, the evaluation team must determine which approach is likely to be most efficient for the site.

ITS Approval and Reporting.

After the ITS field work has been completed, the contractor shall present the data to the Project Geophysicist and Project Manager, or the Project Manager's designee for approval prior to site work. The stationary positioning of the seed items must be shown relative to the data to provide comparison of the anomaly location with the seed item location to evaluate positional accuracy. The results of the ITS will be summarized in the geophysical report and will include:

a. As-built drawing of the ITS plot;
b. Pictures of the seed items;
c. Profile and/or contour maps of the geophysical data;
d. Summary of the ITS results;
e. Proposed geophysical equipment, techniques, and methodologies; and
f. Sufficient supporting information to justify the project team's recommendations.

The Contractor may not proceed with production geophysical mapping until the designated project team member approves the ITS results.

Table 1: Geophysical Equipment QC Tests
Munitions and Explosives of Concern Sites
Military Munitions Response Program

Test No.	Test Description	Acceptance Criteria	Power On	Beginning of Day	Beginning, Middle and End of Day	1st Day on Site
1	Equipment Warm-up	Equipment Specific (typically 5 minutes)	X			
2	Equipment Null	Conduct in non-anomalous areas				X
3	Record Sensor Positions	± 2 inches				X
4	Personnel Test	EM61 2 mV p-p (channel 3 on MkII), magnetometer 2 nT		X		
5	Static Background and Static Spike	Background: EM61 ± 3 mV p-p, magnetometer ± 5 nT. Spike: ± 20% of standard item response, after background correction		X		
6	Base-Line Test	Check for instrument drift /diurnal ch. (to correct data readings if needed)			X (EM31 or MAG)	
7	Pull Away Test	Navigation equipment should have minimal effect on readings				X
8	GPS Positioning	Positional Accuracy: sub-meter				X
9	Azimuth Test	Strong signal strength, no dropouts				X

Notes: cm – Centimeter, mV – Millivolt, mmho/m – Millimho per meter, ppt – parts per thousand, nT – nanotesla

TETRA TECH NUS, INC.

DAILY QUALITY CONTROL REPORT	
Contract Number:	Project:
Location:	Date:
List Features of Work and Equipment Used, Locations (areas surveyed), and List Personnel Present	
Rework Items Identified Today (Not Corrected by Close of Business)	Rework Items Corrected Today
Remarks/Describe any Idle or Downtime and/or Equipment Problems	
On behalf of the contractor, I certify that this report is complete and correct and the equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge except as noted in this report.	ERT Representative Date
Tetra Tech Quality Assurance	
Quality Assurance Representative Remarks and/or Exceptions to the Report	
Inspection of Field Activities Performed	Tetra Tech QA Representative Date

TETRA TECH NUS, INC.

DAILY INSTRUMENT	ITS REPORT

Project Name:	Project No:	Location:	Date:

I. Test Plot Information

Item Number	Inert Item/Surrogate Description	Depth (inches)	Azimuth/ Inclination Angle(Degrees)	Comments
1				
2				
3				
4				
5				
6				
7				
8				

II. Instrument Information

Instrument Type/Manufacture	Instrument Serial Number	Test Plot Items Instrument Tested on (List Item Numbers)	Settings On Instrument Tested (As Per WP)	Test Results, ☒ indicates good for operation	Personnel Testing Equipment	Comments
				☐		
				☐		
				☐		
				☐		

III. Problems Encountered / Corrective Actions Taken / Additional Comments.

explain in space below:

IV. Supervisor

Name and Signature:	Title/Company:	Date:

TETRA TECH NUS, INC.

QUALITY CONTROL SURVEILLANCE REPORT	Report Number:
Project Name:	Contract No:
Client:	Project Manager:

1 - Activity

☐ Project Readiness UFP-SAP Review	☐ Pre-Operational Team Training Review	☐ Mobilization/Site Preparation	☐ Brush Cutting and Vegetation Clearance
☐ Pre-Survey ITS Review	☐ Daily Function Test	☐ UXO Detector-Aided Surface Sweeps/Quality Control Check	☐ UXO Detector-Aided Surface Sweep Field Data Collection &Transcription
☐ Geophysical Survey	☐ Geophysical Survey Field Data Collection and Transcription	☐ GPS Data	☐ Demobilization
☐ Other:	☐ Other:	☐ Other:	☐ Other:

2 - Phase

☐ Preparatory	☐ Initial	☐ Follow up

3 - References [(1)]

4 – Observed Condition/Activities and Comments [(1)]

5 – Results of Surveillance

☐ Acceptable	☐ Unacceptable	Deficiency #: NCR #:
Conducted By:	Signature:	Date:

6 – Project Manager Review

☐ Concur ☐ Non-Concur	Signature:	Date:

7 - Distribution

☐ PM ☐ FOL ☐ SUXOS ☐ UXO Manager ☐ Safety ☐ Other:

[(1)] **Add / reference continuation sheets as necessary.**

TETRA TECH NUS, INC.

ITS Checklist

Project Name: _____
Project Location: _____
Name and Title: _____
Date: _____

Objectives

Have survey objectives been determined, clarified, and documented?	Y	N	NA
Will the ITS be available during the project for the evaluation of suspected instrument malfunctions or evaluation of new equipment and operators?	Y	N	NA

Site Preparation

Has surface clearance been performed?	Y	N	NA
Has background geophysical survey been performed before burial?	Y	N	NA

ITS Seeding

Have the following steps been taken to ensure accurate locations for the seeded items:

Thorough notes taken on each item's burial?	Y	N	NA
Measure depth to top and center of mass of each object?	Y	N	NA
GPS or a land surveyor employed to record the position of each item?	Y	N	NA

Checklist for Out of Box Equipment Tests

Project Name: _____
Project Location: _____
Name and Title: _____
Date: _____

Has the equipment been inventoried and inspected for damage or wear?	Y	N	NA
Are spare parts (cables) included with the system?	Y	N	NA
Has the cable shake test been performed? (Replace any fault components)	Y	N	NA

Checklist for Initial Instrument Tests

Project Name: _____
Project Location: _____
Name and Title: _____
Date: _____

Has the sensor travel test been performed (for underwater surveys), and are the results acceptable to meet survey objectives?	Y	N	NA
Has the GPS unit been checked for accuracy requirements against two known locations?	Y	N	NA
Has the optimum sensor height for each instrument been determined?	Y	N	NA
Have the pull-away and/or interferences tests been performed and successfully demonstrated no influence for navigational or towing equipment?	Y	N	NA
Has an appropriate data acquisition rate been selected?	Y	N	NA

Checklist for Daily Instrument Checks

Project Name: _____
Project Location: _____
Name and Title: _____
Date: _____

Has the operator been checked for presence of metal?	Y	N	NA
Has the instrument been warmed-up?	Y	N	NA
Have the sensor positions been measured and recorded?	Y	N	NA
Has a static background and spike test been performed successfully?	Y	N	NA
Has the equipment function test been performed with detection of all the test targets?	Y	N	NA
Have all loose cables been secured?	Y	N	NA
Has the EM61 been nulled (power on)?			
Has the G-858 been set up according to manufacturer's specifications?	Y	N	NA
Were the data monitored during data collection for anything unusual?	Y	N	NA

Checklist for Field Editing

Project Name: _____
Project Location: _____
Name and Title: _____
Date: _____

Have the following items been evaluated for correctness and edited if necessary:

Line numbers?	Y	N	NA
Start and end points?	Y	N	NA
Line direction?	Y	N	NA
Fiducial locations?	Y	N	NA

Have the data been examined for geophysical noise?	Y	N	NA
Have the data been examined for the presence of drop-outs and spikes?	Y	N	NA
Have the edited data been converted to the appropriate .xyz format?	Y	N	NA

If using magnetics, have the following steps been taken:

Examined base station data for any problems?	Y	N	NA
Performed diurnal correction to field magnetometer data?	Y	N	NA

Have the positional data been evaluated for accuracy and completeness?	Y	N	NA

STANDARD OPERATING PROCEDURE
MRP SOP 04
GEOPHYSICAL DATA PROCESSING AND ANALYSIS

1.0 SCOPE AND APPLICABILITY

This operating procedure is designed to provide a regular set of criteria to be taken into account during data processing and analysis for geophysical surveys performed as part of Munitions Response Programs (MRPs). The general procedure is intended to apply to a wide variety of investigations (targets).

2.0 BACKGROUND

The way in which data processing and analysis is performed is dependent on the type of geophysical method employed. We focus here on the two most common general methods used on MRP sites: magnetics or magnetometry (MAG) and electromagnetic induction (EMI). Initially data are recorded electronically during fieldwork and subsequently downloaded to computer. From there, specific equipment-related (proprietary) software is used to process the data for navigation, correction factors, filtering and ultimately for exporting data files that can be read by a data contouring package. The government has partnered with Geosoft, Inc. in order to develop a data contouring package specifically optimized for MRP geophysical data (Oasis Montaj w/UX Detect module). Contour maps or data profiles and dig sheets (anomaly locations) are normally produced as end products of the geophysical survey.

3.0 PERSONNEL QUALIFICATIONS

Personnel responsible for processing should possess education and training in geophysics to insure proper procedures are followed. Personnel will meet the requirements of USACE Data Item Description OE – 025.01 (USACE 2002) for a Project Geophysicist or for a Site Geophysicist that is directly under the supervision of the Project Geophysicist.

4.0 PROCESSING AND ANALYZING

Standard corrections will be applied to the data using equipment-specific (proprietary) software and by using Geosoft's Oasis Montaj software. Instrument settings and survey line spacing should be taken into account during data processing to properly represent the data. Diurnal corrections, corrections to navigation (geometry) and rotation or translation of coordinate systems, removal of data spikes (judged to be artificial) and dropouts, corrections for fiducial marks, instrument drift and leveling, heading error corrections, and latency corrections may be items to address during processing. Filtering and enhancements may also be needed depending on the nature or quality of the data.

The data analysis performed by the Project Geophysicist or under his/her direct supervision will focus on identifying anomaly responses that could represent MEC. A detailed map and anomaly investigation report will be produced [ex. dig sheet, Data Item Description MR-005-05 (USACE, 2003c)] depicting the northing and easting of all anomalies that meet the identification criteria of

potential ordnance items for the site, and actual data stations locations will also be provided. Each anomaly will be assigned a unique reference number for potential field reacquisition.

STANDARD OPERATING PROCEDURE
MUNITIONS RESPONSE PROGRAM (MRP) SOP 05
GPS DATA COLLECTION AND TRANSFER

1.0 OVERVIEW

The primary purpose of this Standard Operating Procedure (SOP) is to provide the Field Technicians with basic instructions for operating a handheld Global Positioning System (GPS) unit allowing them to set GPS parameters in the receiver, record GPS positions on the field device, and transfer the data for integration into existing Geographic Information System (GIS) figures.

This SOP is specific to GIS quality data collection for Trimble-specific hardware and software.

If possible, the Trimble GeoXT or XH Operators Manual should be downloaded onto the operator's personal computer for reference before or while in the field. The manual can be downloaded at the following website:
http://trl.trimble.com/docushare/dsweb/Get/Document-311749/TerraSyncReferenceManual.pdf

Unless the operator is proficient in the setup and operation of the GPS unit, the Project Manager (or designee) should have the GPS unit shipped to the project-specific contact listed below in the Pittsburgh, Pennsylvania office at least five working days prior to field mobilization so project-specific data files (i.e. shape files), background images, data dictionaries, and correct coordinate systems can be uploaded into the unit.

Tetra Tech NUS
Attn: Ralph Basinski
661 Anderson Drive, Bldg #7
Pittsburgh, PA 15220

The SOP also describes how field collected data is to be transferred through the use of the MRP Website. (http://www.ttnus.com/MRPRepository/). This website serves as a centralized portal to facilitate data exchange for field personnel, GIS staff, and project managers. The website contains a "Reference" page that will contain the latest version of this SOP and other valuable documentation.

For technical questions regarding operation of the GPS units and data collection, please contact John Wright (john.wright@tetratech.com). For general questions about this SOP and use of the MRP website, please contact Mark Maguire (mark.maguire@tetratech.com).

2.0 REQUIRED EQUIPMENT

The following hardware and software should be utilized for locating and establishing GPS points in the field:

2.1 GPS Hardware & Equipment

- Hand-held GPS Unit capable of sub-meter accuracy. This includes the docking cradle, a/c adapter, stylus, and USB cable for data transfer. Two models, the GeoXH and GeoXT, are acceptable for use. The XH yields higher accuracy (in both real-time and post-processed) and should always be requested when highly precise data is required.

- An external antenna will yield better satellite reception, especially in heavy tree canopy. Associated accessories include a range pole and hardware clamp, for mounting the GPS unit to the pole.

- Indelible marker.

- Non-metallic pin flags for temporary marking of positions.

2.2 GPS Software

The following software is required to transfer data from the handheld GPS unit to a personal computer:

- Trimble TerraSync version 2.6 or later (pre-loaded onto GPS unit from vendor)

- Microsoft ActiveSync version 4.5 or later. Download to personal computer from:
  http://www.microsoft.com/windowsmobile/en-us/downloads/microsoft/activesync-download.mspx

  Note: Windows Vista and Windows 7 users should download Windows Mobile Device Center version 6.1 or later from the following site, if it is not already loaded on the machine:
  http://www.microsoft.com/windowsmobile/en-us/downloads/microsoft/device-center-download.mspx

- Trimble Data Transfer Utility (freeware version 2.1 or later). Download to personal computer from:
  http://www.trimble.com/datatransfer.shtml

3.0 START-UP PROCEDURES

Prior to utilizing the GPS in the field, ensure the unit is fully charged. The unit may come charged from the vendor, but an overnight charge is recommended prior to fieldwork.

The Geo-series GPS units require a docking cradle for both charging and data transfer. The Geo-series GPS unit is docked in the cradle by first inserting the far domed end in the top of the cradled, then gently seating the contact end into the latch. The power charger is then connected to the cradle at the back end using the twist-lock connector. Attach a USB cable as needed between the cradle (B end) and the laptop/PC (A end).

It is recommended that the user also be familiar and check various Windows Mobile settings. One critical setting is the Power Options. The backlight should be set as needed to conserve power when not in use.

3.1 Initial Start Up

1) Power on the GPS unit by pushing the small green button located on the lower right front of the unit.

2) Utilizing the stylus that came with the GPS unit, launch **TerraSync** from the Windows Operating System by tapping on the start icon located in the upper left hand corner of the screen and then tap on **TerraSync** from the drop-down list.

3) If the unit does not default to the Setup screen, tap the Main Menu (uppermost left tab, just below the Windows icon) and select Setup.

4) If the unit was previously shipped to the Pittsburgh office for setup, you can skip directly to Section 4.0. However, to confirm or change settings, continue on to Section 3.1.

3.2 Confirm Setup Settings

Use the Setup section to confirm the TerraSync software settings. To open the Setup section, tap the Main Menu and select Setup. (Note that if the unit was shipped from the Pittsburgh office, these settings should have been set for your specific project. Feel free to contact Pittsburgh staff with any questions.)

1) Tap on the Coordinate System.
2) Verify the project specs are correct for your specific project by scrolling through the various settings. Edit as needed and then tap OK; otherwise, tap Cancel to return to Setup Menu. **Note:** It is always best to utilize the Cancel tab rather than the OK tab if no changes are made since configurations are easily changed by mistake.
3) Tap on the Units.
4) Verify the user preferences are correct for your specific project by scrolling through the various settings. Edit as needed and then tap OK; otherwise, tap Cancel to return to Setup Menu.
5) Tap Real-time Settings.

6) Verify the Real-time Settings are correct for your specific project by scrolling through the various settings. Edit as needed and then tap OK; otherwise, tap Cancel to return to Setup Menu.
7) The GPS unit is now configured correctly for your specific project.

3.3 Antenna Connection

1) If a connection has been properly made with the internal antenna, a satellite icon along with the number of usable satellites will appear at the top of the screen next to the battery icon. If no connection is made (e.g.: no satellite icon), tap on the GPS tab to connect antenna.
2) At this point the GPS unit is ready to begin collecting data.

3.4 Loading a Background file

This section provides instructions on pulling in a pre-loaded background file. These files are helpful in visualizing your current location.

1) From the Main Menu select Map, then tap on Layers, select the background file from drop down list.
2) Select the project-specific background file from the list of available files.
3) Once the selected background file appears, the operator can manipulate the screen utilizing the +/- and <-/-> functions at the bottom of the screen.
4) In operating mode, the operator's location will show up on the background file as a floating "x".

4.0 FIELD DATA COLLECTION

For MRP data collection activities, a new GPS file should be created **every day** and transferred **nightly** using the MRP website (see Section 9.0). This is to insure the timely transfer of data, file organization in the database, and allow for next-day GIS mapping. Also, individual GPS data files should be **unique to a particular site** or unit (typically a UXO number). If multiple sites are visited in a single data, multiple files should be created.

4.1 Creating a Data File

1) From the Main Menu select Data.
2) From the Sub Menu (located below the Data tab) select New which will bring up the New Data File menu.
3) An auto-generated filename appears and should be edited for your specific project. The following naming convention should be followed as closely as possible: **IH-UXO4-01012010-TeamA**, where "IH" is the installation abbreviation (Indian Head), "UXO04" is the site, and "01012010" is the data in MMDDYYYY format. If multiple teams are being deployed across an individual site on the same day, it is important to specify the

field team name at the end of the file name ("TeamA"). If the integral keyboard does not appear, tap the small keyboard icon at the bottom of the screen.

4) Select the data dictionary that will be used to collect features. The data dictionary provides predefined fields and drop-down menus to facilitate data collection as it relates to specific MRP data types. The MRP data dictionary is entitled "**MRP Data Collection**" and should appear in the data dictionary drop-down list. This should have been pre-loaded into the GPS prior to use. The data dictionary file is available on the MRP website under the "Reference" section.
5) After entering the file name and selecting the data dictionary, tap Create to create the new file.
6) Confirm antenna height if screen appears. Antenna height is the height that the GPS unit will be held from the ground surface (Typically 3 to 4 feet)
7) The Choose Feature screen appears.

4.2 Collecting Features

1) If not already open, the Collect Feature screen can be opened by tapping the Main Menu and selecting Data. The Sub Menu should default to Collect.
2) **<u>Do not</u> begin the data logging process until you are at the specific location for which you intend to log the data.**
3) A known reference or two should be shot at the beginning and at the end of each day in which the GPS unit is being used. This allows for greater accuracy during post-processing of the data.
4) Upon arriving at the specific location, select the proper feature type from the data dictionary list (MEP Object, Transect End Point, GPS QC Point, or General Point).
5) Tap Create to begin data logging.
6) As the GPS is collecting positions, enter the feature attributes, starting with the Item ID. This field is required and will not allow the user to continue or save the position without entering a value. Enter any additional notes or feature descriptions in the appropriate fields.
7) Data logging can be confirmed by viewing the writing pencil icon in the upper part of the screen. Also, the logging counter will begin. As a Rule of Thumb, accumulate a minimum of 20 readings on the counter, per point, as indicated by the logging counter before saving the GPS data.
8) Once the counter has reached a minimum number of counts (i.e. 20), tap on OK to save the data point to the GPS unit. Confirm the feature. All data points are automatically saved within the GPS unit.
9) Repeat steps 2 through 8, giving each data point a unique name or number.

Note: If the small satellite icon or the pencil icon is blinking, this is an indication the GPS unit is not collecting data. A possible problem may be too few satellites. While still in data collection mode, tap on Main Menu in upper left hand corner of the screen and select Status. Skyplot will display as the default showing the number of available satellites. To increase productivity (number of usable satellites) use the stylus to move the pointer on the productivity and precision line to the left. This will decrease precision, but increase productivity. The precision and productivity of the GPS unit can be adjusted as the number of usable satellites changes throughout the day. To determine if GPS is correctly

recording data, see Section 5.2. If the precision toggle is decreased, the user should frequently check the Skyplot display to restore the default values as soon as possible.

4.3 Navigation

This section provides instructions on navigating to saved data points in an existing file within the GPS unit.

1) From the Main Menu select Map.
2) Using the Select tool, pick the point on the map to where you want to navigate.
3) The location you select will have a box placed around the point.
4) From the Options menu, choose the Set Nav Target (aka set navigation target).
5) The location will now have double blue flags indicating this point is you navigation target.
6) From the Main Menu select Navigation.
7) The dial and data on this page will indicate what distance and direction you need to travel to reach the desired target.
8) Follow the navigation guide until you reach the point you select.
9) Repeat as needed for any map point by going back to Step 1.

4.4 Data Quality Control

Quality control checks should be performed each day of data collection and/or data navigation. QC checks are important both to understand real-time accuracy while in the field, and also to provide control data needed during post-processing.

1) Known survey benchmarks, surveyed monitoring wells, or other established and documented control points should be identified
2) GPS equipment should be placed on known control points and positions recorded
3) For data collection tasks - QC check data should be collected at least at the start and completion of the fieldwork for the day of data collection. Additional occupation and collection of control point data should occur as possible during the work day, and should increase in frequency as the number of data points increase and the need for accurate data collection increases
4) For navigation tasks such as stake placement for planned sample locations, QC data checks should be done at least at the start and completion of the fieldwork for each day. Known visible targets should be occupied and observed by the user, while the GPS satellite status and other user interface data is reviewed. The user should assess whether the real-time accuracy settings on the GPS are within the tolerance of the observed visual reference points.

4.5 Viewing Data or Entering Additional Data Points to the Current File

1) To view the stored data points in the current file, tap on the Main Menu and select Map. Stored data points for that particular file will appear. Use the +/- and <-/-> icons in lower left hand corner of screen to zoom in/out and to manipulate current view.
2) To return to data collection, tap on the Main Menu and select Data. You are now ready to continue to collect additional data points.

4.6 Viewing Data or Entering Data Points from an Existing File

1) To view data points from a previous file, tap on Main Menu and select Data, then select File Manager from the Sub Menu.
2) Highlight the file you want to view and select Map from the Main Menu.
3) To add data points to this file, tap on Main Menu and select Data. Continue to collect additional data points.

4.7 Shutting Down

This section provides instruction for properly shutting down the GPS unit.

1) When shutting down the GPS unit for the day, first click on the "X" in the upper right hand corner.
2) You will be prompted to ensure you want to exit TerraSync. Select Yes.
3) Power off the GPS unit by pushing the small green button located on the bottom face of the unit.
4) Place the GPS unit in its cradle to recharge the battery overnight. Ensure the green charge light is visible on the charging cradle.

5.0 DATA TRANSFER

This section describes how data should be downloaded from the GPS units and uploaded to a central website for post-processing and integration into GIS datasets. GPS data collected on a given day should be transferred **that night** for post-processing by GIS staff the next morning. Once post-processed, the GPS data will be plotted on a map and be immediately provided to the project team for review. Data upload, download, and review will be facilitated through a secure MRP website: http://www.ttnus.com/MRPRepository/

5.1 Load Data from the GPS Unit to Your Computer

1) Install the Data Transfer and ActiveSync software installed on your PC (see section 2.2)
2) Connect the GeoXH/XT to your PC via an A/B USB cable (blade end and square end type "HP printer" style)
3) ActiveSync should auto-detect the connection and recognize the data collector
4) Make sure the data file desired is CLOSED in TerraSync prior to transfer
5) Connect via ActiveSync as a guest (not a partnership)

6) Run the Trimble Data Transfer Utility program on your PC
7) Select "***GIS Datalogger on Windows CE***" or similar selection
8) Hit the green connect icon to the right - the far right area should say "***Connected to ....***" if successful
9) Select the "***Receive***" data tab (under device)
10) Select "***Data***" from file types on the right
11) Find the file(s) needed for data transfer. You can sort the data files by clicking on the date/time header
12) Select or browse to a C-drive folder you can put this file for upload
13) When the file appears on the list, hit the "***Transfer All***". Once complete, a packet of multiple data files will appear on your computer in the specified folder.

5.2 Gain Access to MRP Website

1) Confirm that your computer has internet access
2) Click on the following link: http://www.ttnus.com/MRPRepository/
3) To register for the website, click on the "Register here" link. Enter your information and click "Submit." NOTE: Requests for registration are sent to Ralph Basinski, Program Manager, for approval. Please contact mark.maguire@tetratech.com if you experience any access issues.
4) Enter your username (Tetra Tech email address) and password to log in.

5.3 Upload GPS Data from Your Computer to the MRP Website

1) From the main page, select "Upload" from the menu at left.
2) Select the type of data you are uploading, typically "GPS Field Data"
3) Select the appropriate Installation and Site. Remember that GPS files should be unique for each site, even if multiple sites are visited in one day. If collected data is not associated with a site, select "Other."
4) Select "browse" to navigate to the appropriate *.SSF file on your computer. When you use the Trimble download utility to grab data from the GPS unit, multiple files will appear on your computer. You only need to the upload the *.SSF file.
5) Populate the "Comments" field to describe the dataset and any other pertinent information. This information will be provided to the GIS analyst who will be integrating the dataset, so be sure to be as descriptive as possible especially if there are any issues with the data. (For example, if you were to sample 16 points and for some reason you believe only 15 were logged, it is helpful to share this information.)
7) Select "Upload." Users will be notified if the files were uploaded successfully.

5.4 Download Data from the MRP Website to Your Computer

The download utility on the MRP website will serve different user types. **Field staff** will use the utility to download GIS figures (in PDF format) and view the previous day(s) field data on aerial photographs, checking for any discrepancies or missing data elements. **Project Managers** will also have the ability to download and view these figures, to visualize the data and track project

progress. This utility will also allow **GIS Analysts** to download the *.SSF files posted by field staff for post-processing and map plotting.

To download GIS Figures:

1) From the main page, select "Download" from the menu at left.
2) Select an Installation and Site
3) Users can view Figures for a particular date or by a range of dates, by selecting the ` appropriate options. To search all dates, leave all of these fields as the default.
4) Select "Search"
5) A table will appear showing the files available for download. Simply click on the link to the file and you will be prompted to save it to your computer.

STANDARD OPERATING PROCEDURE
MRP SOP 06
VEGETATION MANAGEMENT AT MEC SITES

A. SCOPE AND APPLICABILITY

This document is designed to set a standard operating procedure (SOP) for vegetation management during activities performed at Munitions and Explosives of Concern (MEC) sites. Inherently, a strong possibility exists that MEC and material potentially presenting an explosive hazard (MPPEH) may be encountered. The procedures detailed in MRP SOP 01, UXO Detector-Aided Surface Surveys, provide specific guidance for UXO survey operations and equipment. MRP SOP 02, MEC Management and Accountability, provides instructions and procedures to be followed in the event that suspect MEC/MPPEH is encountered. Additionally, MEC activities will be performed in accordance with all local, State, and federal regulations and will include all applicable DoD requirements.

B. BACKGROUND

Vegetation management may be required in preparation for field activities at MEC sites. Trees, brush, grass, and other vegetation can impede the performance of MEC operations, geophysical surveys, and related investigation and remediation activities. The degree of vegetation removal will be site-specific and based upon the conditions encountered and activities to be conducted. Following is a general discussion of the type of equipment/techniques that will be used.

- Hand held brush cutters (string or blade) will be used to cut light vegetation and small grassy areas.
- Mechanized lawn mowers will be used to mow larger grassy areas.
- Chain saws will be used in heavier brush areas, to trim tree limbs, and to cut small trees up to 2 inches in diameter.
- Tractor-mounted brush hogs will be used in larger areas and heavier brush areas.
- Brush/vegetation cutting will be left at the site of the area cleared. If this is impractical, a wood chipper may be utilized.

Smaller brush cutting/vegetation management operation will be conducted by the Unexploded Ordnance (UXO) staff. On larger project sites, subcontractors may be utilized. If it is necessary to utilize subcontractors, an UXO escort will be provided during subcontracted brush/vegetation management operation.

C. PERSONNEL QUALIFICATIONS

UXO personnel shall meet the training requirements as stated in DDESB TP-18. Subcontractors will meet the training and medical surveillance requirements as stated in the Tetra Tech NUS

Health and Safety Guidance Manual. Where applicable, vegetation management equipment will only be operated by personnel licensed or certified on that equipment.

D. VEGETATION MANAGEMENT

Vegetation management at MEC sites may range from minor grass cutting and tree limb trimming to the total removal of all site vegetation. The extent and methods of vegetation management are driven primarily by the project specific scope of work, but will also be influenced by such factors as munition sensitivity, terrain, impacts to the environment, threatened or endangered species, current and future land use, available technology, and cost.

Prior to conducting vegetation management operations, a visual UXO surface survey will be conducted. All suspect MEC/MPPEH will be located and marked. UXO avoidance will be practiced during vegetation management operations. Vegetation management crews will not work within marked areas containing suspect MEC/MPPEH. Additionally, brush and grass will be cut no closer than 6 inches from the ground surface to avoid inadvertent contact with partially buried or shallow subsurface MEC.

Site Setup

The boundary of the work area will be established by land survey or GPS coordinates. Corner points of grids and start and end points of transects will also be located. Boundary lines of grids and transect lines will be marked using engineers flagging tape to provide visual guidance for the vegetation management crew when line of sight between stakes or markers is impeded.

UXO Escort will be provided for survey personnel and no stakes or markers will be driven into the ground until the immediate area of the stake or marker is surveyed and declared clear of surface and shallow subsurface anomalies.

Tree Cutting

Tree cutting will occur on a case-by-case basis as required to accomplish the site specific scope of work. Trees will be cut using chainsaws or hand tools. Generally, trees 2 inches in diameter and smaller will be cut as necessary to facilitate the planned site activities. Trees will be sectioned, if necessary, and removed from the immediate work area to avoid interfering with site operations.

Brush Cutting

Brush cutting will be accomplished using hand held brush cutters equipped with string or blade cutting attachments. Larger or heavier brush may require the use of chainsaws. Where appropriate, a tractor or skid-steer with a bush hog mower attachment may also be used. Brush will be cut to a height that allows clearance for UXO operations and geophysical equipment operation but no closer than 6 inches above the ground surface.

Grass Cutting

Grass cutting will be accomplished using mechanized lawn mowing equipment or hand held brush cutters equipped with string attachments. Grass will be cut to a height that allows clearance for UXO operations and geophysical equipment operation but no closer than 6 inches above the ground surface.

Alternative Methods

In rare instances, large scale vegetation clearance methods such as controlled burning or hydraulic ax deforestation may be necessary. An UXO escort will be provided during large scale vegetation clearance operations. At no time will UXO staff directly engage in controlled burning operations or in the operation of hydraulic ax deforestation equipment.

E. VEGETATION DISPOSAL

Vegetation disposal must be coordinated with the facility environmental office. Provided that site activities do not result in significant quantities of material, the preferred method of vegetation disposal will be on-site disposal. Vegetation will be removed from the immediate work area to avoid interfering with site activities, and allowed to naturally decompose.

A wood chipper may also be used to effectively dispose of vegetation without removing the vegetation from the work site. Wood chips will be disposed of away from the immediate work area to avoid interfering with site activities when possible. If necessary, wood chips will be spread over the work site to a depth of no greater than 4 inches to avoid interference with detection depth capabilities of UXO and geophysics equipment.

F. SAFETY

General safety precautions are located in the Tetra Tech NUS Health and Safety Guidance Manual. Specific guidelines are located in the site-specific Health and Safety Plan (HASP) and the Accident Prevention Plan (APP).

Personal Protective Equipment (PPE)

PPE for vegetation management operations will be level D protection with the following additions:

- Logging helmet with attached face shield
- Chainsaw chaps
- Hearing protection
- Leather work gloves

Personnel Safety

The UXO Safety Officer (UXOSO) will be on-site at all times during vegetation management operations. The primary responsibilities of the UXOSO during vegetation management activities are:

- To provide a safety brief detailing the operation, safety, and maintenance of the specific equipment being utilized;
- To insure that MEC/MPPEH hazards remain a primary concern for personnel involved in vegetation management activities;
- To insure that PPE is serviceable and worn properly during vegetation removal activities; and
- To insure that individual personnel utilizing vegetation removal equipment maintain safe working distances from other personnel within the work area.

Additionally, an UXO Escort will be provided at all times during vegetation management activities. The UXO Escort will be utilized even when UXO Staff perform vegetation management. This will provide a more focused observation of the work area for MEC/MPPEH and related hazards.

Equipment Safety

Equipment will be inspected for serviceability daily prior to the commencement of vegetation management activities. Periodic spot checks will also be conducted throughout the day to insure that chains and blades remain properly tightened and sharpened. All equipment will be operated and maintained in accordance with the manufacturer's recommendations.

ATTACHMENT 3

EXPLOSIVES SAFETY SUBMISSION DETERMINATION

UNITED STATES MARINE CORPS
MARINE CORPS SYSTEMS COMMAND
2200 LESTER STREET
QUANTICO, VA 22134-6050

IN REPLY REFER TO:
8020
204
23 Dec 09

From: Commander
To: Commanding Officer, NAVFACIPTSA 135 Ajax Street, Building 135 North Jacksonville, Fl 32212-0030 (Attn: Mr. Charles Cook)

Subj: EXPLOSIVES SAFETY SUBMISSION (ESS) DETERMINATION REQUEST FOR MARINE CORPS RECRUIT DEPOT PARRIS ISLAND SOUTH CAROLINA MUNITION RESPONSE SITES

Ref: (a) MCO 5100.29A Marine Corps Safety Program
(b) NOSSAINST 8020.15B Appendix B
(c) ESS Determination Fax from Mr. Cook

1. Reference (a) assigns Marine Corps Environmental and Explosives Safety Program implementation responsibilities to the Commander, Marine Corps Systems Command.

2. In accordance with reference (b) and as requested by reference (c), it has been determined that an Explosives Safety Submission (ESS) is not required to conduct site investigations at the identified Munition Response Sites (MRS). This determination is made based on anomaly avoidance procedures being used.

3. Notify Marine Corps Air Station Beaufort's Explosive Ordnance Disposal (EOD) unit if Munitions and Explosives of Concern (MEC) are located. Submit EOD response sheets in support of this response. Initial coordination with the EOD team is required prior to beginning any field activities.

4. Point of contact for this matter is Mr. James Taylor, Marine Corps Systems Command, Program Manager for Ammunition, Environmental and Explosives Team, at DSN 378-8781, commercial (703) 432-8781, email: james.t.taylor1@usmc.mil

MAZZA.JERRY.L.
Digitally Signed on 12/23/2009 Cert# 1027937086
JERRY L. MAZZA
By direction

Copy to: Staff Sec, COMMARFORCOM (G-4, ESO); PI ESO; HQMC (I&L)