

38RD233 - Late 19th to Early 20th Century Artifact Scatter/Dump Site

38RD286 - Underwater Civil War Era Ordnance Dump Site

38RD224 - Possible Ruins of Biggs' Saw Mill

38RD278 - Underwater Deposit of Historic Ceramics and Metal Artifacts - Possible Dump Site of 38RD234

38RD234 - Late 19th to Early 20th Century Structure Foundation - House

38RD286 - Expanded Boundary of Underwater Civil War Era Ordnance Dump Site

38RD223 - 19th to 20th Century Bottle Dump/Landfill

38RD275 - Unknown Prehistoric Lithic Flake and Brick Fragment Scatter, 20th Century

38RD235 - V-Shaped Wooden Object Eroding Out of Riverbank

LEGEND

- Proposed Site Operations Footprint
- ▭ Modified Removal Areas (Discussed, Nov. 15, 2018)

Archaeological Sites by NRHP Status

- Not Assessed
- Not Eligible

Notes:

1. Archaeological Sites are from the Cultural Resources Identification Survey for the Congaree Sediment Removal Project provided by TRC. Boundaries and locations are approximate.
2. River water level above normal on date of aerial photo.

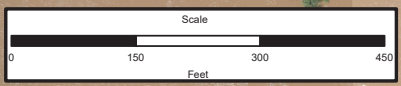


FIGURE 2
DOMINION ENERGY
SOUTH CAROLINA, INC.
ARCHAEOLOGICAL SITE LOCATIONS WITH
RESPECT TO SITE OPERATIONS
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/9/2020 FILE NAME: Figure 2 MOA
 APEX COMPANIES, LLC



UNIVERSITY OF SOUTH CAROLINA

SOUTH CAROLINA INSTITUTE OF ARCHAEOLOGY AND ANTHROPOLOGY

DATA RECOVERY LICENSE

Licensee

Dominion Energy South Carolina, Inc./TRC Environmental Corporation c/o Rusty Harris, project principal

Project name

Congaree River Remediation Project

Project work area

Congaree River below Gervais Street Bridge, Columbia SC (See attached map)

Permitted Activity

This license grants to the licensee the right to conduct archaeological recovery of artifacts encountered during the removal of tar-like materials from the project work area and subject to approved research plan on file at SCIAA.

Date original application received

09/10/2015

Application received by

James Spirek

Application complete incomplete _____

Assurance: Escrowed funds _____ Letter of credit _____ Performance bond _____
Other **N/A**

Date of State assessment of archaeological historic property or paleontological property **1 September 2015**

Hearing required _____ not required

Hearing date and location **N/A**

Approved Rejected _____

James D. Spirek
State Underwater Archaeologist
Maritime Research Division

Date

13 May 2020

License Number

DRL-SCANA-2015-CR-01

Effective Dates

15 May 2020 through 14 May 2021 (one-year)

Gervais Street Bridge

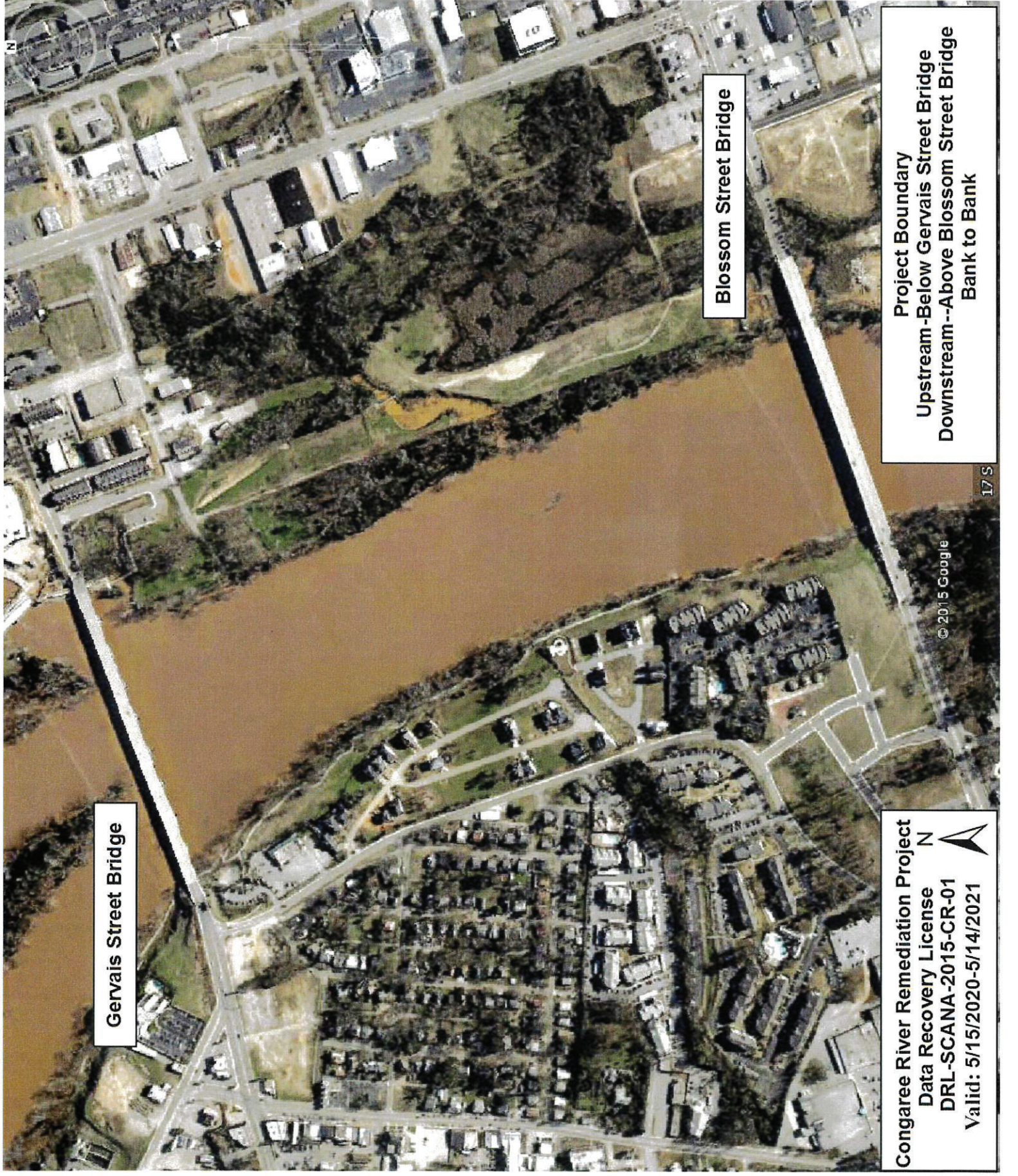
Blossom Street Bridge

Congaree River Remediation Project
Data Recovery License
DRL-SCANA-2015-CR-01
Valid: 5/15/2020-5/14/2021

Project Boundary
Upstream--Below Gervais Street Bridge
Downstream--Above Blossom Street Bridge
Bank to Bank

© 2015 Google

17 S



ATTACHMENT N

UXO MANAGEMENT PLANS

**FINAL WORK PLAN FOR
MUNITIONS RESPONSE
REMOVAL ACTION AND CONSTRUCTION SUPPORT
CONGAREE RIVER PROJECT**

Prepared for:



Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

Prepared by:



Explosive Ordnance Technologies, Inc. (EOTI)
9050 Executive Park Drive Suite 106-A
Knoxville, TN 37923
May 2015
Revision January 2017

I have reviewed the attached Work Plan for the referenced site.

Approved by:
Date: May 2015
Revision Date: January 2017

A handwritten signature in black ink that reads 'David A. Farmer'. The signature is written in a cursive, flowing style.

David A. Farmer
Corporate Quality Manager
Explosive Ordnance Technologies, Inc.
(865) 200-8081

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ACRONYMS

°C	Degrees Centigrade
°F	Degrees Fahrenheit
ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
Apex	Apex Companies, LLC
APP	Accident Prevention Plan
AR	Army Regulation
ATF	Alcohol Tobacco and Firearms
BATF	Bureau of Alcohol Tobacco and Firearms
BIP	Blow in Place
bpm	beats per minute
CAR	Corrective Action Request
CFR	Code of Federal Regulations
CHEMTREC	Chemical Transportation Emergency Center
COR	Contracting Officer's Representative
CPR	Cardio-Pulmonary Resuscitation
CPFF	Cost Plus Fixed Fee
CQDM	Quality Control Data Management
CRP	Congaree River Project
CRZ	Contamination Reduction Zone
CSHP	Corporate Safety and Health Plan
CWM	Chemical Warfare Material
DID	Data Item Description
DDESB	Department of Defense Explosive Safety Board
DMM	Discarded Military Munition
DoD/DOD	Department of Defense
DOP	Dive Operations Plan
DOT	Department of Transportation
DQO	Data Quality Objective
EE/CA	Engineering Evaluation/Cost Assessment
EED	Electro-Explosive Device
EM	Engineer Manual
EMR	Electro-Magnetic Radiation
EMT	Emergency Medical Technician
EOD	Explosive Ordnance Disposal
EOTI	Explosive Ordnance Technologies, Incorporated
EP	Engineer Pamphlet
EPA	Environmental Protection Agency
ERCP	Emergency Response Contingency Plan
ESS	Explosives Safety Submission
EZ	Exclusion Zone
FAR	Federal Acquisition Regulation

FFP	Firm Fixed Price
FGDC	Federal Geographic Data Committee
FUP	Fixed Unit Price
GFE	Government Furnished Equipment
GIS	Geospatial Information System
GPS	Global Positioning System
HAZMAT	Hazardous Material
HAZWOPER	Hazardous Waste Operations and Emergency Response
HE	High Explosive
HEPA	High Efficiency Particulate Air
HF	High Frequency
HPS	Hantavirus Pulmonary Syndrome
HTRW	Hazardous, Toxic, or Radiological Waste
IAW	In Accordance With
ID	Identification
LB	Pound
MD	Munitions Debris
MDAS	Material Documented As Safe
MEC	Munitions and Explosives of Concern
MF	Modulated Frequency
MGFD	Munition with the Greatest Fragmentation Distance
MGP	Manufactured Gas Plant
MHZ	Megahertz
MM	Millimeter
MPPEH	Material Potentially Presenting Explosive Hazard
MR	Munitions Response
MRS	Munitions Response Site
MSD	Minimum Separation distance
MSDS	Material Safety Data Sheets
NEW	Net Explosive Weight
OE	Ordnance and Explosives
OESS	Ordnance and Explosives Safety Specialist (USACE)
OJT	On the Job Training
OSHA	Occupational Safety and Health Administration
PDS	Personnel Decontamination Station
PEL	Permissible Exposure Limit
PM	Project Manager
PPE	Personal Protective Equipment
PR	Pulse Rate
PWS	Performance Work Statement
QA	Quality Assurance
QC	Quality Control
QCI	Quality Control Inspection
QCIR	Quality Control Inspection Record
QCS	Quality Control Specialist

Q-D	Quantity-Distance
RCWM	Recovered Chemical Warfare Material
RDX	Cyclotrimethylenetrinitramine
RF	Radio Frequency
RFD	Remote Firing Device
RI	Remedial Investigation
RMSF	Rocky Mountain Spotted Fever
RRD	Range Related Debris
SCDHEC	South Carolina Department of Health and Environmental Control
SCE&G	South Carolina Electric & Gas Company
SDSFIE	Spatial Data Standard for Facilities, Infrastructure, and Environment
SE QCI	Search Effectiveness Quality Control Inspection
SF	Square Feet
SOP	Standard Operating Procedure
SOW	Scope of Work
SSFR	Site Specific Final Report
STD	Standard
SUXOS	Senior Unexploded Ordnance Supervisor
SZ	Support Zone
TECH	Technician
TEU	Technical Escort Unit
TBD	To Be Determined
TLM	Tar Like Material
TM	Technical Manual
T&M	Time and Materials
TNT	Tri-Nitro Toluene
TP	Technical Publication
TPP	Technical Planning Process
TLV	Threshold Limit Value
UHF	Ultra High Frequency
USACE	United States Army Corps of Engineers
USAESCH	U. S. Army Engineering and Support Center- Huntsville
UTM	Universal Transverse Mercator
UXO	Unexploded Ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer
UXOSO/QCS	Unexploded Ordnance Safety Officer and Quality Control Specialist (Dual Hat Position)
VCC	Voluntary Clean-Up Contract
VHF	Very High Frequency
WBGT	Wet Bulb Globe Temperature
WP	Work Plan

1.0 CHAPTER 1 – INTRODUCTION

1.1 General Background Information

Apex Companies, LLC (Apex) contracted Explosive Ordnance Technologies, Inc (EOTI) to perform clearance of Munitions and Explosives of Concern (MEC) in support of contaminated soil and sediment removal on the Congaree River Project (CRP), Columbia, South Carolina (SC) for the South Carolina Electric and Gas Company (SCE&G). Due to weather-related effects, the scope of the effort has been altered to reduce the amount of soil and sediment removal to an amount required to install a cap on the river bottom in order to separate the public from contact with contaminated soil. This work plan provides the technical approach, rationale, and field procedures to be followed in order to achieve the objectives of removal of MEC from land and sediments from the project site. This work plan was prepared in accordance with (IAW) the APEX Contract No. 875001, dated March 11, 2014.

The purpose Removal Action and Construction Support of the CRP is to remove MEC in order to reduce hazards from any Civil War era military munitions co-located within the coal tar contaminated soil and sediment removal area being excavated by Apex in order to facilitate installation of capping material. This work plan covers the land and sediment Removal Action and Construction Support. The removal activities will be completed IAW the U. S. Army Corps of Engineers (USACE) approved Explosives Safety Submission (ESS).

1.2 Site Location

The CRP area is located on the Congaree River in Columbia, SC. The site, also referred to as the “project area”, begins directly south of the Gervais Street Bridge, extends approximately 200-300 feet into the river from the eastern shoreline and approximately 2,000 feet downriver, towards the Blossom Street Bridge. The MEC intrusive activities will occur on eastern side of Congaree River between Gervais and Blossom Street Bridges, shown on Figure B-1-Site Location.

1.3 Site History

In 1865, during the Civil War, DMM and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman’s occupation and subsequent destruction of Columbia. The Union Army kept some of these items for its own use and the remainder was destroyed. One of the methods was dumping the items into the river.

Archeological investigations, conducted as late as 1980, recovered some DMM from the area as well as some other potentially historically significant artifacts. Specifically this work was focused in and adjacent to the unnamed tributary that enters the river just south of the Gervais Street Bridge. Several cannonballs were identified during this operation and properly disposed of by trained explosive ordnance disposal (EOD) personnel located at nearby Fort Jackson.

Due to the potential presence of DMM within the project area, an additional reconnaissance and screening of the area in question was conducted as part of the investigative activities. An acoustic (side scan sonar) and magnetic (magnetometer) remote sensing survey was performed to identify ordnance and other submerged cultural resources in the remediation area by Tidewater Atlantic Research, Inc. and a report submitted on 8 February 2012. Analysis of the survey data identified concentrations of

anomalies in the immediate vicinity of the Senate Street landing and scatters extending into the river. A terrestrial magnetometer investigation of the unnamed tributary below the Gervais Street Bridge was also carried out and that investigation identified eight additional anomalies with a potential association with ordnance. Figure B-2-Previous Investigation Results shows the location of anomalies detected during the February 2012 investigation.

In June 2010, the occurrence of a tar-like material (TLM) within the Congaree River was reported to the South Carolina Department of Health and Environmental Control (SCDHEC). Preliminary testing indicated that the material may be attributable to the Huger Street former Manufactured Gas Plant (MGP) that was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950s.

Preliminary sample results conducted on the material by SCDHEC and South Carolina Electric and Gas Company (SCE&G) indicated that the TLM had similar chemical and physical characteristics as coal tar, a by-product of Manufactured Gas Operations, which were common in cities from the late 1800s until the 1950s. Additional research found that the most likely source of the TLM was a former Manufactured Gas Plant (MGP) located northeast of the river at 1409 Huger Street that operated from about 1906 until the mid-1950s. Later this was the location of the city bus terminal until 2008.

MGPs produced a flammable gas from coal that was used for heating, cooking and lighting purposes prior to the construction of interstate natural gas pipelines. The coal tar material was a waste product from coal-gas production. Once the gas was produced, the coal tar by-product was discharged into a former stream, which originated at what is known today as Finley Park, past the MGP site, and into the Congaree River just below the Gervais Street Bridge. The Huger Street MGP was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950s, prior to the existence of environmental regulations and permitting.

SCE&G had previously entered into a Voluntary Cleanup Contract (VCC) with DHEC in August 2002 to conduct environmental assessment and cleanup activities at the former Huger Street MGP site. SCE&G has worked proactively and cooperatively with DHEC under its existing VCC to determine the extent of TLM in the Congaree River and to develop a plan for cleanup. Overall, the delineation activities extended from the Gervais Street Bridge downriver approximately 9,050 feet.

An Engineering Evaluation/Cost Assessment (EE/CA) was prepared and a Final was submitted in January 2013. A non-time critical removal action of the impacted river sediments was chosen as the alternative. The TLM-impacted sediment varies in thickness from a few inches to approximately 6 feet thick in some areas. The then-current total estimate of sediment requiring removal was approximately 40,000 tons. The total project area is estimated to be 23 acres, with 10.5 acres consisting of waters of the United States. The landside or upland portion of the project area consists of approximately 12.5 acres of mostly undeveloped land with a cleared utility right-of-way. Much of the area will not be disturbed.

On August 21, 2013 a public release was issued summarizing the project purpose and objectives detailing that this is an environmental clean-up project mandated by SCDHEC intended to remove approximately 40,000 tons of tar-like material (TLM) and impacted sediment from the Congaree River. In the fall of 2015, 3 attempts were made to complete the UXO investigation. Repeated rain events that resulted in historic flooding of the Congaree River necessitated curtailment of the UXO investigation

efforts. Although approximately 180 anomalies were investigated, including previously identified anomalies and mag-and-dig efforts, no MEC items were found. An estimated 153 pounds of scrap were recovered.

Currently, SCE& G and Apex plan to install a capping material that will separate the contamination in the river bed from exposure to the public. Installation of the capping material will require a certain amount of leveling of a sandbar in the upper portion of the area previously identified for removal. EOTI will conduct a mag-and-dig investigation of the area to be leveled. During the installation of the capping material, EOTI will provide on-site construction support.

The removal of the impacted sediment will result in a permanent improvement to the aquatic environment in the project area. Upon completion of the removal activities in the Congaree River, the project area will be allowed to return to its original pre-impacted state.

The purpose of this MEC removal/construction support is to protect worker safety by removing MEC prior to TLM excavation by APEX. The removal area is shown on Figure B-3 & B-4-Clearance Area and described in Chapter 3 MEC Clearance Plan.

1.4 Topography

The predominant topographic feature within the project area is the Congaree River itself, which is a broad shallow river with numerous bedrock assemblages that are visible above the water level at normal river flows. The river slope in the vicinity of the project area is approximately 2.10 feet/mile (USACE, 1977). The river depth varies significantly in the project area due to the variability of the bedrock river bottom elevations. These bottom elevations fluctuate from an approximate high of 116 feet to approximately 105 feet. All elevations are referenced to NAVD '88. Average river flow elevation is approximately 116 feet with an extreme variance of approximately 110 to 152 feet in elevation. Figure 2 provides the bathymetric contours for the river bottom and the topographic contours of the eastern shoreline.

The project area abuts the eastern shoreline, which rises sharply from the water's edge in most places due to a steep bank that varies in height from approximately 5 to 20 feet depending on location. The ground slopes more gently to the east once the top of the riverbank is reached with an approximate 28 feet increase in land surface elevation over approximately 500 feet. Gist Street is the first paved land surface encountered to the east of the project area. The riverbank is forested in this area with vegetative cover consisting of various trees and tall native grasses and shrubs. The undergrowth is periodically maintained and trimmed in the vicinity of the wooden scenic overlook and river walkway and is much thicker and overgrown further south.

Access to the river is provided by a partially paved access road, which extends from the intersection of Senate and Gist Streets to the river. The Senate Street alluvial fan, a key land feature in this area, is located at the end of the access road. The alluvial fan is a relatively flat portion of the project area that extends out into the river and appears to have developed over time. It will be the main access point during completion of future field activities unless another access point is constructed.

1.5 Climate

The climate in the vicinity of the project site is characterized on the following charts presented below the **Figure 1-Average Monthly Temperatures, Figure 2-Average Monthly Precipitation, Figure 3-Monthly Inclimate Weather Percentage and Figure 4-Average Wind Speed.**

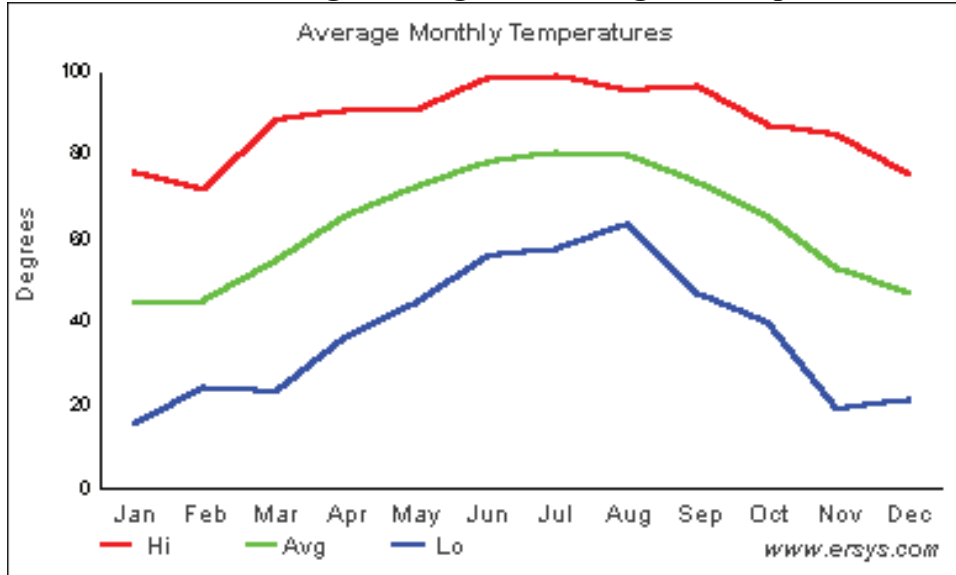


Figure 1 Average Monthly Temperatures

The two charts below show information relevant to precipitation. The first chart is the typical precipitation for the month indicated. The second chart shows the percentage of the month that inclimate weather (rain, snow, etc.) occurs. Combined the two charts give the reader a better understanding of precipitation in the area.

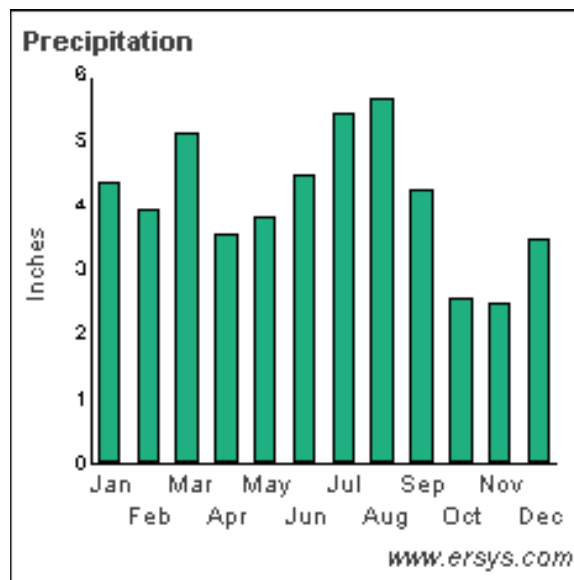


Figure 2 Average Monthly Precipitation

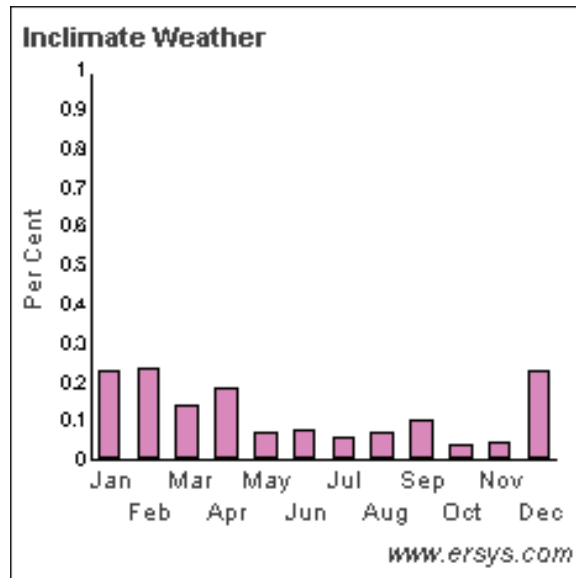


Figure 3 Monthly Inclimate Weather Percentage

The chart below illustrates typical wind speeds for the Columbia, SC area.

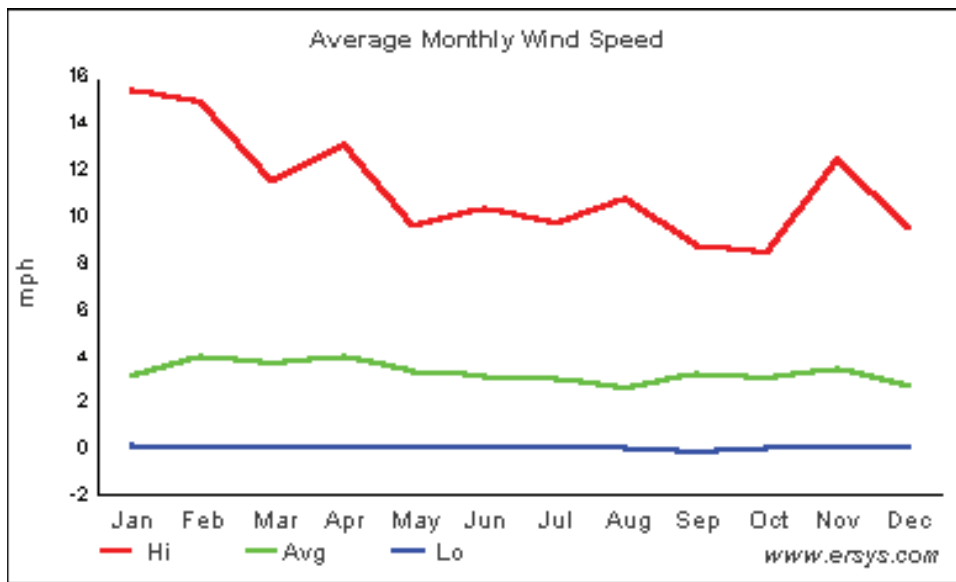


Figure 4 Average Monthly Wind Speed

1.6 Discovery of Recovered Chemical Warfare Material (RCWM)

- 1.6.1 The Congaree River Project site is not suspected of containing RCWM. If however, during planned MEC removal operations, EOTI identifies or suspects RCWM all personnel will immediately withdraw upwind from the work area and contact the USACE Project Manager. EOTI will secure the area and provide two personnel located upwind of the suspect RCWM to secure the site until relieved by the Department of the Army emergency response personnel.

1.6.2 If suspect RCWM is encountered, the following procedures will be followed:

- All work will immediately cease;
- Project personnel will withdraw along cleared paths upwind from the discovery;
- A team consisting of a minimum of two EOTI UXO personnel will secure the area to prevent unauthorized access;
- The supervisors will position personnel as far upwind as possible while still maintaining security of the area; and
- The USACE Ordnance and Explosives Safety Specialist (OESS) will immediately be notified.

1.7 Procedures for Change in Site Conditions

Unforeseen circumstances, such as severe weather events, may create a change in site conditions that could affect the performance of this project. Regardless of the reason for the change in site conditions, EOTI will immediately notify Apex Project Manager of the condition change and the action taken.

2.0 CHAPTER 2 – TECHNICAL MANAGEMENT PLAN

2.1 Objectives

EOTI's objective in this task order is to provide all munitions response services necessary to support operations conducted by Apex to prepare the site and emplace capping material over an area known or suspected to contain TLM that may be collocated with munitions that may have been discarded and dumped in the river during the American Civil War. EOTI will perform operations as necessary to detect and remove suspected DMM from a sandbar that will be required to be levelled to facilitate the installation of the capping material. Levelling the sandbar area is expected to require the removal of up to one to two feet of dirt. The levelling effort will be conducted during a time of low water. The entire sandbar area is less than 0.2 acres in area.

The sand bar will be removed using conventional excavation equipment by a qualified marine remediation/capping contractor. The specific equipment and logistics will be determined at the discretion of the contractor, who has yet to be selected. The removal activities will only be conducted during normal or low water river conditions. A likely scenario will consist of; after deploying the appropriate sediment containment devices around the area to be removed, an excavator (i.e., the first excavator) will be tracked out onto the most southern tip of the sand bar and the 1 to 2 feet of material will be excavated and cast behind the first excavator at which point a second excavator will pick up the material and either temporarily place it on the shore line or into an off-road dump truck. The material will then be transported to an on-site processing area for further inspection prior to being transported off-site for proper disposal. The first excavator will then retreat backwards and continue the process until the sandbar has been removed. The remaining portion of the streambed will remain undisturbed to the extent practicable, with minor filling or grading conducted only to the extent required to install the capping materials. In some areas it may be necessary to add or place off-site, imported sand to make a smooth transition in which to place the cap materials.

Following the levelling effort, EOTI will provide Standby Construction Support during non-intrusive capping material installation activities in accordance with EP 75-1-2. EOTI will be prepared to mobilize a third person if required to dispose of MEC or MPPEH during the construction support phase of the project.

“This interim response action is being performed under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and is part of the overall Remedial Action Process. Additional removal responses may be dictated in the future during the remainder of the remedial response process, as determined by subsequent action memoranda or other decision documents. If subsequent removal responses are determined to be necessary in the full remedial process, this ESS will be reviewed and amended in accordance with DoD 6055.09-M as necessary to support that response.”

This Technical Management Plan describes the approach, methods, and operational procedures to be employed by EOTI to perform MEC operations at the CRP site. USACE DID WERS-001.01 and Chapter 4 of EM 1110-1-4009 were used in addressing technical management for this MEC project.

No single workday will exceed ten (10) hours. During construction support, EOTI UXO technicians will be available on site when intrusive operations are conducted.

2.2 Organization

EOTI's project organization is designed to effectively control the removal action. EOTI's Project Manager, Mr. Mathew Norris, GISP will be the primary point of contact with the Apex Project Manager, Mr. Rusty Contrael and will have overall responsibility for ensuring that work is completed in accordance with the Work Plan. He will prepare submittals and reports in accordance with the PWS. The project organization is presented on Figure 5-Organization Diagram.

The Senior UXO Supervisor (SUXOS) will be the primary point of contact in the field. He will plan and supervise work completed on the site and ensure compliance with the Work Plan and other applicable requirements. He will directly coordinate with local officials, USACE onsite safety representative, and stakeholders as necessary to minimize conflicts with scheduled activities. He will prepare and submit daily reports through the EOTI Project Manager.

- The UXO Safety Officer (UXOSO) and the UXO Quality Control Specialist (UXOQCS) will be on-site when work is performed. For this project, the UXOSO and UXOQCS functions will be combined and performed by one dual-hatted person (UXOSO/QCS). He will be responsible to ensure that work is completed safely and to standard IAW but not limited to USACE and DoD guidance (EM 385-1-97, DoD 6055.9 and Std TM 60A 1-1-31) as well as other guidance as directed throughout this work plan. He will evaluate work daily and report any safety or quality concern to the SUXOS, Project Manager and / or Corporate Safety Manager. The UXOSO/QCS will work closely with the USACE on-site Safety Representative to immediately address any issues or concerns. He always has a direct line of communication with the EOTI Corporate Safety Manager.

All UXO Technicians and team members will meet, or exceed the requirements in DDESB TP 18 for the positions they hold. The organizational chart below shows the key project positions and personnel and the relationships between them and other team members. The SUXOS, in coordination with the Project Manager, may adjust the project organization and reallocate resource as required to most effectively complete the entire scope of the project.

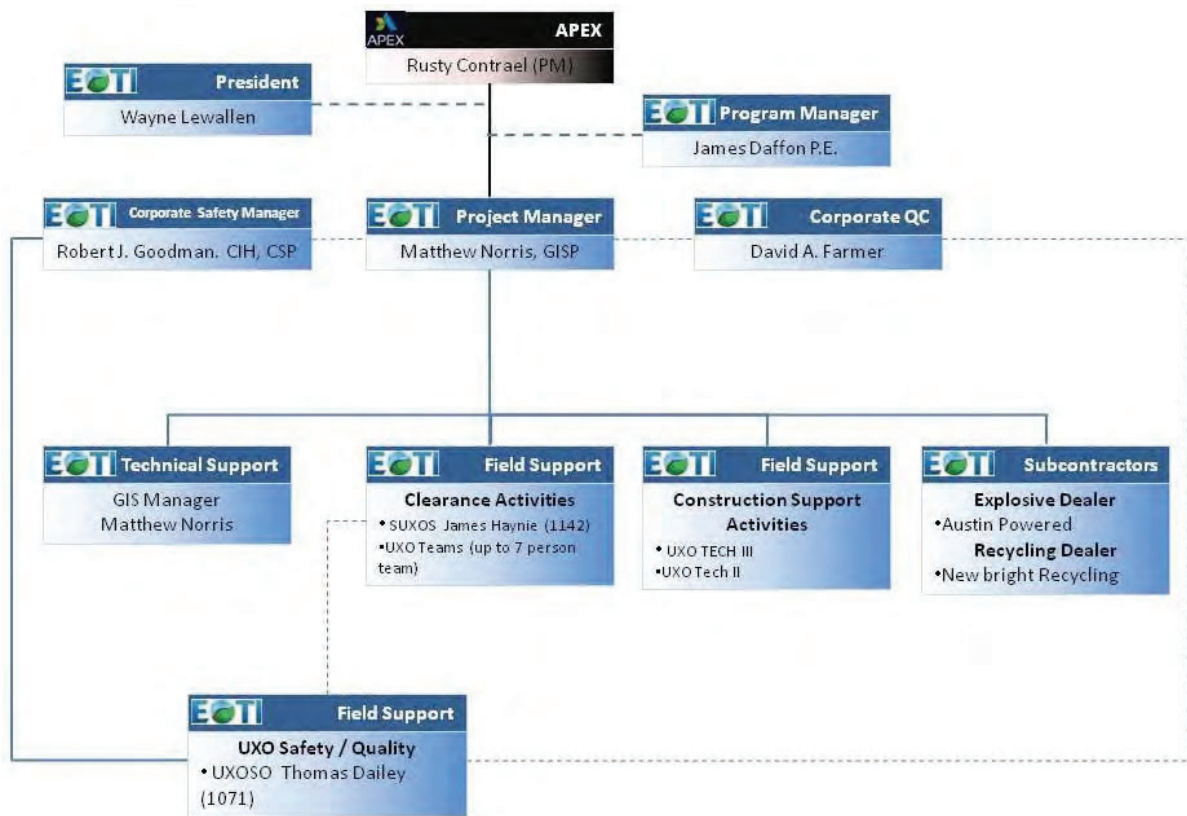


Figure 5 Organization Diagram

EOTI intends to perform this Removal Action with one UXO Team. The Team Leader will be responsible for a team of two or more personnel depending on assigned tasks and project needs. During removal operations the standard teams will consist of a UXO Tech III and up to 6 UXO Tech II/I. Team size may be reduced, at the discretion of the SUXOS. The SUXOS will make team assignments daily according to the specific needs of the project. Resumes of key personnel are included in Appendix H of this Work Plan.

2.3 Personnel

Personnel and Qualifications - Personnel required for this project will include UXO supervisors and technicians, all of whom possess the relevant personal training and experience requirements set forth in DDESB TP 18. Personnel for this project have been selected from a pool of available UXO technicians. Resumes of key personnel are included in Appendix H if not listed in the UXO database maintained by USAESCH. The following paragraphs describe the specific responsibilities of UXO personnel assigned to the project team.

2.3.1 Project Manager

2.3.1.1 The Project Manager is responsible for communicating with APEX Project Manager and USACE Project Manager or the USACE Safety Specialist. He will execute all directions received from the APEX Project Manager, managing all aspects of the project, overseeing the overall performance of all individuals on the project team, coordinating all contract and subcontract work, and resolving project problems. The Project Manager

is also responsible for controlling cost and schedule milestones. The Project Manager will also coordinate the preparation of the Work Plan and the implementation of on-site field activities.

2.3.1.2 The Project Manager will interface directly with subcontractors to keep them advised of the PWS, schedule, and budgets. The Project Manager is also responsible for ensuring that the subcontractor costs are maintained within budget and that schedule commitments are achieved.

2.3.1.3 The Project Manager performs overall project management and is responsible for the following:

- Preparing and submitting purchase orders;
- Approving and forwarding accounts payable;
- Approving Daily Activity Report;
- Procuring necessary equipment and supplies;
- Establishing, maintaining and tracking petty cash expenditures;
- Reviewing and approving Time Sheets, Expense Reports, and Travel Order Request;
- Submitting Equipment Expense Report; and
- Supervising the Project SUXOS and, UXOSO/QCS.
- Prepare and conduct coordination meeting

2.3.2 Senior UXO Supervisor (SUXOS)

The SUXOS has more than 10 years of military/civilian EOD/UXO experience. The SUXOS will manage all on-site field activities. The SUXOS will keep the Project Manager informed of activities requiring his notification. The SUXOS is responsible for all daily work activities. He will brief the Project Manager daily on all project activities to include production, quality of work, safety, equipment status and personnel status. The SUXOS will directly coordinate any evacuation requirements with the USACE Safety Specialist. The responsibilities of the SUXOS include:

- Identification of personnel and equipment requirements;
- Supervision of all daily field team activities;
- Early detection and identification of potential problem areas and institution of corrective measures;
- Assisting with the preparation of all project reports;
- Preparation of a daily report, which will include man-hours expended, areas cleared, explosives expended, and any other information required by the Project Manager;
- Providing on-the-job training for selected UXO Supervisor(s) who may be called upon to temporarily perform SUXOS duties during his absence from the site;
- Supervision of UXO Technicians; and
- Scheduling and executing a daily safety meeting, scheduling and coordinating subcontractor field team activities, and oversight of all field activities.

2.3.3 UXO Safety Officer (UXOSO)

The UXOSO has more than eight years of military/civilian EOD/UXO experience. He is responsible for implementing all site SSHP requirements, on-site training requirements and recommending changes

to level of personal protection equipment (PPE) to the SUXOS as site conditions warrant. He has Stop Work Authority for safety conditions. He will report all safety work stoppages immediately to the USACE Safety Specialist. The UXOSO evaluates and analyzes any potential safety problems, implements safety related corrective actions, and maintains a Daily Safety Log. The UXOSO reports to the Safety Manager. The UXOSO will:

- Perform on-the-job training for selected UXO Technicians who may be called upon to temporarily perform the duties of UXOSO during his absence from the site, upon approval of the USACE Safety Specialist; and
- Maintain daily liaison with the USACE Safety Specialist.

2.3.4 UXO Quality Control Specialist (UXOQCS)

The UXOQCS has more than eight years of military/civilian EOD/UXO experience. The UXOQCS reports to the Quality Manager. The UXOQCS will perform quality inspections/review all project operations, including explosives inventories, daily reports, time sheets and other documentation, and will inspect and approve each completed area prior to turnover to the USACE Safety Specialist.

For this project, the UXOSO and UXOQCS functions will be combined and performed by one dual-hatted person (UXOSO/QCS).

2.3.5 UXO Technician III

This individual, who supervises a project team, will have experience in MEC removal operations and supervising personnel, and shall have at least eight years combined active duty military EOD and contractor UXO experience. This individual must be able to fully perform all functions enumerated for UXO Tech I and II. Specific duties of the UXO Tech IIIs include:

- Reconnaissance and classification of UXO;
- Identifying fuzes and determining fuze conditions of all munitions including U.S. and foreign
 - Guided missiles,
 - Bombs and bomb fuzes,
 - Projectiles and projectile fuzes,
 - Grenades and grenade fuzes,
 - Rockets and rocket fuzes,
 - Land mines and associated components,
 - Pyrotechnic items,
 - Military explosives and demolition materials,
 - Submunitions;
- Supervising the conduct of all on-site activities directly related to MEC operations;
- Supervising the location of subsurface UXO using military and/or civilian magnetometers and related equipment;
- Supervises
 - Excavation and recovery of subsurface UXO by manual means or mechanical
 - Construction of UXO-related protective works,
 - Location of surface UXO by visual means,
 - Transporting and storing UXO/MEC assuring compliance with Federal, state, and local laws,
 - Disposal of UXO by detonation,

- Preparation of a UXO disposal site,
 - Preparation of an on-site safe holding area for UXO,
 - Donning and doffing of personal protective equipment,
 - Operation of a personnel decontamination station,
 - Maintenance and operator checks on all team equipment,
 - Segregation of Munitions Debris (MD) and Range Related Debris (RRD) from clutter ,
 - Safe handling procedures,
 - Team preventive medicine and field sanitation procedures;
- Determine UXO-related storage compatibility;
 - Preparing explosives storage plans in accordance with all applicable guidance;
 - Supervise;
 - Preparing required administrative reports;
 - Preparing SOPs for on-site MEC operations;
 - Conducting daily site safety briefings; and
 - Perform Risk hazard analysis,

2.3.6 UXO Technician II

This individual will be able to fully perform all functions enumerated for UXO Tech I. In addition, the ability to perform the following functions is a requirement of the UXO Tech II:

- Identifying fuzes and determining fuze condition of all U.S. and foreign munitions, including:
 - Guided missiles,
 - Bombs and bomb fuzes,
 - Projectiles and projectile fuzes,
 - Grenades and grenades fuzes,
 - Rockets and rocket fuzes,
 - Land mines and associated components,
 - Pyrotechnics,
 - Military explosives and demolition materials, and
 - Submunitions;
- Locate subsurface UXO using military and/or civilian magnetometers and related equipment;
- Perform excavation procedures on buried UXO by
 - Manual means, and
 - Mechanical means;
- Perform operator maintenance of military and/or civilian magnetometers;
- Locate surface UXO using visual means;
- Operate motor vehicle transporting MEC material, when appropriate;
- Preparing an on-site holding area for MEC material;
- Perform storage of MEC material and demolition materials in accordance with applicable guidance;
- Prepare an MEC disposal site;
- Prepare
 - Non-electric firing system for an MEC disposal operation,

- Electric firing system for an MEC disposal operation,
- Detonating cord firing system;
- Dispose of MEC/MPPEH by Detonation;
- Operate a personnel decontamination station;
- Don and doff appropriate personal protective equipment in contaminated areas;
- Construct MEC-related protective works;
- Determining a magnetic azimuth using current navigational/locating equipment; and
- Performing field expedient identification procedures to identify explosives contaminated soil.

2.3.7 UXO Technician I

The UXO Tech I's specific duties (under the supervision of a UXO Tech III or a UXO-qualified individual of higher rank than the UXO Tech III) for this project will include:

- Conducting classification of MEC materials;
- Identifying all munitions including
 - Bombs and bomb fuzes,
 - Guided missiles,
 - Projectiles and projectiles fuzes,
 - Rockets and rocket fuzes,
 - Land mines and associated components,
 - Pyrotechnics items,
 - Military explosives and demolition materials,
 - Grenades and grenade fuzes,
 - Submunitions;
- Locating subsurface MEC using military and/or civilian magnetometers and related equipment;
- Performing excavation procedures on subsurface MEC by;
 - Manual means,
 - Mechanical means;
- Locate surface MEC using visual means;
- Transporting and storing MEC and demolition materials;
- Preparing firing systems, both electric and non-electric, for destruction operations disposing of ammunition/ explosives by detonation;
- Operating Personnel Decontamination Stations (PDS);
- Donning and doffing personnel protective equipment in contaminated areas;
- Erection of MEC related protective works;
- Assist in performing operator maintenance of military and/or civilian magnetometers and related equipment;
- Operate motor vehicle transporting MEC material, when appropriate; and
- Prepare an MEC disposal site.

2.4 Communication and Reporting

2.4.1 The EOTI Project Manager and SUXOS are primarily responsible for the management of work, data and cost. The Project Manager will develop the initial schedule. The SUXOS will maintain the schedule and make adjustments as required throughout the project. The SUXOS

will coordinate closely with local officials to minimize conflicts with other planned activities. He may adjust work hours / days or the order that work is completed in order to minimize conflicts and maximize productivity. The project manager will provide updated schedules throughout the project, as required.

- 2.4.2 The SUXOS will submit data to the Project Manager daily, as required. Data will include a daily report that will describe the activities completed and issues that arose during the workday. The project manager will post the daily reports on the project collaboration website, along with photographs and other data relating to the project. The website will incorporate GIS to better display the data and project status.
- 2.4.3 All task included in this project are FFP or FUP. The Project Manager will control cost by completing the project on or ahead of schedule and negotiating with vendors to ensure the best prices for equipment and material.
- 2.4.4 Work will be completed in accordance with the requirements of the contract. Quality Management and Quality Control requirements described in Chapter 4 will be applied to all phases of the project. EOTI will ensure strict compliance with the Accident Prevention Plan in Appendix D.

2.5 Deliverables

In addition to the Periodic Reporting requirements discussed in Section 2.7, EOTI will prepare a Site Specific Final Report.

2.6 Schedule

EOTI has prepared a Project Schedule and will be updated as necessary throughout the project. The initial schedule is based on the fixed unit price tasks and other tasks will be scheduled as they are defined. EOTI will follow the same scheduled work hours as APEX but anticipates working five, 10-hour days per week. The schedule is generally Monday through Friday. The schedule working days may be adjusted to better suit project needs. The SUXOS will coordinate with the Project Manager prior to adjusting the schedule.

2.7 Periodic Reporting

- 2.7.1 The SUXOS will prepare and submit daily reports to the EOTI Project Manager.

2.8 Costing and Billing

- 2.8.1 The Project Manager and SUXOS will control and manage costs through the use of Purchase Orders and Travel Orders. A record of expenditures will be maintained by the SUXOS and monitored by the Project Manager.

2.9 Public Relations Support

EOTI personnel will refer all requests for information concerning site conditions to the APEX PM.

2.10 Subcontractor Management Procedures

2.10.1 Identification of Subcontractors and Suppliers

EOTI anticipates awarding a subcontract to a South Carolina-licensed professional land surveyor to provide survey and mapping support for the project. EOTI does not intend to subcontract any other portion of the scope of work. However, suppliers may deliver equipment and materials to the project site. All subcontractor personnel will be trained to the approved work plan and the included Accident Prevention Plan. All visitors, including suppliers supporting the project, will receive a safety brief from the SUXOS or the UXOSO/QCS prior to entering any area where work is ongoing. They will sign in and will be escorted as required to perform their functions on the site. Only essential personnel will be allowed in the exclusion zone while intrusive operations are ongoing.

2.10.2 Means for Controlling and Coordinating Subcontractors / Suppliers

All subcontracted personnel working on the site will receive the same thorough site-specific training provided to all EOTI site personnel. This training will include detailed training on procedures in the Work Plan and Accident Prevention Plan. All suppliers making deliveries on site will receive a safety briefing, which will include recognition and awareness of potential site hazards. Suppliers will not be permitted to enter the Exclusion Zone (EZ) of the project site unless escorted by an EOTI UXO-qualified employee. Non-essential persons, including suppliers, will not be allowed in any active EZ.

2.10.3 Safety Responsibilities of Subcontractors / Suppliers

All subcontractor personnel and suppliers making deliveries on site will receive a safety briefing. They are responsible for following all site safety and health procedures. They will not enter any exclusion zone area without a UXO-qualified escort. Non-essential persons, including suppliers, will not be allowed in any active EZ. They will wear all required personal protective equipment while on the site in areas where it is required. They will report any accidents of their personnel to the SUXOS or UXOSO for investigation.

2.11 Field Operation Management Procedures

EOTI's Project Manager has overall responsibility for the management of the project. He will coordinate directly with the APEX Project Manager and subcontractors on project related issues, such as schedule, submittals/reports, etc. The Project Manager reports directly to the EOTI President and MEC Program Manager. The Project Manager communicates frequently with the SUXOS and UXOSO/QCS. The SUXOS will coordinate all field activities. He will coordinate with the on-site USACE representatives and local officials. He will prepare and submit daily project status reports to the Project Manager. Project related reports, documents, and information will be placed on a secure project collaboration website to allow team members easy access to up-to-date project status information.

2.12 Technical Procedures to Execute Project Tasks

Detailed procedures for the execution of project tasks are contained in Chapter 3.

2.13 Data Management

2.13.1 A detailed accounting of all MEC items encountered during the investigation / removal activities will be maintained. As MPPEH / MEC is located it will be documented on the MEC

Accountability Log (Appendix F). A detailed accounting of all suspected MPPEH / MEC items encountered during the removal action will be maintained. This accounting will include:

- Identification Number (a unique ID #);
- Location;
- Nomenclature;
- Fuse Description;
- Fuse Condition; and
- Additional comments, if required.

2.13.2 Each suspect MEC item encountered will be identified using a unique numerical identifier, such as A-3-0001 (for first suspect item (0001) encountered in the Removal grid A-3).

2.13.3 The Team Leader will provide validated data to the SUXOS at the close of each working day.

2.13.4 The SUXOS will:

- Collect and review the raw field data for accuracy.
- Provide the verified data to the Knoxville office for posting to EOTI's project collaboration website for use in the final report.
- For documentation purposes, photographs will be taken of encountered MEC. If MEC is determined to be acceptable to move, multiple items may be included in the same photograph. The photograph will be taken to show detail and will be annotated with the location or area discovered.
- Photographic records will be used to supplement information recorded as needed.

2.13.5 Removal Report - EOTI will prepare a Removal Report IAW the contract.

2.14 DQOs

Data Quality Objectives (DQOs) are qualitative and quantitative statements developed, usually in the Technical Planning Process (TPP), to clarify study objectives, define the type of data needed, and specify the tolerable levels of potential decision errors. A DQO is used as the basis for establishing the type, quality, and quantity of data needed to support the decisions that will be made. For this project, quality objectives are discussed in Chapter 4. Specific quality objectives for Geospatial Information Systems (GIS) are discussed in Section 3.6 of this WP. In order to safely install the capping material, a MEC clearance of the potentially co-located MEC is to be performed prior to sandbar levelling excavation. A list of the type of MEC believed to be present is presented in Section 3.2 but consists of civil war era cannonballs (6 lbs and 10 inch cannonballs). While a cannonball of unknown size and depth was reported in the past the depth of MEC is unknown. Anomalies will be manually investigated and resolved to a depth required for sandbar levelling or to bedrock whichever is encountered first since the sediment thickness varies from no sediment (exposed bedrock) to approximately 4 feet. It is anticipated that 1-2 feet of material will be removed in the levelling effort. The tolerable limits for this are presented in Chapter 4. While presented in Chapter 3 below the methodology to be used is a "mag and dig" where magnetometers are used to identify anomalies and dug by hand shovel.

3.0 CHAPTER 3 MEC CLEARANCE PLAN

3.1 Overall Approach to Munitions Response Activities

This section describes EOTI's approach to completing the requirements of the PWS. Specific quality management standards and procedures used to control the work completed under the PWS are described in detail in Chapter 4 of this Work Plan.

All UXO/MPPEH disposal operations will be conducted in accordance with the procedures described in this plan and the approved ESS. DDESB 6055.09-M and EM 1110-1-4009 will also be followed during munitions response activities. If unidentifiable UXO is found, the default separation distance specified in DDESB TP16 will be used to establish the appropriate exclusion zones. Unidentified UXO will not be disposed of until the munitions filler can be determined. EP 385-1-97, dated September 2008 and EP 75-1-3 provide guidance in helping to determine unknown explosive fillers. Final disposition/disposal procedures will be determined in coordination with the USACE on-site safety representative. Demolition operations will be conducted to destroy or vent UXO / MPPEH, as required for safe disposal. Detailed discussion of MEC reporting requirements and disposition methods and techniques are provided in the ESS, submitted separately of the work plan.

- 3.1.1 Personnel deemed non-essential to the demolition operation will be evacuated or assigned duties outside of the fragmentation zone. Electrical or nonelectrical systems (Non-EL) will be used to initiate BIP to insure maximum control and safety. The UXOSO is responsible for ensuring all personnel are accounted for during disposal operations and that the demolition operation is conducted in strict accordance with required procedures. The EOTI SUXOS and/or UXOSO will visually inspect the demolition site with the Demo Team Leader and announce all clear upon completion of demolition operations.

3.2 Identification of Areas of Concern

- 3.2.1 The clearance area for this project is as shown on Figure B-3 & B-4-Clearance Areas.

The area to be levelled to facilitate the emplacement of matting is shown in Figure B-4. The entire area for matting installation is shown in Figure B-3. The area to be excavated for levelling is less than 0.2 acres. (0.1928) based on a nominal 60 foot by 140 foot area. The depth of removal is expected to be one to two feet.

Based on historical information primarily from an Inventory of Stores Captured in Columbia, SC document dated February 17, 1865, MEC items of interest that could potentially be encountered are identified below. The historical list contained a more general nomenclature than that used in the DOD Fragmentation data base of today. The list below is taken directly in name from the 1865 document.

- Case shot, fixed, 12 pounder gun
- Fuse-shell, fixed, 12 pounder gun
- Grape, 12 pounder gun
- Canister, fixed, 12 pounder gun
- Shot, fixed, 6 pounder gun

- Case, fixed, 6 pounder gun
- Fuse-shell, fixed, 6 pounder gun
- Canister, fixed, 6 pounder gun
- Shot, fixed, 24 pounder gun
- Shell, fixed, 24 pounder gun
- Canister, fixed, 24 pounder gun
- Shell, fixed, 8 inch
- Shot and shell, not fixed, 8 inch
- Shot and shell, not fixed, 8 inch
- Shot and shell, not fixed, 10 inch

According to historical information for Columbia, SC inventory, a variety of other munitions were identified as having been used or stored at the site. No information found to date associates any other munitions with the project site. Therefore, the 10 in “cannonball” shell has been selected as the munition with the greatest fragmentation distance (MGFD) for the project.

3.3 Geophysical Prove-out Plan and Report

Digital Geophysical Mapping (DGM) is not planned for this project. Construction and use of Test Strips to document effectiveness and proficiency with analog instruments is discussed in Chapter 4.

3.4 Geophysical Investigation

Digital Geophysical Mapping (DGM) is not planned for this project. Use of analog instruments (Schonstedt GA 52-Cx or all-metals detector) to accomplish project objectives is discussed in Section 3.7.

3.5 Location Surveys and Mapping Plan

EOTI will be supported by surveyors provided by APEX to conduct boundary surveys of the designated clearance areas as shown in Figure B-3.

The surveyor will install stakes that clearly show the boundaries of the cleared area and label each stake with the proper UTM coordinate system. Flagging will be placed at the top of each stake. No stakes will be installed without approval from the UXO Tech II escort, who will check for anomalies in the location that each stake will be emplaced. The UXO Tech II will scan all stake emplacement locations with a hand held magnetometer (such as a Schonstedt GA-52Cx), or an all-metals detector (such as a White’s Metal Detector), or equivalent. The surveying subcontractor will maintain a field logbook detailing all field activities, including daily entries of the personnel on-site, time of day all work started and ended, weather conditions, delays, all relevant survey data, equipment used, and field sketches.

Survey data will be submitted by hard copy and digital media. The site grid data will include a map of the entire site with grids shown and other pertinent features. The surveyor will produce maps that accurately convey the clearance areas and data.

MEC location data will also be submitted in Microsoft Excel. Data will include grid number where found, item number assigned, type of item, depth, and location in appropriate UTM coordinates.

3.6 Geographic Information System (GIS) Plan

3.6.1 GENERAL

The foundation of the GIS will be derived from existing CRP data developed during previous site efforts. EOTI has acquired the existing GIS provided by APEX, and will expand it to meet the needs of the project. The GIS will be maintained through the project's life cycle and accumulate all associated geospatial data along with base map layer and analysis data.

3.6.2 ACCURACY

During removal activities, results will be collected and documented by the UXO Teams. All MEC coordinate locations will be documented using hand-held GPS such as the Trimble GeoXH or by taping in from two known points in order to determine the location of the item within plus or minus one foot.

3.6.3 GEOSPATIAL INFORMATION SYSTEMS (GIS) INCORPORATION

The foundation of the GIS will be derived from base layers collected from USACE, state GIS clearinghouses, and previous UXO related investigation/reconnaissance conducted on the site. All data will be converted or digitized into ArcGIS shapefiles and or Geodatabase formats to streamline data and avoid multiple data formats.

All data collected during field activities will be submitted to the GIS Manager. The GIS Manager will perform QC measures on all Geophysical and OE field data to elevate formatting or incorporation issues. Collected data will be incorporated into the GIS and conform to the Universal Transverse Mercator (UTM) projection, a datum of GCS North America 1983 (NAD83), and with linear unit of measure in Meters. All Geospatial data delivered to USACE will conform to Universal Transverse Mercator projection and a datum of GCS North America 1983 (NAD83) with linear units of measure stated as specified in DID WERS-007.01.

EOTI will maintain GIS QC data for the project. QC procedures will be performed periodically on the GIS datasets for inaccuracies that may jeopardize the stability of the GIS and spatial data it contains. Any inaccuracies that arise will be reviewed to determine if the error rests in the GIS incorporation methods or if the actual field data is inaccurate. After the error assessment has been completed, the EOTI Project Manager will be made aware of the inaccuracies and a formal error assessment report will be submitted by the GIS Manager. The GIS Manager will take proper action to resolve the error and retain stability over the GIS database.

Additional data entered or modifications to the existing GIS will be noted with revision dates. This will also be captured in the geospatial dataset's Federal Geographic Data Committee (FGDC) metadata.

All Spatial data incorporated into the project specific GIS will conform to the Spatial Data Standard for Facilities, Infrastructure, and Environment (SDSFIE) standards to give all spatial datasets more compatibility with other government GIS programs. Federal Geographic Data Committee (FGDC) metadata will be developed for spatial layers that have been created by EOTI. It is assumed that spatial data retrieved from other sources such as GIS clearinghouses, previous site investigation, imagery, etc., will contain previously developed metadata created by the originator. All GIS data will be developed and incorporated in to ESRI's Shapefile or Geodatabase format. All GIS project and layout files will be in the (ArcGIS.mxd) file format and submitted with the SSFR. All Spatial Imagery during the life of the project will transferred in to geo TIFF format to help in reducing image file size.

3.6.4 PLOTTING

EOTI anticipates hard copy printouts will be utilized on the project. Hard copy map graphic scales will be based on standard mapping scales. Maps will be developed showing results of MEC found during project activities. Detailed site maps will be produced. Maps will be available in digital PDF format to the APEX.

3.6.5 MAPPING

All survey boundary points related to designated work areas will be incorporated into the project specific GIS. Maps will include true north and magnetic north arrows with the difference between them in degree and minutes shown. Tic marks at standard interval with UTM coordinate designators for the specified area that the map covers will be shown on the edge of the map. A map legend with standard mapping symbols and map index showing area covered on map in relationship to project boundary will be displayed on the map.

3.6.6 COMPUTER FILES & DIGITAL DATA SETS

EOTI utilizes ESRI's ArcGIS version 10.x in development of comprehensive and accurate geospatial data. EOTI will submit the most current GIS as part of any report submitted to APEX. This will include ArcGIS project files and metadata for the geospatial data that is referenced in the project files. The GIS will be updated throughout the project's life.

All GIS data and ArcGIS projects will be developed and incorporated into the ESRI's Geodatabase format. All GIS project and layout files will be in the (ArcGIS.mxd) file format and submitted with the SSFR. All spatial imagery during the life of the project will be transferred into Geo TIFF/Geo JPEG format to help in reducing image file size unless stated otherwise by the Government.

All MEC items that are discovered during the removal that are determined or suspected of containing energetic material will be documented within the GIS. Coordinates for the individual items will be collected using the Geo XH GPS unit prior to BIP, consolidation, or removal operations beginning.

External tabular data that is not integrated within the Geodatabase will be provided to APEX in ANSI SQL format as well as Microsoft Access at the completion of the project. All supporting databases will be complete and single entities, with no relations or joined connections to others.

All geospatial data developed by EOTI will be incorporated into the project specific GIS and will conform to the SDSFIE standards and the USACE data standards to give all spatial datasets more compatibility with other Government GIS programs. Federal Geographic Data Committee (FGDC) metadata will be developed for core SDSFIE data layers that are developed by EOTI. It is assumed that spatial data retrieved from other sources such as GIS clearinghouses, previous site investigations, etc., will contain previously developed metadata created by the originator.

3.7 Intrusive Investigation

3.7.1 Intrusive Investigation Methodology

3.7.1.1 Mobilization

Immediately after receiving a notice to proceed for each phase, EOTI will begin the mobilization process. It is anticipated that two phases of mobilization will occur to accomplish the clearance task. The Project Manager will identify the personnel and equipment required, schedule a sequenced mobilization, and make the necessary travel and shipping arrangements. Personnel qualifications and certification are in Appendix H of this Work Plan.

Personnel

Personnel will be mobilized from their home to Columbia, SC as required to complete the work associated with the project in accordance with the project schedule. The Project Manager and SUXOS will mobilize ahead of the main team body, if necessary, to help set up the project site. They will also arrange to receive equipment, coordinate with survey personnel, and insure that all signed copies of required permits are in place. After this initial mobilization of the management staff has coordinated with local personnel and set up the site, the mobilization body of the remaining field team required to complete all planned activities will occur.

Equipment

EOTI will deliver equipment to the site as required by the project schedule. Mechanical excavation and/or brush cutting equipment are not anticipated but (if required) will be rented and delivered to the site by a local vendor. Other equipment will be delivered to the site by EOTI personnel or shipped to the site by commercial carrier.

3.7.1.2 Site Setup

Immediately upon arrival on the first field day at the site, EOTI will begin site setup activities.

3.7.1.3 Office / Facilities

Due to the expected short duration of field activities and the small work force, EOTI will not establish a formal project office at the project location. Office functions and communication will be established and operated out of site management vehicles and/or from site management personnel's motel rooms. EOTI intends to utilize portable toilets to be delivered during site set-up.

3.7.1.4 Work Site

Immediately upon arrival for the first field work day, EOTI will setup the work site. EOTI will establish and survey the boundary of the designated clearance area using a subcontracted South Carolina-licensed surveyor. One week prior the start of intrusive operations EOTI's PM will notify "call before you dig" number 811 or SCE&G 1-800-251-7234 of the intent to start subsurface clearance. SCE&G will perform marking of any utilities within the clearance foot print and any required digging in those areas will be carefully conducted by hand to avoid damaging any utilities.

3.7.1.5 Survey / Site Layout

The SUXOS will coordinate with the surveyor responsible for marking the work areas to ensure that the site layout is complete and documents the clearance area. To date, the boundary information presented on Figure B-4 has been provided for this effort.

3.7.1.6 Equipment Testing

Hand held magnetometers / metal detectors will be checked on a test plot. Daily checks will be conducted by each instrument operator using his assigned instrument on the test strip. The instruments will be tested against a known source to verify that it responds appropriately. Once the instrument is determined to be functioning properly, the operator will conduct a sweep of the test strip, using the methods and techniques applied in the field. The UXO Team leader and UXOQCS will observe each team member to ensure that he uses proper techniques and can properly locate seed items in the test strip. If the operator displays improper techniques or is unable to accurately and consistently locate seed items, the team leader will conduct refresher training and the instrument operator will then demonstrate his proficiency on the test strip before moving to the designated clearance area. If it is determined that the operator's technique is proper but that the instrument is the cause of his failure to locate seed items, he will be given a different instrument and will repeat the test. Equipment determined to be defective will be tagged and removed from operation. The test strip simulates site conditions. It will be placed in a location free of geophysical anomalies that may interfere with the tests or affect the results. The UXOQCS is responsible for ensuring that personnel accomplish all QC checks and that the appropriate logbook entries are made.

As boundaries of the areas are being marked, EOTI will establish internal grids or clearance areas. The SUXOS will determine the most effective way to divide the removal area into internal grids or clearance areas. The internal areas will be established based on size and shape of the area, terrain, etc. but will generally not exceed one acre in size.

3.7.1.7 Vegetation Removal

Only minimal vegetation clearance, if any, will be required to effectively clear MEC, as described in Section 3.7.9. Only vegetation required to effectively complete the removal action will be cut. Vegetation may be cut using any combination of hand or mechanized clearance methods.

3.7.1.8 Surface Removal

Removal of surface MEC will be completed in accordance with procedures described in Section 3.7.9. The removal will include all MEC, MPPEH and magnetic anomalies on the surface that could mask items in the subsurface and no munitions debris equivalent to, or greater than 3.55 inch diameter or thickness of 3.55 inch or greater from the surface. The method used for surface clearance will be performed using magnetometers to assist in the location of items on the surface. Sections below describe the establishment of search lanes to ensure effective removal of the entire clearance area. Although MD and RRD are not expected on this site as it is not a range, any MD removed during the surface and subsurface removal will be collected and processed as described in section 3.7.13. The surface removal will be completed in conjunction with the subsurface removal. A grid or designated clearance area will not be considered complete and will not be turned over for QC/QA checks until both surface and subsurface removal is complete.

3.7.1.9 Subsurface MEC / MPPEH Removal

The sediment removal area is identified in Figure B-4. The parameters for subsurface clearance are to remove MEC, MPPEH, and any ferrous metal items equivalent to 3.55 inch diameter or thickness (length) of 3.55 inch to depths up to 11 times the width or diameter. The area may be subdivided by placing grid stakes throughout the clearance area in order to better control the removal action and

facilitate reporting and quality control. The internal grids corners will be located with a sub-foot GPS unit or with measuring tapes and corners will be marked with stakes.

3.7.1.9.1 Search Lanes

Those areas requiring a systematic subsurface removal will be divided into lanes to ensure effective removal of the entire area. Tape measures, cones, or small lines will mark search lanes. Unless otherwise directed, the search lane width will be no wider than five feet. The map in Figure B-4 shows the areas that require surface and sub-surface removal. The precise location of these areas will be marked on the ground by the state licensed surveyor. EOTI will then layout grids/divisions and search lanes in each area that allow for the most efficient removal based on the size and shape of the area.

3.7.1.9.2 Anomaly Identification and Investigation

After establishing lanes (as described above), the areas will be cleared by a team consisting of a UXO Tech III (Team Leader) and up to six UXO Tech II/I (team members).

Each UXO Technician will use a hand held magnetometer (such as a Schonstedt GA-52Cx), or an all-metals detector (such as a White's Metal Detector), or equivalent to identify potential subsurface MEC. If a geophysical anomaly is detected it will be investigated by the dig team using mechanical and / or manual digging methods (see ESS for explosives safety information).

3.7.2 MEC Accountability and Records

3.7.2.1 As UXO/MPPEH is located it will be documented on the MEC Accountability Log (Appendix F). A detailed accounting of all suspected UXO/MPPEH items encountered during the removal action will be maintained. This accounting will include:

- Identification Number (a unique ID #);
- Location;
- Nomenclature;
- Fuze Description;
- Fuze Condition; and
- Additional comments, if required.

Each suspect UXO item encountered will be identified using a unique numerical identifier, such as A-3-0001 (for first suspect item (0001) encountered in the Removal Area/Grid A-3).

3.7.2.2 Photographs of or suspect UXO/MPPEH items will be taken for documentation purposes. A ruler or some similar item, to show scale, will be placed adjacent to the item. The photographer needs to remember these photographs will be utilized in the final report; thus, a focused, well thought out photograph is necessary.

3.7.3 UXO Personnel Qualifications

UXO personnel required for this project will include UXO supervisors and technicians, all of whom possess the relevant personal training and experience requirements set forth in DDESB TP 18. Personnel for this project have been selected from a pool of available UXO technicians. Detailed

personnel qualification requirements are in Section 2.3. Resumes of key personnel are included in Appendix H if not listed in the UXO database maintained by USAESCH.

3.7.4 MC Sampling Locations

MC Sampling is not a part of this project.

3.7.5 MC Sampling Procedures

MC Sampling is not a part of this project.

3.7.6 Munition with the Greatest Fragmentation Distance (MGFD)

3.7.7 The Munition with the Greatest Fragmentation Distance (MGFD) and minimum separation distances are presented in the Explosives Safety Submission (ESS).

3.7.8 MEC Identification

The SUXOS and UXOSO must be in agreement on the condition of a MEC item before any removal action is attempted. All available data sources will be consulted, as required to make this determination.

3.7.9 MEC Removal

3.7.9.1 Surface and Subsurface Removal

A surface removal will be conducted in conjunction with the subsurface removal in the designated clearance areas as shown in Figure B-4, in accordance with the SOW (Appendix A). UXO Technicians will visually search and use magnetometers such as Schonstedt GA52Cx, White's Metal detector, or similar equipment to locate MEC/MD. The SUXOS will assign grids/clearance areas to the team and the Team Leader (UXO Tech III) will organize his team to effectively conduct a systematic surface and subsurface clearance. If any area has heavy surface contamination the SUXOS may opt to conduct the surface clearance prior to completing the subsurface clearance.

3.7.9.2 Brush Clearance

3.7.9.2.1 Some minor brush cutting may be required EOTI will ensure effective removal in portions of the designated areas. It is anticipated that little, if any, brush cutting will be required. Brush clearance will be conducted by UXO qualified personnel. The purpose of the brush clearance is to allow an effective removal of MPPEH as required in the SOW.

3.7.9.2.2 EOTI will conduct brush-cutting operations only as necessary to allow for MPPEH detection and removal efforts to take place unrestricted from vegetation undergrowth. EOTI will perform minimum brush removal required to clear the surface and subsurface of MPPEH/MD required by the PWS. Underbrush, tall grass, shrubs, small trees, and limbs may be cut in order to allow efficient MPPEH detection and /or removal. Cut brush will be removed from the area identified for clearance, if necessary to prevent interference with site operations. EOTI's brush cutting team will use a variety of clearing techniques depending on the ground conditions and type of vegetation. Various hand and mechanical methods may be applied to complete this task. EOTI

does not anticipate heavy vegetation in the project area. However, the use of mechanical brush cutting equipment, such as chainsaws and heavy-duty steel bladed weed eaters may be required in the open, lightly vegetated areas. If self-propelled brush cutting equipment is used, the cutting height will be adjusted to ensure that the blades do not strike potential MEC. UXO personnel will perform a visual sweep ahead of the mechanical equipment to identify any potential hazards on the surface of the ground. In areas with soft ground, EOTI will use a combination of mechanical and hand clearing techniques, possibly including the use of equipment such as a Bobcat Brush Cat or similar equipment and weed eaters. Chain saws and chippers may also be used to cut and reduce brush and low hanging limbs that would interfere with detection and removal operations. The EOTI brush cutting team will consist of UXO Technicians. In any case, any brush cutting team will include at least two persons, a minimum of one of whom will meet at least the requirements to be a UXO Tech II.

3.7.9.2.3 The brush clearance team(s) will be structured to safely and efficiently clear each of the designated areas. The SUXOS will designate team personnel and equipment, based on the size of the area, type of brush, terrain, MPPEH, etc. Brush cutting teams will consist of no less than two personnel.

3.7.9.3 Removal of Surface and Subsurface MEC/MPPEH

The map in Figure B-4 shows the area that requires sub-surface removal. The precise location of the area will be marked on the ground by the state licensed surveyor. EOTI will layout grids and search lanes in each area that allow for the most efficient removal based on the size and shape of the area as shown in Figure B-4.

3.7.9.3.1 After clearing brush sufficiently to allow safe, effective removal, EOTI will clear the designated areas. EOTI's removal team will consist of a UXO Tech III (Team Leader) and up to six UXO Tech II/I (team members). The SUXOS will organize and make team assignments to ensure that the project is completed in an efficient and safe manner. Any team assigned to complete removal or other MEC operation will have a minimum of two UXO qualified personnel, including at least one that meets the qualification of a UXO Tech III.

3.7.9.3.2 EOTI's UXOSO/QCS will observe removal operations to ensure that safe, quality work is conducted in compliance with the requirements of the Work Plan. The UXO/QCS will conduct at least a 10% Search Effectiveness Quality Control Inspection (SE QCI) check of the area that was cleared using the same type of equipment and techniques used during the removal process. If an area fails the inspection the team will re-sweep the area and it will then be re-inspected. UXOQCS will conduct blind seeding within the clearance area to insure that Complete QC procedures are contained in Chapter 4.

3.7.9.3.3 All magnetometers will be calibrated and working properly. All equipment will be tested prior to each use. At a minimum, equipment will be tested in the morning prior to beginning work and after lunch prior to resuming work. Magnetometers will be tested on a test strip in accordance with Section 4.7.3.

3.7.9.3.4 Search Lanes

Those areas requiring a systematic subsurface removal will be divided into lanes to ensure effective removal of the entire area. Tape measures, cones, or small lines will mark search lanes. Unless otherwise directed the search lane width will be no wider than five feet.

3.7.9.3.5 Anomaly Identification and Investigation

- 3.7.9.3.5.1 After establishing lanes (as described above), the areas will be cleared by teams consisting of a UXO Tech III (Team Leader) and up to six UXO Tech II/I (team members).
- 3.7.9.3.5.2 Each lane will be cleared by qualified UXO Technicians under the supervision of the Team Leader. Each UXO Technician will use a hand held magnetometer (Schonstedt GA-52Cx, White's Metal Detector, or equivalent) to identify potential subsurface MEC. If a geophysical anomaly is detected that could be caused by MEC it will be investigated by the dig team using mechanical and / or manual digging methods. If mechanical methods are used, the team will excavate to within one foot of the anomaly and then hand methods will be used to carefully expose the source of the anomaly. All material suspected as MPPEH, including UXO, DMM, MD, and Range Related Debris, will be inspected by the SUXOS and UXOSO to determine if it is acceptable to move. If, after inspection, it remains MPPEH and can be safely moved, it will be consolidated and destroyed by detonation as described in Section 3.7.11. If it is not acceptable to move, it will be blown in place as described in Section 3.7.11. All MD and RRD will be handled and processed IAW Section 3.7.13.

3.7.10 MEC Holding Areas

EOTI does not plan to establish holding areas for MEC in this project. MEC/MPPEH items will be marked and will be destroyed as soon as possible in scheduled demolition operations in accordance with the approved ESS. All demolition operations will be conducted in coordination with the local law enforcement and approved ESS. Demolition operations will be performed daily per approved ESS as required or items will be properly guarded until operations can be conducted.

3.7.11 MEC Disposal

Personnel Responsibilities

3.7.11.1 SUXOS – The SUXOS has overall responsibility for reporting and disposition of MEC. He will:

- Schedule and coordinate all demolition operations;
- Ensure a MEC log is maintained;
- Assure that MD generated from demolition operations is inspected prior to placement in the holding bins; and
- Inspect all recovered MD, RRD and CD.

3.7.11.2 UXOSO and the UXOQCS – The UXOSO and the UXOQCS are responsible for insuring all MEC operations meet safety and quality requirements. They will:

- Observe and inspect all demolition operations; and

- Insure all requirements of this section are complied with.

3.7.11.3 UXO Tech III – The UXO Tech III is responsible for the supervision of the MEC disposal operation. He will:

- Post individuals at entry points (if required);
- Construct appropriate engineering controls IAW "Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions," HNC-ED-CS-S-98-7, August 1998 if required;
- Assign team members to specific demolition duties;
- Assure the area is clear prior to capping in for demolition operations; and
- Check the area following each shot or series of shots.

3.7.11.4 UXO Tech II – The UXO Tech II will perform demolition duties as assigned.

3.7.11.5 UXO Tech I/Sweeper – The UXO Tech I/Sweeper will perform demolition duties as assigned.

Safety Precautions

3.7.11.6 A minimum of two personnel (buddy system) will be present during all MEC operations so that one UXO person will always act as a safety observer. Only UXO-qualified personnel will perform MEC procedures. As an exception, a UXO technician I may assist in the performance of MEC procedures when under the supervision of a UXO Technician III or higher.

3.7.11.7 During all MEC operations, only the minimum number of personnel required to safely perform the task will be allowed on-site. All non-essential personnel will remain out of the exclusion zone.

3.7.11.8 If an unidentifiable MEC is found, or toxic chemical ordnance is found, EOTI will coordinate for EOD support through APEX and local law enforcement.

3.7.11.9 UXO personnel required for this project will include qualified UXO supervisors and technicians that possess the relevant qualifications and experience. Personnel assigned to this project have been selected from a pool of available qualified UXO Technicians. All UXO personnel will meet the applicable personnel training and experience requirements.

3.7.11.10 EOTI UXO personnel will not attempt to remove any fuze(s) from the UXO. Personnel will not dismantle or strip components from any UXO. Personnel are not authorized to inert any UXO items found on-site. MEC/UXO items will not be taken from the site as souvenirs.

Off-Site Transportation

EOTI does not anticipate transporting any MEC / MPPEH items off-site for disposal.

Collection Points

Collection points will be performed in accordance with the approved ESS..

Demolition and Post Demolition Operations

- Demolition and Post Demolition Operations will be performed in accordance with the approved ESS.

General Demolition Practices

Personnel will adhere to the following standard safe practices and procedures when conducting demolition operations:

- Review electromagnetic radiation (EMR) hazards and precautions and electrical grounding procedures;
- Carry blasting caps in approved containers and keep them out of the direct rays of the sun;
- Do not handle, use, or remain near explosives during the approach or progress of an electrical storm. All persons will retire to a place of safety;
- Do not use explosives or accessory equipment that are deteriorated or damaged. They may detonate prematurely or fail completely;
- Do not abandon any explosives. Fatal or serious accidents can result from such careless practice;
- Do not use unexploded dud ordnance items for demolition purposes. They may be in an extremely sensitive and hazardous condition;
- Disposal operations will not be initiated until at least one-half hour after sunrise and will be concluded by at least one-half hour prior to sunset;
- Restrict and control access to the disposal site to a minimum of authorized personnel necessary for safe conduct of the disposal operations;
- Do not carry fire- or spark-producing devices into a disposal site except as specifically authorized;
- Do not smoke except in areas specifically designated. After smoking, assure that all burning tobacco is extinguished; and
- Avoid inhaling, and skin contact with explosives, the smoke, fumes, vapors of explosives, and related hazardous materials.

Handling Demolition Materials

When handling demolition materials, EOTI UXO Technicians will observe the following rules and safe practices:

- Do not strike, tamper with, or attempt to remove or investigate the contents of a blasting cap (electric or non-electric), detonator, or other explosive initiating device. A detonation may occur.
- Do not pull on the electrical lead wires of electric blasting caps, detonators or other electro-explosive devices. A detonation may occur.
- Do not attempt to remove an unfired or misfired primer or blasting cap from a coupling base. There is a high risk of an explosion.
- Always point the explosive end of blasting caps, detonators, and explosive devices away from the body during handling. This will minimize injury should the item explode.

- Shaped charges - be certain there is no obstruction in the conical cavity or between the charge and the target, as any obstruction will materially reduce the penetration effect.

Preparation for Electric Firing

When preparing firing systems, EOTI will:

- Use only standard blasting caps of at least the equivalent of a commercial No. 8 blasting cap.
- If using electric blasting caps, all caps will be of the same manufacture, for each demolition shot involving more than one cap.
- Keep blasting caps in approved containers, located at least 7.62 meters (25 feet) from other explosives, until needed for priming.
- Do not bury blasting caps. Use detonating cord to position blasting caps above the ground. Buried blasting caps are subject to unobserved pressures and movement, which could lead to premature firing or misfires.

Electric Priming

- EOTI plans to use an RFD. EOTI plans to prime with electric detonators attached to the receiver unit(s). Depending upon availability, Non-EI (shock tube) detonators may be used in place of electric detonators. Non-electric procedures are included at paragraph 3.7.11.33.

EOTI will prepare electric priming systems using the following techniques and procedures:

- Test electric-blasting caps for continuity at least 50 feet downwind from any explosives prior to connecting them to the firing circuit. Upon completion of testing, the lead wires will be short-circuited by twisting the bare ends of the wires together. The wires will remain shunted until ready to connect to the firing circuit.
- Unroll the lead wires so that the cap is as far as possible from the operator and pointing away from him/her. Place the blasting cap under a sandbag or behind a barricade before removing the shunt and testing for continuity. Make sure the cap does not point toward other personnel or explosives.
- Use only the special silver-chloride dry cell battery in the testing galvanometer. Other types of dry cells may produce sufficient voltage to detonate blasting caps.
- Do not connect the power source to the firing wires until all pre-firing tests have been completed and until ready in all respects to fire the charges.
- Do not hold the blasting cap directly in the hand when uncoiling the leads. Hold the wires approximately 152 millimeter (6 inches) from the cap. This will minimize injury should the cap explode. The lead wires will be straightened by hand and not thrown, waved, or snapped to loosen the coils.
- Do not remove the shunt from the lead wires of blasting caps except for testing for continuity or actual connection into the firing circuit. The individual removing the shunts will ground himself prior to this operation to prevent accumulated static electricity from firing the blasting cap.
- Keep both ends of the firing wires shorted or twisted together except for testing or firing. Do not connect the blasting caps to the circuit firing unless the power ends of the circuit firing leads are shorted.
- Keep all parts of the firing circuit insulated from the ground or other conductors such as bare wires, rails, pipes, or other paths of stray current.
- The UXO person in-charge will order the final priming of the shot.

Firing Demolition Charges

- 3.7.11.11 Keep the power end of the firing wire shunted until ready to connect the power source.
- 3.7.11.12 The signal for detonation will be given by the UXO person in-charge only after all personnel in the area have reached cover or a safe distance from the charge.
- 3.7.11.13 Prior to making connections to the power source, test the firing circuit for electrical continuity.
- 3.7.11.14 The UXO person in-charge will order the firing wires to be connected to the power source. He will maintain control over the activating device, while verifying that the area is clear of personnel, animals, and equipment, including aircraft.
- 3.7.11.15 When using a firing panel, lock the switch in the open position until ready to fire. The single key will be in the possession of the UXO person in-charge.
- 3.7.11.16 Do not complete the circuit at the power source (panel) or give the signal for detonation until directed to do so by the UXO person in-charge.
- 3.7.11.17 Do not attempt to fire a single electric blasting cap or a combination of electric blasting caps in a circuit with less than the minimum current required by the total circuit. Misfires can be expected where this occurs.
- 3.7.11.18 The UXO person in charge and a safety observer shall check the shot following the detonation.
- 3.7.11.19 The team will search the area after each firing for any remaining explosive components and loose explosives. Scattered explosive material should be carefully gathered and destroyed by detonation with the next shot. If left in place, these items can create an additional explosive hazard. This search includes verifying that a secondary item is not present in the area after conducting “blow-in-place” operations. Always check the “blow-hole” for secondary items and remove all MD.
- 3.7.11.20 Electro-Magnetic Radiation (EMR) Hazards. Prior to the application of detonation-in-place procedures, an EMR survey shall be conducted to determine if there are any transmitting antennas of radio, radar, or other electro-magnetic-generating devices located in the vicinity.
- 3.7.11.21 Radio Frequency (RF) EMR. RF EMR consists of waves of electrical energy. These waves are radiated in a line-of-site from the antennas of electronic devices that transmit radio, radar, television, or other communication, to include cellular telephones, or other communication or navigation radio frequency signals. Table 2-1 states the minimum safe distance from electro-explosive devices (EEDs) and the transmitting antenna of all RF emitters. Table 2-2 states the minimum safe distances, which will be maintained between Mobile RF transmitters and electric blasting operations. The

factors to be considered when evaluating the degree of hazard that the EMR (RF) energy represents are:

- The strength of the field (its power);
- The frequencies transmitted;
- The distance from the transmitter antenna to the ordnance; and
- The amount or type of protection available.

Table 1 Minimum Safe Distance from Electro-explosive Devices (EEDs) and RF Transmitter Antenna Emitters

AVERAGE OR PEAK TRANSMITTER POWER IN WATTS	MINIMUM DISTANCE TO TRANSMITTER IN METERS/FEET
0 – 30	30 / 98.4
31 – 50	50 / 164.1
51 – 100	110 / 360
101 – 250	160 / 525
251 – 500	230 / 755
501 - 1,000	305 / 1,000
1,001 - 3,000	480 / 1,575
3,001 - 5,000	610 / 2,001
5,001 - 20,000	915 / 3,002
20,001 - 50,000	1,530 / 5,020
50,001 – 100,000	3,050 / 10,007
100,001 - 400,000	6,100 / 20,014
400,001 - 1,600,000	12,200 / 40,028
1,600,000 - 6,400,000	24,400 / 80,056

* When the transmission is a pulsed or pulsed continuous wave type and its pulse width is less than 10 microseconds, the power column indicates average power. For all other transmissions, including those with pulse widths greater than 10 microseconds, the power column indicates peak power.

Table 2 Minimum Safe Distances in Feet Between Mobile RF Transmitters and Electric Blasting Operations

Transmitter Power (Watts)	MF to 3.4 MHz Industrial	HF 28 to 29.7 MHz Amateur	VHF 35 to 36 MHz 42 to 44 MHz 50 to 64 MHz	VHF 144 to 148 MHz 150.8 to 161.6 MHz	UHF 450 to 460 MHz Cellular Car Phones above 800 MHz
5 ¹	30	70	60	20	10
10	40	100	80	30	20
50	90	230	180	70	40
100	120	320	260	100	60
180 ²	170	430	350	130	80

¹ Citizens band radio (walkie-talkie) (26.96 to 27.41 MHz) - minimum safe distance -five feet. Double sideband - 4 watts maximum transmitter power - hand-held, 5 feet; vehicle mounted, 65 feet. Single sideband - 12 watts peak envelope power - handheld, 20 feet; vehicle mounted, 110 feet.

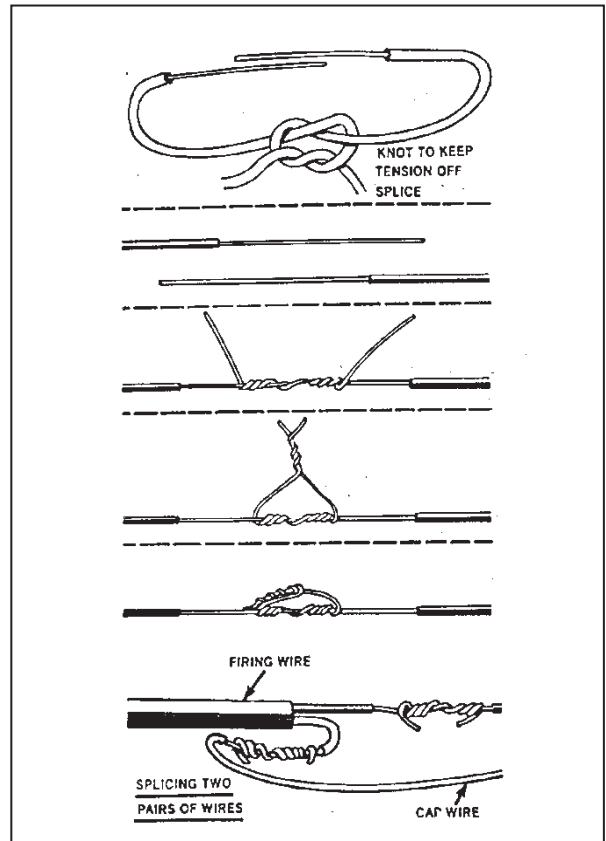
² Maximum power for 2-way mobile units in VHF (150.8 to 161.6 MHz range) and for 2-way mobile and fixed station units in UHF (450 to 460 MHz range).

3.7.11.22 Lightning, Electric Power Lines, and Static Electricity. Lightning is a hazard to both electric and non-electric blasting caps. A strike or a nearby miss is almost certain to initiate either type of cap or other sensitive explosive elements such as caps in delay detonators. Lightning strikes, even at remote locations, may cause extremely high local

earth currents, which may initiate electrical firing circuits. Effects of remote lightning strikes are multiplied by proximity to conducting elements, such as those found in buildings, fences, railroads, bridges, streams, and underground cables or conduit. The only safe procedure is to suspend all blasting activities during electrical storms and when one is impending. All blasting activities will be suspended when lightning-thunder storms are within ten miles of the project site.

3.7.11.23 Electrical firing will not be performed within 510 feet of energized power transmission lines. When it is necessary to conduct disposal operations at distances closer than 510 feet to electric power lines, non-electric firing systems will be used or the power lines de-energized.

3.7.11.24 Many electric blasting caps have been detonated because they grounded static electricity that was in the air. Static electricity is produced by a great variety of causes; among them, dust storms, which have caused a large number of detonations; snow storms, less dangerous, but known to have caused premature explosions; and escaping steam, known to have charged the air and detonated electric caps. Enough static electricity to detonate electric caps also can be generated by such sources as moving belts and revolving automobile (truck) tires. Static electricity is an increased hazard when operating in an extremely cold climate or area of low humidity.



Preparation of Demolition Shots

After determining and locating a safe location away from the charges, lay out the firing wire and prepare and place all explosive charges.

Test Firing Wire

3.7.11.25 If using the blasting galvanometer/M51 test set - check the galvanometer by holding a piece of metal across its terminals. If the battery is good, there should be a wide deflection of the needle. Check the M51 test set by holding a piece of wire across its terminals and depress handle - lamp should glow.

3.7.11.26 When using a Model "D" Blaster's Ohmmeter with the Lawrence Silver Chloride Dry Cell, a full needle indication is required. Frequently cells, which have been stored for long periods of time, will require re-activation. To obtain full-scale deflection of the

meter needle, the meter contact posts should be shorted with a metal instrument such as a screwdriver or knife blade. Place the metal blade in full contact with both terminals simultaneously for a period of twenty seconds to one minute. This should activate the cell to full-scale deflection. If it does not, do not use the ohmmeter.

3.7.11.27 Separate firing wire connectors at both ends, and touch those at one end to galvanometer/test set posts. The needle should not move nor lamp glow. If either occurs, the firing wire has a short circuit.

3.7.11.28 Twist wires together at one end and touch those at the other end to the galvanometer/test set posts. This should cause a wide deflection of the needle or the lamp to glow. No movement of the needle indicates a break; a slight movement indicates a point of high resistance, which may be caused by a dirty wire, loose wire connections, or wires with several strands broken off at connections. Note: Firing wire can be tested on the reel, but unnoticed broken wires could produce false readings. Firing wire must be tested after unreeling. Caution: Do not drag a firing cable over sand or other insulated surfaces as this can generate a static charge that will electrically fire blasting caps.

3.7.11.29 Twist free ends of firing wire together to prevent an electric charge from building up in the firing wire.

Test Blasting Caps

Complete the following steps in order to test the electric blasting caps:

- Test galvanometer/M51 test set as outlined above.
- Test electric-blasting caps for continuity at least 50 feet downwind from any explosives prior to connecting them to the firing circuit.
- Place the cap under a sandbag or other protective device in the event that the cap accidentally functions.
- Individual conducting this test will ground himself prior to removing the shunt.
- Remove short circuit shunt.
- Touch one cap lead wire to one post and the other cap lead wire to the other post. If the galvanometer's needle deflects slightly less than it did when instrument was tested, or the lamp glows, the blasting cap is satisfactory; if not the cap is defective. Destroy it on the detonation. Note: If the battery is fresh, the galvanometer should read at least half scale when the instrument is tested and when a good blasting cap is tested.

Connecting the circuit.

Complete the following steps when connecting an electrical firing circuit:

- At the firing position, keep the free ends of the firing wire twisted together until ready to connect the blasting machine.
- Individual will ground himself prior to performing next step.
- Splice free cap lead wires to firing wire.
- Insert cap into charge.

Firing Procedures

Complete the following steps in order when firing the shot:

- Test the entire circuit. Move to the firing position and test the entire firing circuit with the galvanometer or test set as outlined above. If the firing circuit is defective, shunt wires; go down-range and recheck circuit. If the splice is found defective, re-splice wires. If cap is found defective, replace it.
- Twist free ends of firing wire together.
- Exercise the blasting machine. Test blasting machine by actuating it several times with nothing attached to the terminals.
- Connect blasting machine.
- Sound a warning (siren, horn, etc.) and loudly call out “Fire in the hole”! three times. (Specific procedures for warnings and notifications will conform to SOP for demolition operations at CRP)
- Activate blasting machine.

Electric Misfire

3.7.11.30 Prevention of electric misfires: In order to prevent misfires, insure that:

- All blasting caps are included in the firing circuit;
- All connections between blasting cap wires, connecting wires, and firing wires are properly made;
- Short circuits are avoided;
- Grounds are avoided; and
- Number of blasting caps in any circuit does not exceed rated capacity of power source on hand.

3.7.11.31 Causes of electric misfires. Common specific causes of electric misfires include:

- Inoperative or weak blasting machines or power source;
- Improperly operated blasting machine or power source;
- Defective and damaged connections, causing either a short circuit, a break in the circuit, or high resistance with resulting low current;
- Faulty blasting caps;
- The use in the same circuit of blasting caps made by different manufacturers or different design; and
- The use of more blasting caps than power source rating permits.

3.7.11.32 Clearing electric misfires. If charge is primed electrically, proceed as follows:

- Make three successive attempts to fire;
- If unsuccessful, remove firing wires from blasting machine and check continuity of firing circuit.
- If continuity is good, reattach firing wires to blasting machine and make 3 more attempts to fire charge;
- Check firing wire connections to terminals of the blasting machine and make 3 more attempts to fire charge;
- Change blasting machine after third unsuccessful attempt with original blasting machine.

- If still unsuccessful, disconnect blasting machine from firing wire ends and shunt firing wire by twisting firing wire ends together;
- Allow a minimum of 30 minutes to elapse from the last attempt to fire, before starting to investigate;
- Remove and disconnect old blasting caps and shunt wires; Connect wires of new blasting cap(s) to firing circuit and re-prime charge; and
- Reconnect firing wire ends to blasting machine and fire charge.

Non-electric Procedures

3.7.11.33 A nonelectric (shock tube) detonator firing system is designed to initiate demolition charges when a lightweight, low-initiating explosive weight, nonelectric, nonfragmenting, and waterproof initiating system is desired. These systems are made up of nonelectric detonators with pyrotechnic leads, pyrotechnic lead initiators, firing devices, and connectors. These systems provide control similar to electric initiating systems. The nonelectric detonators are not hazards of electromagnetic radiation to ordnance (HERO) or electrostatic sensitive. Unlike standard nonelectric blasting caps, no crimping or water sealing of the detonator or pyrotechnic lead is necessary and time fuze is not required in most applications. All handling procedures for donor explosives will be done as with electric firing systems.

- After determining and locating a safe location away from the charges prepare and place all explosive charges.
- The UXO person in charge will order the final priming of the shot.
- Make sure detonator is not pointed toward personnel or explosives.
- Unspool nonelectric detonator (with pyrotechnic lead) from demolition charge to required standoff.
- Insert or attach detonator to demolition charge.
- The UXO person in-charge will order the lead to be connected to the power source. He will maintain control over the activating device, while verifying that the area is clear of personnel, animals, and equipment, including aircraft.
- Attach lead to firing device (initiator or receiver) IAW the manufacturer's instructions.
- When using a firing panel, lock the switch in the open position until ready to fire. The single key will be in the possession of the UXO person in-charge.
- Fire the shot using the initiating device IAW the manufacturer's instructions.
- The UXO person in charge and a safety observer shall check the shot following the detonation.
- The team will search the area after each firing for any remaining explosive components and loose explosives. Scattered explosive material should be carefully gathered and destroyed by detonation with the next shot. If left in place, these items can create an additional explosive hazard. This search includes verifying that a secondary item is not present in the area after conducting "blow-in-place" operations. Always check the "blow-hole" for secondary items and remove all MD.

- In the event of a misfire, follow the RFD manufacturer's procedures in order:
 - Do not approach the shot until 30 minutes has elapsed.
 - Igniter tip may be worn or damaged. Try a new tip.

- There may be water on the tip. Blow out the tip and test fire the tip without any tube installed.
- Shock tube may be damaged or defective. Cut a one-foot section beginning approximately six inches from the igniter. Hold one end of the one-foot section over the palm of your hand and gently blow through the other end. If a fine powder is blown out of the tube, reattach the pyrotechnic lead to the igniter tip.
- Replace the detonator assembly and shock tube and attempt the detonation again.

3.7.12 Material Potentially Presenting an Explosive Hazard (MPPEH)

3.7.12.1A UXO Tech I can tentatively identify a located item as MPPEH, followed by a required confirmation by a UXO Tech II or Tech III.

3.7.12.2A UXO Tech II will conduct a 100% inspection of each item as it is recovered and determine the following:

- Is the item a UXO, a DMM, munitions debris, or range related debris?
- Does the item contain explosive hazards or other dangerous fillers?
- Does the item require detonation?
- Does the item require demilitarization (demil) or venting to expose dangerous fillers?
- Does the item require draining of engine fluids, illuminating dials and other visible liquid hazardous, toxic, or radiological waste (HTRW) materials?

3.7.12.3 All munitions debris and range related debris will be picked up by UXO removal team during surface sweep and subsurface removal operations.

3.7.12.4 The munitions debris and range related debris will be placed into containers for collection while sweeping. When the containers are approaching full, they are transported to a predetermined location on the site.

3.7.12.5 All munitions debris and range related debris will be re-inspected by the UXO removal Team Leader (UXO Tech III) prior to transportation to the secured containers.

3.7.12.6 Items requiring demilitarization and/or venting will be segregated and processed in a timely manner and placed in securable containers.

3.7.12.7 The UXOSO/QCS will conduct daily audits of procedures for processing MPPEH and will conduct and document random checks of specific pieces.

3.7.12.8 SUXOS and UXOSO/QCS will ensure that Work Plan procedures, based on and in compliance with Chapter 14 of EM 1110-1-4009, are being followed and performed safely.

3.7.12.9 All final processed material will be placed in lockable containers, for security, before turning in for recycling. In accordance with Chapter 14 of EM 1110 dated 15 June 2007, and Errata Sheet No. 2, EOTI will dispose of all material determined by inspection not to contain an explosive hazard (munitions debris and range related debris)

through an offsite recycling facility. EOTI will destroy material remaining as MPPEH after inspection.

3.7.12.10 Items that require demilitarization will be demilitarized in accordance with DoD 4160.21-M-1, Defense Demilitarization Manual. All MEC items will be investigated to insure that there are no explosives remaining in the items and that only inert filled or empty items are removed from the grid. Redundancy is built into the investigation process to assure no MEC items are removed from the site.

3.7.12.11 SUXOS will be responsible for ensuring work and Quality Control (QC) Plans specify the procedures and responsibilities for processing MPPEH for final disposition as UXO, DMM, munitions debris or range-related debris.

3.7.13 Munitions Debris (MD) & Range Related Debris (RRD)

3.7.13.1 SUXOS will:

- Ensure a Requisition and Turn-in Document, DD Form 1348-1A is completed for all munitions debris and range-related debris to be transferred for final disposition.
- Perform random checks to satisfy that the munitions debris and range-related debris are free from explosive hazards necessary to complete the Form, DD 1348-1A.
- Certify all munitions debris and range-related debris as free of explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW materials. No range related debris is expected on the CRP project.
- Be responsible for ensuring that inspected debris is secured in a closed, labeled, and sealed in a container and documented as follows;
 - The container will be closed and clearly labeled on the outside with the following information: The first container will be labeled with a unique identification number that will start with USACE/Installation Name/Contractor's Name/0001/Seal's unique identification and continue sequentially.
 - The container will be closed in such a manner that a seal must be broken in order to open the container. A seal will bear the same unique identification number as the container or the container will be clearly marked with the seal's identification information if it differs from the number on the container.
 - A documented description of the container will be provided by EOTI with the following information for each container: contents, weight of container, location where munitions or range-related debris was obtained, name of contractor, names of certifying and verifying individuals, unique container identification, and seal identification. EOTI will also provide these documents within the Final Report.

3.7.14 Disposal Alternatives

If MPPEH is discovered that cannot be destroyed on-site, the SUXOS will coordinate with the USACE on-site Safety Specialist to determine an appropriate method of off-site disposal. The SUXOS will

present possible courses of action and a recommendation to the EOTI Project Manager. The final method of off-site disposal will be approved by USACE.

3.8 Geospatial Information and Electronic Submittal

The GIS Plan is described in Section 3.6 of this WP.

3.9 Investigative Derived Waste Plan

Investigative Derived Waste is not applicable to this project.

3.10 Risk Characterization and Analysis

Risk Characterization and Analysis is not a part of this project per the PWS.

3.11 Analysis of Land Use Controls

Land Use Controls are not associated with this project.

3.12 Preparation of the Five-Year Review Plan

A Five-Year Review is not a part of this project.

3.13 Construction Support

EOTI will provide a Construction Support team consisting of a UXO Tech III and a UXO Tech II to provide Standby Support to the construction contractor when construction activities are planned. Additional teams may be added if required to provide adequate support to the construction contractor. If it becomes necessary to perform demolition operation to destroy MPPEH, a third UXO technician will be mobilized and the team will be organized to conduct the demolition operation as described in Section 3.7.11.

EOTI will coordinate schedules with the construction contractor to ensure that the support is available when and where needed. Activities performed during standby support include, but are not necessarily limited to: safety and awareness training; MPPEH inspection/identification; anomaly detection/avoidance; area inspections; etc.

4.0 CHAPTER 4 – QUALITY CONTROL PLAN

4.1 QUALITY CONTROL OBJECTIVES

This section presents the project QC Plan as required by the PWS. The QC procedures described in this section will be used for all work performed during this MEC Removal Project. This site-specific QC plan is designed to manage, control, and document performance of work efforts and to ensure quality throughout the execution of all tasks. This QC Plan will achieve the following objectives:

- Identify QC procedures and responsibilities.
- Document the quality of work efforts via audits and independent staff reviews of deliverables.
- Ensure data integrity through implementation of data management QC procedures.
- Ensure the development of an appropriate accountability and appropriate data collection.

4.2 QUALITY POLICIES

- 4.2.1 All services provided will be consistent with and will meet the requirements of all applicable laws and regulations.
- 4.2.2 Quality Management will be applied throughout all phases of the project – from the time of the task order award, until the SSFR is accepted.
- 4.2.3 Emphasis will be placed on preventive actions that minimize quality failures or defects.
- 4.2.4 All EOTI employees and team members are empowered to identify and evaluate potential quality problem areas and are encouraged to recommend solutions or corrective actions.
- 4.2.5 EOTI will staff all project sites with the best qualified, trained, available personnel, based upon their knowledge and prior experience with the type of operations and hazards expected to be encountered. The minimum qualifications will meet or exceed the customer's requirements.
- 4.2.6 All EOTI personnel will be provided with all of the information necessary to accomplish their assigned tasks in a safe, responsible, cost-efficient manner and they will be held accountable for the quality of their work.
- 4.2.7 The project team will be provided with a copy of the final approved Work Plan / SSHP prior to the performance of any MEC-related activities on a project site.
- 4.2.8 EOTI will take corrective actions on any complaint, quality defect, or negative result from an audit of operations.

4.3 DEFINITIONS

- Removal Standard - a specified size of MEC to a specified depth. The removal standard for this project is: No findings on the surface of the munitions response site of MEC or MPPEH regardless of size excluding small arms ammunition, and no munitions debris equivalent to, or greater than 3.55 in (6 lbs shell) in diameter or width with a thickness (length) of 3.55 in or greater; and finding within the subsurface of the munitions response site no ferrous metal items (including, but not limited to MEC and MPPEH) equivalent to, or greater than 3.55 in in

diameter or width with a thickness (length) of 3.55 in (6 lbs shell) or greater to a depth the lesser of 11 times the item diameter (or width).

- Customer/Client - refer to the term “Purchaser” for the contract.
- Nonconformance:
 - A minor nonconformance is not likely to materially reduce the usability of the services. It is generally a departure from the approved procedures that have little bearing on the end product.
 - A major nonconformance is likely to result in failure of the services or to materially reduce the usability of the end product.
 - A critical nonconformance is likely to result in hazardous or unsafe conditions for individuals using or depending upon the services.
- Purchaser: The term purchaser shall refer to the non-government body administering the particular contract involved, or the authorized representative of that body.
- Quality Conformance Inspection (QCI): Normal inspections/audits conducted by authorized EOTI personnel during the accomplishment of the organization’s mission to determine conformance to contract requirements.
- QC: The process by which EOTI manages, controls, and documents its activities in the accomplishment of the mission.
- Quality Defect: A nonconformance issue with published policy and/or a contractual requirement that requires corrective action(s).
- Quality Management: All those control and assurance activities instituted to safely and effectively accomplish the assigned mission.
- Root Cause: The basic reason for an undesirable condition or problem if eliminated or corrected, would have prevented it from existing or occurring.
- Stop-Work-Authority: The right and obligation to stop all work when serious quality or safety concerns arise.
- Surface Removal: Locating and removing UXO items that are visible on the surface, or partially visible. This includes items that are partially exposed, which will require only minimal hand excavation to determine identification.
- Characterize: Locating, identifying, and characterizing metallic objects that caused a geophysical response.

4.4 QC RESPONSIBILITY

EOTI is solely responsible for the control of product quality. Only those products/services that conform to contractual requirements will be offered to Apex for acceptance.

4.5 CONTRACT SUBMITTALS

All contract submittals will be prepared by qualified personnel in accordance with the PWS and contract requirements. All documents undergo a peer review in which they will be reviewed by an equally qualified person familiar with the project and submittal requirements.

4.6 QUALITY MANAGEMENT

- 4.6.1 The Project Manager has the responsibility of ensuring that QC procedures are implemented in accordance with the work plan and applicable documents identified within it.

4.6.2 The QA/QC Manager will provide the Quality Management oversight for the project. The QA/QC Manager is a part of the project team, but is authorized to elevate any quality problems that cannot be resolved by the project team. The QA/QC Manager interacts with the Project Manager, SUXOS, UXOQCS, subcontractor QC staff, as appropriate, and Project Manager to prevent and/or correct problem situations, as necessary. Vendors and subcontractors will be monitored to assure that they supply items and services, which meet quality requirements. Periodic audits will be performed to verify that the quality system and the UXOQCS are performing as required. He also ensures that:

- Required site training is conducted prior to the start of field activities.
- The UXOQC Specialist is qualified and trained.
- QC is built into the Project Work Plan to support the MEC removal action.
- The requirements of the QC Plan are adhered to.

4.6.3 Effective day-to-day field QC management is delegated to the on-site EOTI UXOQCS. He will interact daily with the project team to ensure that all QC procedures presented in the Project Work Plan are followed in the accomplishment of all project tasks. The UXOQCS reports directly to the QA/QC Manager. Scheduled activities are coordinated with the Project Manager, SUXOS, UXOSO, and all other project team members as needed. He has the authority to:

- Initiate action to prevent the occurrence of nonconformance's relating to the provided services.
- Identify and record any problems relating to the services.
- Initiate, recommend or provide solutions through the on-site management channel.
- Verify the implementation of solutions.
- Control further actions of any nonconforming services until the unsatisfactory conditions have been corrected.
- Elevate Quality concerns, which cannot be resolved on-site to the Quality Manager.

4.6.4 All project team members are responsible for and will be held accountable for the quality of their work. Every team member has Stop-Work-Authority when an immediate safety situation is observed which could cause personal injury or damage to property and equipment. All project team members are encouraged to identify potential quality problems and are encouraged to suggest solutions or corrective actions to ensure all work conforms to the approved Work Plan and QA requirements. During site-specific training, personnel will be briefed by the QA/QC Manager or the UXOQCS, on the importance of quality work and the above stated requirements. This briefing is aimed at insuring that all site personnel understand EOTI's dedication to quality.

4.7 QC PLAN PROCESSES

This section documents the processes affecting quality. These are essential steps to ensure a quality product is delivered to the Government.

4.7.1 *Specific Procedures*

Described below are the specific procedure that will be used to assure quality in this PWS regarding; Audits, Corrective/Preventive Action, Data Management, Field Operations, Equipment Calibration and Maintenance, and Personnel Protective Equipment.

4.7.2 Scheduled Audits

Periodic audits will be performed by the QA/QC Manager to ensure that the requirements of this Quality Plan are being followed. This may include on-site visits as well as frequent document review activities. Training records, periodic reports, and adherence to all aspects of this QC Plan will be monitored to assure compliance.

4.7.3 Daily QC Audits

All instruments, vehicles/machinery, and equipment will be checked prior to the start of each workday and periodically throughout the day batteries will be replaced as needed, and instruments requiring calibration will be checked against a known source. Hand held magnetometers / metal detectors will be checked on a test plot. Daily checks will be conducted by each instrument operator using his assigned instrument on the test plot. The instruments will be tested against a known source to verify that it responds appropriately. Once the instrument is determined to be functioning properly, the operator will conduct a sweep of the test strip, using the methods and techniques applied in the field. The UXO Team leader and UXOQCS will observe each team member to ensure that he uses proper techniques and can properly locate seed items in the test plot. If the operator displays improper techniques or is unable to accurately and consistently locate seed items, the team leader will conduct refresher training and the instrument operator will then demonstrate his proficiency on the test plot before moving to the designated clearance area. If it is determined that the operator's technique is proper but that the instrument is the cause of his failure to locate seed items, he will be given a different instrument and will repeat the test. Equipment determined to be defective will be tagged and removed from operation. The test strip simulates site conditions. It will be placed in a location free of geophysical anomalies that may interfere with the tests or affect the results. Figure 6 shows the conceptual layout of the test strip and Table 4 includes seed item placement details. The UXOQCS is responsible for ensuring that personnel accomplish all QC checks and that the appropriate logbook entries are made. The UXOQCS performs random, unscheduled QCI to ensure that personnel accomplish all work specified in the Project Work Plan. The QCI Schedule will adhere to the following Table 5. The UXOQCS has the latitude to modify this schedule based on the quality of work being performed and the frequency of noted activities.

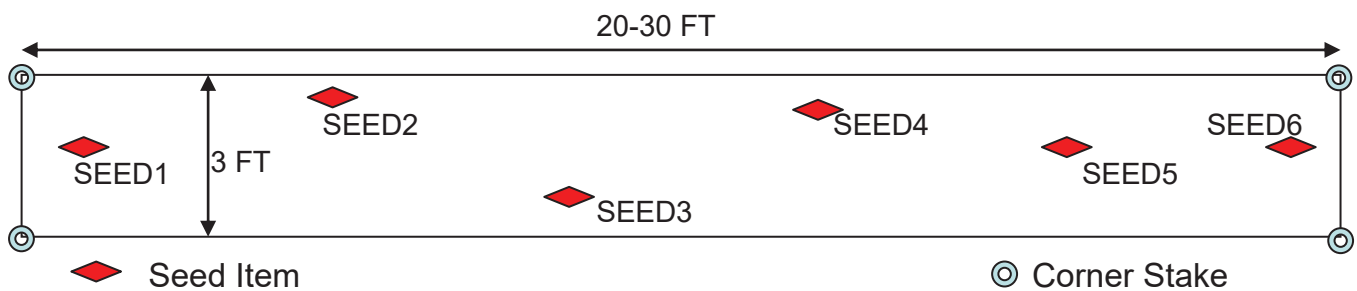


Figure 6 Test Strip Conceptual Layout

Table 3 Test Strip Seed Item Description

Test Strip Seed Item Description			
Seed Item ID	Description	Depth [in]	Notes
SEED1	10 lb Shell	34	Oriented approximately 45° from horizontal and parallel to the major axis of the test strip

SEED2	6 lb Shell	28	Oriented approximately 90° from horizontal and parallel to the major axis of the test strip
SEED3	10 lb Shell	46	Oriented approximately horizontal and approximately perpendicular to the major axis of the test strip
SEED4	6 lb Shell	39	Oriented approximately 45° from horizontal and parallel to the major axis of the test strip
SEED5	8 lb Shell	31	Oriented approximately 45° from horizontal and perpendicular to the major axis of the test strip
SEED6	8 lb Shell	43	Oriented approximately 45° from horizontal and perpendicular to the major axis of the test strip

Note: Seed items may be inert items or simulants with similar dimensions. At least two items will be blind seed items that are periodically moved by the UXOQCS.

Table 4 Frequency of QC/QA Inspections and Checks

TASK	100%	DAILY	WEEKLY	BI-WEEKLY	AS NEEDED
Personnel Qualifications	✓				
Test Plot Proficiency		✓			✓
Accident/Incident Reporting	✓				
Search Effectiveness					✓
Turn-in of Recovered Munitions Debris	✓				
Preventive Maintenance		✓			
Communications Equipment Inspection		✓			
Safety Inspections		✓	✓		
Medical Support		✓			
Communications Effectiveness		✓			
Explosives Accountability					✓
Excavation Activities	✓				
MEC Final Disposal			✓		
MEC Accountability			✓		
Fire Protection – Prevention			✓		
Project Administration			✓		
Safety and Health Programs				✓	
Visitor Briefing					✓
Site – Specific Training					✓
Hazard Assessment – Risk Analysis					✓

4.8 QUALITY ASSURANCE / QUALITY CONTROL STANDARDS

4.8.1 *Surface Removal*

Every area designated for surface removal will undergo a Search Effectiveness Quality Control Inspection (SE QCI) involving approximately 10% of the square footage. The exact location of this square footage is at the discretion of the UXOQCS. The UXOQCS will also verify that the anomalies removed from the surface are accounted for separately, properly, and weighed accurately. The UXOQCS will place seed items, as described in this Section, to verify the effectiveness of the removal.

4.8.2 *Subsurface Removal*

The UXOQCS will perform a UXO QCI on at least 10% of each area excavated by the removal team. Additionally, seed items will be used, as described in Section 4.8.3, to ensure the removal effectiveness. The UXO QCI will be performed using one of the following two methods, or a combination of the two methods.

- As available, a UXOQCS will monitor UXO Removal Teams while they acquire and excavate anomalies. He will observe the team’s procedures to ensure quality standards are met.
- Following excavation, the UXOQCS will check the location using the same detection technology to ensure the team has removed all anomalies.

4.8.3 *QC Performance Requirements*

The Quality Control requirements of this project are provided in Table 4. The surface of all indicated removal areas will be cleared, in accordance with DID WERS-004.01.

Table 5 Performance Requirements Matrix

Performance Requirements Matrix				
Requirement	Applicability	Performance Standard	Frequency	Consequence of Failure
Repeatability	All operators with assigned equipment	All items in the test strip detected (trains ear to items of interest).	At least daily	Replace defective equipment / remedial training. Operators that fail the retest will be assigned to other tasks for the day and will be re-tested again the next working day.
Coverage	Site	100% of the area swept and anomalies removed / No MEC of any size and no RD/MD items \geq 3.55 in (6lb shell) diameter or width. All seed items are recovered.	At least 1-2 blind seed items per operator per lot	Redo lot
Detection and Recovery	Each Sector	All MEC/MPPEH and MD/RD greater than 3.55 (6 lb) in or width removed from the surface/subsurface. All seed items are located and recovered.	At least 1-2 blind seed items per operator per lot. 10% of the area checked by UXOQCS	Redo lot
Geodetic Equipment Functionality	All	Geodetic Repeatability- Check against a known position set by a surveyor / position located within 1 foot	At least Daily	Replace defective equipment / remedial training. Operators that fail the retest will be assigned to other tasks and will not operate geodetic equipment, until proficiency is demonstrated.
Recheck of Excavations	All	After excavation the UXOQCS will recheck the voids to determine that no magnetic signature exists.	All excavated voids will be rechecked by UXOQCS	Failure to verify that the void is free of magnetic signatures will result in further excavation and repeat of this operation after source of magnetic signature is identified.

The UXOQCS will use blind seed items in the test plots and in the removal areas to ensure the effectiveness and completeness of the removal action. The UXOQCS will place two or three (2-3) inert MD items or surrogates (similar to those used to seed the test strip) in area to verify detection proficiency. The UXOQCS will record the location and depth of the seed items using GPS (location) and tape measure (depth) and will document the failure of any operator to accurately locate them. The location, depth, and number of items will be varied each week, when conducting intrusive operations. Additionally, the UXOQCS will place seed items on the surface and in the subsurface of the removal

area. The detection seeds will also serve as coverage seeds for QC purposes. The seed items may be metallic covers for electrical junction boxes or other suitable surrogate item, painted and identified with a unique number. A lot is defined as the portion of the area assigned to the team to clear. The lots may be irregular shaped and may vary in size, depending on the shape of the removal area, but will generally be approximately one acre. The UXOQCS will record the location (grid/clearance area) of each seed item and will verify that all are located prior to the final clearance of area. Failure to recover the seed items will result in a QC failure condition that will require re-clearing of the lot. All QC logs, reports, and other QC related documentation will be maintained in MS word and MS Excel formats and available to the client PM, EOTI PM, and SUXOS.

4.9 QC FILES

4.9.1 The following two files will be established and maintained by the UXOQCS.

- QCI Record File
- Corrective Action Request (CAR) File

4.9.2 The QCI Record File will be a two-part file, containing Active and Inactive Sub-files.

4.9.3 The Inactive Sub-file will contain the Quality Conformance Inspection Record (QCIR) for tasks that were found to be in compliance with the Work Plan and those that were not in compliance, but have been re-inspected and are subsequently corrected.

4.9.4 The Active Sub-file will contain those QCIR for tasks that were found to be not in compliance with the Work Plan and have not yet been corrected.

4.9.5 The CAR File will be a two-part file containing an Active Sub-file and an Inactive Sub-file. A CAR will be maintained in the Active File until follow-up has been conducted and deemed satisfactory. Once the follow-up is completed, the CAR will be placed in the Inactive File.

4.10 CORRECTIVE/PREVENTATIVE ACTION

4.10.1 Nonconformance will be documented on a QCIR. The QCIR will document the reason for the nonconformance and describe the corrective actions taken to resolve the problem and the actions taken to prevent reoccurrence. QCI are generally intended to be preventative, rather than corrective in nature. Through preventative QCI, continuous improvement of site operations will occur.

4.10.2 The QCIR may be handwritten in ink when computer access is limited, but when practical they will be prepared electronically in Microsoft Word format.

4.10.3 A QCIR may be completed for tasks when they are in conformance with the Work Plan. QCIRs for conforming tasks will not generally be distributed off the project site.

4.10.4 A QCIR will be completed for tasks when they do not conform to the Work Plan. Nonconformance QCIRs will be forwarded by facsimile or email to the Project Manager and the QA/QC Manager.

- 4.10.5 A QCIR will be completed for re-inspection of nonconformance. If the re-inspection indicates that the nonconformance has been corrected, both QCIRs will be filed in the Inactive Sub-file and a copy of the re-inspection QCIR will be forwarded to the Project Manager and the QA/QC Manager. If the re-inspection indicates the nonconformance has NOT been corrected, both QCIRs will be filed in the Active Sub-file. A copy of the re-inspection QCIR will be forwarded to the Project Manager and the QA/QC Manager.
- 4.10.6 Nonconformance will be evaluated and corrective action implemented by on-site management whenever possible. The Project Manager and QA/QC Manager will track all non-conformances to assure that they have been resolved, actions to prevent re-occurrence have been implemented and that lessons learned are communicated effectively.

4.11 CUSTOMER COMPLAINTS

- 4.11.1 Customer complaints will be addressed immediately. The complaint may come in the form of a verbal comment or written correspondence. Whatever the vehicle, the Project Manager will conduct an investigation to analyze the complaint and assure corrective action has been initiated. The corrective action will address not only the root cause but also the application of controls to assure its effectiveness.
- 4.11.2 The Project Manager will document the complaint or nonconformance and the investigation. He will look for the root cause.
- 4.11.3 Lessons Learned will be documented on the CAR and communicated to Project personnel and the QA/QC Manager.
- 4.11.4 The action on the CAR is not complete until the UXOQCS and/or SUXOS have completed follow-up. The corrective/preventative actions have to be adequate to prevent reoccurrence and the customer must be satisfied with these actions.
- 4.11.5 The issue addressed in the CAR will be an item for a future QCI to ensure that the corrective/preventive actions have in fact addressed the issue and the solution was effective.

4.12 DOCUMENT CONTROL AND DATA MANAGEMENT

Rigid control must be maintained over the production of QC documents. The following guidelines will apply to all documentation generated by QC staff.

4.12.1 Document Completion

4.12.1.1 All sections of forms will be completed. Any unused spaces will be marked not applicable (N/A). In long columns of empty lines, N/A may be written in the first and last lines of that column with a single line connecting the entries. Large areas of unused spaces may be designated N/A by drawing a single line through the unused areas with the letters N and A on either side of that line.

4.12.1.2 Time and date formats: To eliminate misunderstanding, the following formats will be used on all official reports and correspondence:

- Time: 24-hour (Examples: 0730H, 1930H)
- Date: MM/DD/YY (Examples: 10/05/12, 11/15/12)

4.12.1.3 All signatures will be accompanied by the date the signature was made, either in a date block or with the date written following the signature.

4.12.1.4 White opaque correction fluids/tape may not be applied to records to correct mistakes.

4.12.1.5 Incorrect entries shall be drawn through with a single line with the initials of the author and the date of the correction immediately adjacent. Corrected entries will be placed above or immediately following the line through or otherwise entered on the document in a legible, understandable means.

4.12.1.6 Any entries or corrections to a document, other than in document control blocks, made after its date of inception, shall be considered a “late entry”. Late entries will be clearly designated with the capital letters “LE”, the initials of the person making the late entry, and the date the late entry is made.

4.12.1.7 Official original documents will be distinctly marked, as such.

4.13 DATA MANAGEMENT

4.13.1 Electronic data and records will be managed to prevent accidental loss of information. All data will be backed up periodically and data will not be stored only on one single media. Floppy disks, Zip disks, CDs or other means of storage will be used in addition to standard computer hard drives to assure data is not lost by the failure of any one device. Since conventional Document Control Practices do not always lend themselves to electronic records, the following additional guidelines will be followed for all electronic QC records.

4.13.2 Once an electronic record is completed and saved to disk, the file name will be used as the registration number for that document and shall appear on each page of the electronic record such that it also appears on printed copies. This file name will be entered in the Field Document Control Log as that documents registration number.

4.13.3 Changes, additions, late entries and corrections to completed electronic records will be accomplished by creating a revision to the previously completed record. Included in the file name of the completed record will be the sequential revision number of that record. The first such revision of any record will be designated as R1 at the end of the file name. Subsequent revisions will be designated R2, R3, etc.

4.13.4 The original record will not be deleted electronically, and each revised record will include a description of the changes made on that particular revision as well as retaining the description of any previous revisions.

4.13.5 Any document that is revised after any required distribution either off-site or to any electronic or hard copy file will be likewise distributed to all recipients as the original document. The revision will be filed along with the original and any previous revisions.

- 4.13.6 Electronic forms, which require signatures, will be printed, and the printed original signed and dated in black ink as required. The words “signature on file” shall be entered on the electronic copy, in the signature space, of all documents requiring signatures. The signed original will be filed in the proper location. Subsequent revisions to forms requiring signatures will also be printed, signed and filed.
- 4.13.7 Logs maintained electronically may be updated as required for daily activities without going through the above revision process. Each day’s log, however; will be saved electronically with the date included in the file name. Previous day’s logs will not be deleted from the database and will serve as additional back up should the current days log be damaged or lost.

4.14 PHOTOGRAPHIC RECORDS

Photographs will be generated to document significant site activities, MPPEH, and MEC. Photographic records will be used to supplement information recorded in the daily logs, to include photographs of equipment prior to use, and the condition of the site prior to any activity. Photographs will clearly show the task being accomplished and provide for a visual record of the operations. Operations will not be staged. Selected representative photographs will be included in the SSFR and all photos will be provided on digital media accompanying the SSFR.

4.15 LOGS AND REPORTS

Field activity logbooks will be maintained in ink. All personnel will use bound and numbered field logbooks with consecutively numbered pages. These logbooks are QA records and will be completed in accordance with this section of this QC Plan. These activity logbooks will become part of the SSFR; thus, it is imperative that they be completed clearly and legibly. Appropriate documentation will be maintained regarding the location and disposition of all MEC and munitions, range-related and clutter. Locations will be documented on a site map and entered in the Ordnance Accountability Log. Daily and Weekly Summary Reports will be prepared by the UXOQCS and forwarded via facsimile or email to the Project Manager on a timely basis.

4.16 DAILY ACTIVITY LOG

Daily Activity Logs will be maintained and will include the following:

- Date and recorder of field information.
- Start and end time of work activities including lunch and down time.
- Visitors.
- Weather conditions.
- Important telephone calls.
- Any deviations from planned activities.
- Equipment checks and calibrations.
- Equipment monitoring results, if applicable.
- QCI Performed.
- Nonconforming conditions.
- Lessons Learned.
- Signatures of the SUXOS and UXOQCS indicating concurrence.

4.17 SAFETY LOG

Safety Logs will include the following:

- Date and recorder of log.
- Significant site events relating to safety.
- Accidents.
- Stop Work due to safety concerns.
- Lessons Learned.
- Safety Audits.
- Signatures of the SUXOS and UXOQCS indicating concurrence.

4.18 TRAINING LOG

Training will be documented in the Training Log as follows:

- Date and recorder of log.
- Nature of training.
- Tailgate safety briefings (including time conducted, person conducting the briefing and attendees).
- Visitor Training (including names of visitors, description of training, and person performing training).
- Signatures of the SUXOS and UXOQCS indicating concurrence.

4.19 MEC IDENTIFICATION AND REPORTING

- 4.19.1 At least two UXO qualified personnel must be in agreement on the condition of a suspected MEC item before any removal action is attempted. All available data sources will be consulted prior to this determination.
- 4.19.2 As UXO/MPPEH is located it will be documented on the MEC Accountability Log (Appendix F). A detailed accounting of all MEC items encountered during the removal action will be maintained. This accounting will include:
- Identification Number (a unique ID #).
 - Location.
 - Nomenclature.
 - Fuse Description.
 - Fuse Condition.
 - Additional comments, if required.
- 4.19.3 Each suspect UXO/MPPEH item encountered will be identified using a unique numerical identifier, such as A5-0001 (for first suspect item (0001) encountered in grid/area A5).
- 4.19.4 Photographs of suspect MEC items will be taken for documentation purposes. A ruler or some similar item, to show scale, will be placed adjacent to the item. The photographer needs to remember these photographs will be utilized in the SSFR; thus, a focused, well thought out photograph is necessary.
- 4.19.5 MEC identification data will be entered into an electronic MEC Accountability Log daily. Terminology and definitions used when completing the MEC Accountability Log will be consistent with those given in the 21 April 2005 Memorandum from the Office of the assistant

Secretary, Installation and Environment; Subject: Munitions Response Terminology. The UXOQCS will review this data to ensure accuracy and consistency in reporting. This review will include a comparison of photographs with recorded data. Any conflict or discrepancy will be discussed and resolved with the Team Leader. Signatures of the SUXOS and UXOQCS on the MEC Accountability Log indicate concurrence of the reported data.

4.20 LESSONS LEARNED

Lessons learned from day to day activities are an important part of the continuous improvement process. They can prove vital to prevent similar problems from occurring at other sites. Lessons learned from daily activities and from the occurrence of nonconforming conditions will be documented by the UXOQCS and UXOSO, as appropriate. Lessons learned as a result of nonconforming conditions are captured and documented on the QCIR as a result of its investigation and disposition. Other Lessons learned, from both positive and negative events will be documented in the Daily Activity Log and/or Safety Log. These items will be included in the SSFR. The QA/QC Manager will maintain a database of lessons learned for communication to other sites and for incorporation into training requirements.

4.21 TRAINING

4.21.1 The Project Manager will verify that all project personnel have completed the following training prior to their assignment:

- U.S. Naval Explosive Ordnance Disposal (EOD), Indian Head, Maryland / Eglin AFB, FL or EOD Assistance Course, Redstone Arsenal, AL / Eglin AFB, FL or other formal course of instruction meeting the requirements in DDESB TP 18 appropriate to the level of employment.
- OSHA 40 Hour Hazardous Waste Operations and Emergency Response (HAZWOPER) in accordance with 29CFR1910.120 and 8 hour refreshers as need.
- UXOSO will have OSHA 30-hour Safety Course.
- Site Specific Training on this Work Plan and additional training, as needed, will be performed and documented on a QCIR, which will be forwarded to the Project Manager for review.
- Safety Meetings will also be documented.
- The UXOQCS will ensure that all personnel using geophysical detection equipment are properly trained to use that piece of equipment. This may include verification of past experience as well as on-site training on using specific equipment in site-specific conditions, which will be documented on a QCIR and forwarded to the Project Manager.
- If sweep personnel are employed they will receive site specific training related to the task that they will perform.

4.21.2 The UXOQCS will conduct, as necessary, site-specific training and/or review of known MEC to ensure that all site personnel are thoroughly familiar with the hazards and the general safety precautions and procedures required. All personnel and site visitors will also receive site-specific training and safety briefings, as required, to ensure safety on the project. Visitors must be briefed on all of the known or anticipated hazards of the site, required PPE to be worn while on the site, and site emergency procedures. Visitors will be escorted by a UXO qualified person whenever they enter the exclusion zone and all UXO operations will cease whenever a visitor is within the exclusion zone.

4.22 CHEMICAL QUALITY DATA MANAGEMENT (CQDM)

No Hazardous, Toxic and Radiological Waste (HTRW) or CWM is expected at this site per the PWS, therefore a CQDM sub-plan is not applicable.

4.23 QC DOCUMENTATION SUBMITTAL

All QC documentation required by this Work Plan will be submitted as part of or as supporting documentation for the SSFR.

4.24 QC RECORD RETENTION

All original QC Records and documentation will be maintained on-site and made available for government inspection upon request

5.0 CHAPTER 5 EXPLOSIVE MANAGEMENT PLAN

5.1 General

This plan details the management of explosives that may be required for the destruction or venting of MEC, suspected MEC, or inert UXO/MPPEH items at CRP. This plan was developed utilizing the guidelines specified in Federal Acquisition Regulation (FAR) 45.5, local and state laws and regulations, Alcohol Tobacco and Firearms Publication (ATFP) 5400.7, DA Pamphlet 385-64 and DOT regulations. Explosives used in the performance of this Task Order will be obtained by EOTI from commercial sources. These materials will be obtained and used for the specific purpose of disposal of MEC and explosive venting of inert MEC items, if required, located during the MPPEH Removal activities at the CRP site. An RFD will be used with an electrical detonator system. A shock tube (pyrotechnic lead) initiator may be substituted for the electrical detonator depending upon availability from the supplier. Explosives will be delivered to the site in the quantities required on the day of planned demolition operations. All explosives delivered to the site will be consumed in the demolition operations on the same day they are delivered.

5.2 Licenses/permits

EOTI will maintain on site and, upon request, make available to any local, state, or federal authority a copy of all licenses/permits required authorizing EOTI to purchase, store, transport, or use explosives. If no other licenses or permits are required by the state, EOTI will maintain a copy of its Federal ATF license on-site.

5.3 Description and Quantities

Explosive materials used during the performance of the work on this project will be obtained from commercial sources. These explosive materials will be for the specific purpose of disposal of suspect UXO/MPPEH and explosive venting of inert items, if required, located during the removal action. A remote firing device with an electrical or nonelectrical (shock tube) firing system will be utilized. If a remote firing device is not available, a hard-wired electrical firing system may be used. Donor explosive materials will be delivered to the site and will be consumed in the demolition operations on the same day they are delivered.

Materials to be delivered to the site will include:

- 10 each Electric Blasting Caps (1.4B) or
- 10 each Nonelectric initiators (1.4B)
- 100 each Shaped Charge perforators, 32 gram (1.1.D)
- 1000 feet Detonation Cord, (1.1D) 50 each Cast Booster 1/2 lb. (1.1D)

Depending upon availability from the suppliers, other sizes of boosters and/or perforators may be used. In any case, material to be used for donor explosives will be suitable for the items to be destroyed. Quantities may also vary due to minimum order quantities requirements (generally case lots).

Quantities of explosive materials required to conduct the day's operation will be ordered from the vendor, as required, and delivered to the site on the day they are required. MEC will be marked and guarded, if necessary (e.g. accessible to the public), until disposal is accomplished. EOTI estimates 2 ea. electric blasting caps (1.4B); and 2 ea. 32-gram perforators (1.1D) and/or 2 ea 1/2- pound cast booster

(1.1D) will be used during disposal or venting operations for a single item and detonation cord (1.1D) will be used to link perforators and/or cast boosters if multiple items are disposed of in a single demolition shot. Depending upon availability, shock tube (Non El) detonators may be used in place of electric detonators.

5.4 Acquisition Source

EOTI will obtain donor explosives from regional explosives vender or other licensed supplier, who agrees to supply and deliver the necessary quantities of demolition explosives.

5.5 List of Explosive Materials

As stated above, explosives that are expected to be used are:

- Electric Blasting Caps (1.4B) or
- Nonelectric initiators (1.4B)
- Shaped Charge perforators, 32 gram (1.1.D)
- Detonation Cord, (1.1D)
- Cast Booster ¾ lb. (1.1D)

Depending upon availability from the suppliers, other sizes of boosters and/or perforators may be used. In any case, material to be used for donor explosives will be suitable for the items to be destroyed.

5.6 Initial Receipt Procedures

5.6.1 Upon receipt of donor materials from licensed explosive suppliers, an inventory will be conducted to ascertain:

- correct type
- serviceable condition
- correct quantity

5.6.2 A copy of the invoice(s) for the incoming donor materials will be kept in the on-site donor materials accountability file.

5.6.3 Upon receipt, a separate EOTI Memorandum will be prepared, with the following information, and retained on-site:

- Date of acquisition
- Name or brand name of manufacturer
- Manufacturer's marks of identification
- Quantity
- Description
- Name, address, and license number of the persons from whom the explosive materials are received

5.7 Procedures for Variances between quantities shipped and quantities received.

If any discrepancies of any kind should be found during the initial receipt inventory and inspection, the following procedures will be followed:

- If during the initial receipt inventory a discrepancy is found between the quantity listed on the invoice and the quantity being delivered, the quantity received will be annotated on the invoice and on the memorandum.
- The SUXOS will notify the supplier of the discrepancy before the explosives are accepted from the supplier's representative.
- The Project Manager will be notified telephonically, with a copy of the memorandum and a copy of the invoice being faxed as soon as possible.

5.8 Establishment of explosive storage facility

- 5.8.1 EOTI will not establish a storage facility for donor explosives at CRP. Donor explosive materials required for destruction or venting of MPPEH will be ordered from commercial suppliers and delivered to the site when needed for demolition operations. All donor explosive materials received will be used the same day or returned to the supplier.
- 5.8.2 MPPEH will not be stored. When discovered it will be inspected to determine if it is acceptable to move. If possible it will be consolidated for onsite detonation. If it is determined to be unacceptable to move, it will be blown in place. MPPEH will be guarded, as necessary to ensure the protection of the public (e.g. accessible to the public), until demolition operations are completed.

5.9 Physical security of explosive storage facility

- 5.9.1 EOTI does not plan to establish an explosives storage facility for this project. Explosives for disposal of MEC will be provided and delivered by a local vendor and delivered on an as-needed basis. While donor explosives are on site, EOTI will comply with all applicable regulations and requirements of ATF regulations, and USAESCH requirements for security of explosives.

5.10 Transportation

When transporting donor explosives within the project site to the disposal location:

- Vehicles carrying explosives should be inspected and have a Motor Vehicle Inspection DD Form 626 completed.
- Vehicles used for transportation of explosive materials will not be loaded beyond their rated capacity and the explosive materials will be secured to prevent shifting of load or dislodgment from the vehicle; when explosive materials are transported by a vehicle with an open body, a magazine or closed container shall be securely mounted on the bed to contain the cargo.
- All vehicles transporting explosive materials shall display all placards, lettering, and/or numbering required by DOT and will have two each 10BC fire extinguishers on board.
- Explosive materials and blasting supplies shall not be transported with other materials or cargos. Blasting caps (including electric) shall not be transported in the vehicle or conveyance with other explosives unless the conditions of 49 CFR 177.835(g) are met (i.e., an IME-22 Container is used to transport the blasting caps).
- All vehicles used for transportation of explosive materials will be in the charge of and operated by a person who is physically fit, careful, reliable, able to read and understand safety instructions, and not under the influence of intoxicants or narcotics.

- Only the authorized driver and his or her helper will be permitted to ride on any conveyance transporting explosive materials or detonators.
- Explosives will not be exposed to sparking metal during transportation of materials and all electric wiring will be completely protected and securely fastened to prevent short circuits.
- Vehicles used to haul explosives will be properly inspected and an “Explosives Motor Vehicle Inspection Checklist” completed and kept on file.
- Vehicles transporting explosive materials will be operated with extreme care; full stops will be made at approaches to all railroad crossings and main highways and the vehicles shall not proceed until it is known that the way is clear.
- No vehicle will be refueled while explosive materials are on the motor vehicle except in an emergency.
- Persons employed in the transportation, handling, or other use of explosive materials will not smoke or carry on their persons or in the vehicle, matches, firearms, ammunition, or flame-producing devices.
- Vehicles transporting explosive materials will not be left unattended.

5.11 Requirements for vehicles transporting explosives to the removal site

All applicable requirements of DOT and ATF regulations that apply to transportation of explosives on the removal site will be enforced.

5.12 Receipt Procedures

5.12.1 Accountability

- 5.12.1.1 Upon receipt from the vendor, accountability will be established for each type of explosive material in accordance with Paragraph 5.6 above. Copies of vendor invoices will be kept with the receipt memoranda in the donor materials accountability file in the on-site project office.
- 5.12.1.2 Any transactions, which include receipt, issue, and/or turn-in of donor materials, will be conducted by two persons, at least one of whom will be a UXO Tech III or higher. Discrepancies will be resolved immediately. If it is determined that a theft or loss has occurred, the procedures in Section 5.14 will be followed.
- 5.12.1.3 All documents associated with receipt, transfer, issue, or turn –in of donor explosives will be maintained in the Donor Materials Accountability file in the on-site project office.

5.12.2 Designated Individuals

- 5.12.2.1 The following individuals are authorized to order and receive explosives from the supplier:
 - Senior UXO Supervisor
 - Site Safety and Health Officer
- 5.12.2.2 The following individuals are authorized to transport and use donor explosives:

- Senior UXO Supervisor
- Site Safety and Health Officer
- UXO Tech III
- UXO Tech II

5.12.3 Explosive Use Certification

5.12.3.1 At the conclusion of the intrusive activities at the CRP, the SUXOS will complete an EOTI Memorandum stating all donor explosives expended during MEC removal operations were used for their intended purpose. Any explosives remaining after a disposal operation will be disposed of in accordance with Section 5.16.

5.13 Inventory

EOTI will not store explosives on the site and therefore only the initial inventory, as described Section 5.6, will be required.

5.14 Procedures upon Discovery of Lost, Stolen, or Unauthorized Use of Explosives

Lost, stolen or unauthorized use of explosive materials will be reported as follows:

- The SUXOS will give an immediate telephonic notification to the Contracting Officer, followed up by a written report within 24 hours
- Notify the Bureau of Alcohol, Tobacco, and Firearms (ATF) at 800-800-3855, within 24 hours of discovery (complete ATF Form 5400.5, Report of Theft or Loss - Explosive Materials and mail to nearest ATF office. Instructions for completion of the form are on the reverse side.);
- Notify the local law enforcement agency.

5.15 Returning Explosives to the Explosive Storage Area

Explosives will be delivered in the quantity required for the planned demolition operation and all delivered commercial explosives will be consumed in the demolition operation.

5.16 Disposal of Unused Explosive Materials

Explosives will be delivered in the quantity required for the planned demolition operation and all delivered commercial explosives will be consumed in the demolition operation.

5.16.1 Perform an economic analysis for different alternatives

Since this is a firm fixed price (FFP) task, this requirement does not apply.

6.0 CHAPTER 6 ENVIRONMENTAL PROTECTION PLAN

This chapter of the Work Plan describes environmental concerns and describes methods used during site activities designed to minimize pollution, protect and preserve natural resources, restore damage, and control noise and dust within reasonable limits.

6.1 Identification of Environmental Concerns

6.1.1 Endangered / Threatened Species within the Project Site

There are no known endangered species within the project boundaries and planned activities are not expected to have any potential negative impact on protected species or their environment. There are one endangered animal species and three threatened plant species known to occur in Richland County, South Carolina. The Shortnose Sturgeon and Red-cockaded Woodpecker is the endangered species listed in Richland County. The Smooth Coneflower, Rough-leaved Loosestrife, and Canby's Dropwort are known to occur in Richland County. The Red cockaded wood pecker and the three plant species are not found within the project area. A description of each species is provided below.

6.1.1.1 Shortnose Sturgeon Sturgeons are fish of an ancient lineage easily recognized by five rows of scutes (bony plates) along their bodies: one row along the mid-back, one along the middle, and one along the lower body on each side. Sturgeons have heterocercal tails; that is, the top lobe of the caudal fin is larger than the bottom one. Coloration varies from yellowish pink to yellowish brown on the fish's back and creamy white below. Sturgeons, the largest of the bony fishes, are bottom dwellers that use chin barbels to locate food on the substrate. The barbels on the shortnose sturgeon are rather small, less than one half the width of the mouth. Sturgeons have protrusible, inferior mouths used to suck in benthic insects, crustaceans, and other food items. The shortnose sturgeon is smaller than the common Atlantic



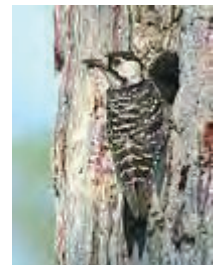
Shortnose sturgeon (*Acipenser brevirostrum*)

sturgeon, *Acipenser oxyrinchus*, and has a shorter, uncurved snout. It is also known as the blunt-nosed, round-nosed and small sturgeon, and it may grow up to 143 cm (56 in).

<http://www.dnr.sc.gov/marine/mrri/acechar/specgal/sturgeon.htm>

6.1.1.2 Red-cockaded Woodpecker (*Picoides borealis*)

Red-cockaded woodpeckers are relatively small; adults measure 20 to 23 cm (7.8 to 9 inches) and weigh 40 to 55 g (1.4 to 1.9 ounces). Red-cockaded woodpeckers are relatively slender, long-tailed and small-billed woodpeckers. They are black and white with a coarsely barred back, white cheek patch and black crown. Their breasts and bellies are white to grayish-white with spots on the sides changing to bars on the flanks. Outer tail feathers are white with black barring and central tail feathers are black. Adult plumage is extremely similar between sexes and generally indistinguishable in the field. The only difference between adult males and females is the presence of the red cockade at the upper edge of the white auriculars, which is virtually invisible in field situations.



<http://www.fws.gov/rcwrecovery/> - Photo by Michael McCloy

Juveniles appear similar to adults but may be distinguished in the field by duller plumage, white

flecks often present just above the bill on the forehead and diffuse black shading in the white cheek patch. Juvenile males have a distinctive red patch on the crown and may be distinguished from juvenile females in this way.

6.1.1.3 Rough-leaved Loosestrife (*Lysimachia asperulifolia*)

The Rough-leaved Loosestrife is a rhizomatous perennial herb growing erect to a maximum height around 60 to 70 centimeters. The lower stem is pinkish in color and ribbed, and the upper stem is yellowish and lacks ribs. The stem in the inflorescence is covered in reddish glands. The leaves are green, lance-shaped, and up to 5 centimeters long by 2 wide. They are borne in whorls of three or four around the stem, or sometimes in opposite pairs. The leaves are not rough in texture as the common name would suggest. Smaller, tougher, brown-colored leaves are opposite or borne in whorls of up to 7 near the stem base. The top of the stem is occupied by the inflorescence, which is a raceme of star-shaped yellow flowers interspersed with leaf-like green bracts. Each flower has 4 to 7, but usually five, yellow petals with wide bases and pointed, ragged tips. The petals and green sepals are dotted with red glands and streaked with reddish resin canals. The fruit is a red-mottled straw-colored capsule a few millimeters in length.



http://upload.wikimedia.org/wikipedia/commons/thumb/1/1b/Lysimachia_asperulifolia.jpg/431px-

6.1.1.4 Smooth Coneflower (*Echinacea laevigata*)

The Smooth Coneflower, is an Endangered Species Act federally listed endangered species of plant found in the piedmont of the southeastern United States. Most populations are found on roadsides and other open areas with plenty of sunlight, often on calcium- and magnesium-rich soils. The Smooth Coneflower grows up to about 1.5 meters in height with a mostly naked, smooth, leafless stem. Any leaves are roughly lance-shaped. On top of the stem is a flower head containing narrow pink or purplish ray florets up to 8 centimeters long. The florets droop away from the center of the head. The small, tubular disc florets in the center are dark purple in color. Blooming occurs in May through July.



<http://www.carolinanature.com/plants/echinacealaevigata.html> -Photo Bv Will Cook

6.1.1.5 Canby's Dropwort (*Oxypolis canbyi*)

Canby's dropwort belongs to the mint family (Apiaceae). It is a perennial herb which grows from 80 to 120 cm (30 to 50 in) tall. The "quill-like" hollow leaves and the thick, corky wings that extend out from the margins of the fruit are the most distinctive features of the plant. The stems are erect or ascending, round, and slender with arching/ascending or forking branches above the mid-stem. The flowers are monoecious or dioecious (flowers have either male or female parts or both) and small and white, sometimes tinged with red or pink. The flowers are borne on compound umbrella-like structures that extend from the base of the leaves, and the fruit is a schizocarp (fruit splits into one-seeded segments) about 4-6 mm long. The plant inhabits a variety of coastal plain communities, including pond cypress savannahs, the shallows and edges of cypress/pond pine ponds, sloughs, and wet pine savannas.



http://www.fws.gov/raleigh/media/tn_canbys_dropwort.jpg - Photo By Dale Suiter

6.1.2 Wetlands within the Project Site

There are no known wetlands within the project site.

6.1.3 Cultural, Archaeological, and Water Resources within the Project Site

There are no known cultural, archaeological, or water resources within the project site that will be impacted by planned activities.

6.1.4 Coastal Zones within the Project Site

The project site is located on the Congaree River but not within a coastal zone and no impacts from UXO clearance activities will impact the project area.

6.1.5 Trees and Shrubs that will be removed within the Project Site

The vegetation clearance requirements for this project are minimal and generally limited clearance of small shrubs. Planned activities will have minimal impact on vegetation. EOTI will not cut trees that are six inches or more in diameter at a distance of 1 foot above ground level.

6.2 Mitigation Procedures

6.2.1 Manifesting, transportation, and Disposal of Waste

EOTI does not anticipate generating any hazardous waste that will require off-site transportation, treatment, storage, or disposal. MEC and/or MPPEH will be destroyed on-site and resulting scrap will be certified as Material Documented as Safe (MDAS) and turned over to a recycler for smelting before it is released to the public. Non-hazardous, CD and municipal waste generated during this project will be transported to a municipal landfill for disposal.

6.2.2 Burning Activities

EOTI will not conduct burning activities during the performance of work required in the PWS.

6.2.3 Dust and Emission Control

6.2.3.1 None of the planned activities are expected to generate significant dust. Excavation operations using mechanical equipment may generate small quantities of nuisance dust. The SUXOS, UXOSO/QCS, and Team Leader will closely monitor dust emissions resulting from soil excavation operation. Dust masks will be available to workers in areas of high dust concentrations.

6.2.3.2 Other emissions will primarily result from operation of diesel engines associated with excavation equipment. These emissions will be limited by limiting the time that equipment idles when not in use. Team leaders will ensure that equipment is turned off when not in use. If excessive emissions are generated due to engine maintenance, equipment will be shut down until inspected by a mechanic.

6.2.4 Spill Control and Prevention

6.2.4.1 EOTI will inspect vehicles and heavy equipment before, during and after operation to identify any leaks of petroleum, oil and lubricants (POL). If leaks are detected, the equipment will not be used until the leak is controlled. Drip pans will be used to catch dripping POL.

6.2.4.2 POL will be stored on-site in approved containers, in approved areas with required containment. If a spill occurs it will be reported immediately. Immediate steps will be taken to contain the spill and limit contamination. Contaminated soil will be excavated and packaged for treatment or disposal.

6.2.5 Storage Areas and Temporary Facilities

6.2.5.1 EOTI may place chemical toilets on the site. These toilets will be delivered, setup and serviced by a subcontractor.

6.2.6 Access Routes

EOTI will primarily use existing roads and trails to access the work areas. These routes will allow access by foot or light vehicle to areas requiring MEC clearance. Any additional temporary access routes required to access portion of the clearance areas will be cleared of MEC / MPPEH, but will otherwise be unimproved.

6.2.7 Trees and Shrubs Protection and Restoration

EOTI will not cut trees larger than six inches in diameter measured at a distance of one foot from the ground surface and anticipates only minimal clearance of shrubs.

6.2.8 Control of Water Run-on and Run-off

EOTI does not anticipate extensive excavations that would require run-on or run-off controls.

6.2.9 Decontamination and Disposal of Equipment

Soil will be thoroughly cleaned from equipment and tools at the end of the project. Tools and equipment will be cleaned by brushing, sweeping and/or wiping dirt from them. Equipment may be further cleaned at established wash facilities.

6.2.10 Minimizing Areas of Disturbance

EOTI will minimize the areas of disturbance by working only in the areas designated in the PWS and marked by the surveyor. EOTI will limit vegetation removal and excavation to what is necessary to complete the work.

6.3 Post-activity Clean-up

After completing the project, EOTI will cleanup and restore the site to a condition as close to its original condition as possible. All equipment, tools and material will be removed from the site. EOTI will police the site to remove all trash, debris and other waste from the work site. The SUXOS will inspect the area to ensure that area is clean prior to demobilization.

6.4 Air-monitoring Plan

There is no RCWM expected at this site and no anticipated, significant exposure to other chemicals, and therefore air monitoring will be limited. The only significant air contaminant anticipated to be associated with this project is minimal dust generated as a result of excavation operations. If dust levels become a nuisance or hazard to workers, water may be used as an engineering control to lower the dust levels. Dust masks will be worn, as required to further reduce exposure to dust.

7.0 CHAPTER 7 PROPERTY MANAGEMENT PLAN

This Chapter does not apply to the work planned by EOTI.

No Government Furnished Equipment is to be used on this project.

8.0 CHAPTER 8 INTERIM HOLDING FACILITY SITING PLAN FOR RCWM PROJECTS

This Chapter does not apply to the work planned by EOTI.

RCWM is not expected to be encountered at the site were activities described in this Work Plan will take place. No Interim Holding Facility for RCWM is required in the PWS.

9.0 CHAPTER 9 PHYSICAL SECURITY PLAN FOR RCWM PROJECT SITES

This Chapter does not apply to this Task Order.

RCWM is not expected to be encountered at the site were activities described in this Work Plan will take place. No Physical Security Plan for RCWM is required in the PWS.

10.0 CHAPTER 10 -- REFERENCES

Alcohol Tobacco Firearms (ATF), Publication 5400.7, Federal Explosives Laws
Department of Defense Explosives Safety Board (DDESB), TP-16, Methods for Calculating Primary Fragment Characteristic
Department of Defense Explosives Safety Board (DDESB) TP-18, Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel
Department of Defense (DOD), 4160.21-M-1, Defense Demilitarization Manual
EOTI Corporate Quality Plan
EOTI Corporate Safety Plan
ERsys.com, http://www.ersys.com/usa/45/4516000/wtr_norm.htm ; Climate Weather Norm Charts for Columbia, SC
National Fire Protection Association, NFPA 780, Standard for the Installation of Lightning Protection Systems
U.S. Army Corps of Engineers (USACE), Congaree River Basin Navigability Study, 1977.
U.S. Army Engineering Support Center Huntsville (USAESCH) OE-CX Interim Guidance 02-03
U.S. Army, AR 385-64 Explosives Safety Program
U.S. Army, TM 60-Series Training Manuals
USACE, EM 1110-1-4009, Ordnance and Explosives Response
USACE, EM 385-1-1, USACE Safety and Health Requirements Manual
USACE, EM 385-1-97, Explosive Safety and Health Requirements Manual Change 1
USACE, EP 1110-1-18, Ordnance and Explosives Response
USACE, EP 75-1-2, MEC Support During Hazardous, Toxic, and Radioactive Waste (HTRW) and Construction Activities
USACE, ER 1110-1-12, Quality Management
USACE, Worldwide Environmental Remediation Services (WERS), Data Item Descriptions (DIDs)
USAESCH, OE-CX Interim Guidance 08-01

**APPENDIX A
TASK ORDER SCOPE OF WORK**

(EOTI has only been contracted to prepare plans and no formal SOW was prepared. EOTI's proposal for currently scoped work is presented below)

**MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
REMOVAL ACTION AND CONSTRUCTION SUPPORT
COLUMBIA, SC**



MUNITIONS AND ENVIRONMENTAL SERVICES
9050 Executive Park Drive, Suite 106 A • Knoxville, TN 37923
Tel: (865) 200-8081 • Fax: (865) 766-5971

March 11, 2014

Apex Companies, LLC Attn: Rusty Contrael
1600 Commerce Circle
Trafford, PA 15085

RE: Proposal for Completing Project Planning and Document Preparation for UXO Support of the Congaree River Remediation Project in Columbia, SC

1. EOTI is very pleased to be invited to participate in the South Carolina Electric and Gas Company removal project along the Congaree River in Columbia, SC. Key to success for this very complex project is thorough, integrated team planning. EOTI is prepared to support and participate in teleconference and face-to-face meetings with APEX, other subcontractors, regulators and stakeholders, in order to determine the safest most effective manner to accomplish project goals. EOTI will provide managers, engineers, UXO Safety Specialists, and other technical experts, as required to complete the project planning. EOTI anticipates project planning to be conducted through a series of calls and meetings, including up to three meetings in the vicinity of the project location in Columbia, SC, at the APEX offices in Trafford, PA or at Regulator or Corps of Engineer offices in the southeast United States. It is anticipated that each meeting will take place in one day and will be attended by two personnel. EOTI will provide technical advice for the execution of Munitions and Explosives of Concern (MEC) removal in support of remediation activities.

2. After completing project planning, EOTI will prepare required planning and work documents associated with the UXO support for the remediation activities. It is anticipated that draft and final versions of each plan may be required. Draft plans will be submitted for review electronically and hard copies of final plans will be provided if requested. Required plans may include the following:

a. **MEC Work Plan (WP)**. The WP will be prepared in accordance with Data Item Description (DID) WERS-001.01, EM 385-1-97, and EP 75-1-2 will address UXO support at the remediation site. The WP will describe specific work proposed in order to meet the project objectives and requirements. The WP will contain, at a minimum, a Technical Management Plan, an Explosive Management Plan, an Accident Prevention Plan (APP) (DID WERS-005.01), which includes a Site Safety and Health Plan (SSHP), and a Quality Control Plan (QCP). The QCP shall be a detailed and comprehensive plan covering all aspects of the UXO support.

b. **Explosives Safety Submission (ESS)**. EOTI will prepare an ESS in accordance with requirements of the Department of Defense (DoD) Manual 6055.09-M (DoD, 2008a). If the ESS is prepared by the Corps of Engineers or other party, EOTI will provide required information related to planned MEC operations.

c. **Dive Safe Practices Manual.** EOTI will provide a updated Dive Safe Practices Manual prepared in accordance with the requirements in EM 385-1-1 Section 30.

d. **Diving Operations Plan.** EOTI will produce a site and project specific Diving Operations Plan which will include a dive operations-specific Emergency Management Plan and Activity Hazard Analysis (AHA) as attachments.

3. EOTI has developed and enclosed detailed cost proposal for the project planning and document preparation described above. We understand that the next phase of the project is likely a demonstration project on the shore. We will provide cost estimates for this work as well as the underwater work once the initial planning is complete.

4. Please contact me at 865-200-8081 is you have any questions or comments or if you need any additional information.

Sincerely,

Explosive Ordnance Technologies, Inc.



James Y. Daffron, PE
Project Manager

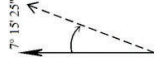
Encl: as

**APPENDIX B
MAPS**

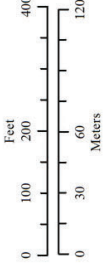
**MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
REMOVAL ACTION AND CONSTRUCTION SUPPORT
COLUMBIA, SC**

Legend

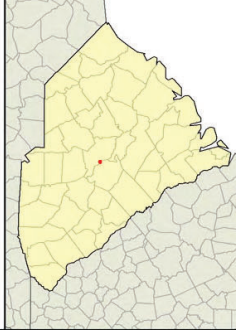
Capping Area



NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC

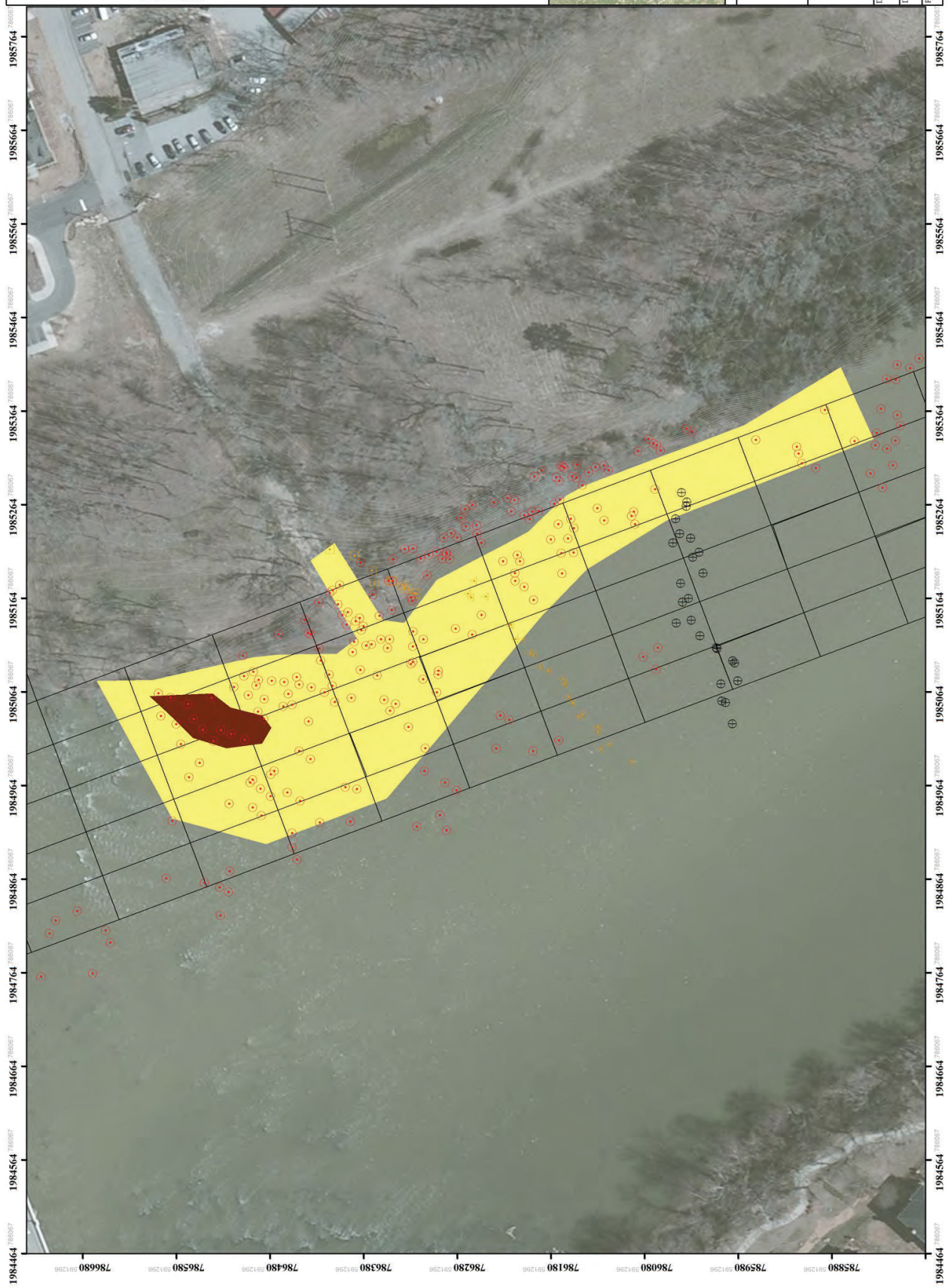


Site Location



**FIGURE B-1
SITE LOCATION**

Columbia, SC	
Prepared For: Apex Companies LLC	
Prepared By: Explosive Ordnance Technologies, Inc.	
VERIFIED M. Norris	APPROVED J. Duffron
DRAWN DATE 01/27/2017	FILE Map1.mxd
PAGE # B-1	SCALE 1 inch = 200 feet



Legend

- ⊕ Previous Investigation Anomalies
- ⊕ Geological Feature
- ▴ Pipeline
- ▣ Pipeline Associated
- ⊙ Electromagnetic Anomaly
- ⊙ Previous Investigation Grids
- ⬜ Capping Area
- ⬜ Approximate Sand Bar Location

7° 15' 25"

NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC

0 50 100 200
0 15 30 60
Feet
Meters

Site Location

**FIGURE B-2
PREVIOUS INVESTIGATION
RESULTS**
Columbia, SC

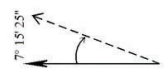
Prepared For:
Apex Companies LLC

Prepared By:
Explosive Ordnance
Technologies, Inc.

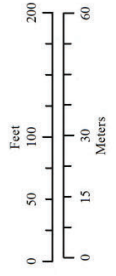
VERIFIED	APPROVED
M. Norris	J. Duffron
DATE	FILE
01/27/2017	Map2.mxd
PAGE #	SCALE
B-2	1 inch = 100 feet

Legend

- Capping Design
- Approximate Sand Bar Location
- Capping Area



NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC



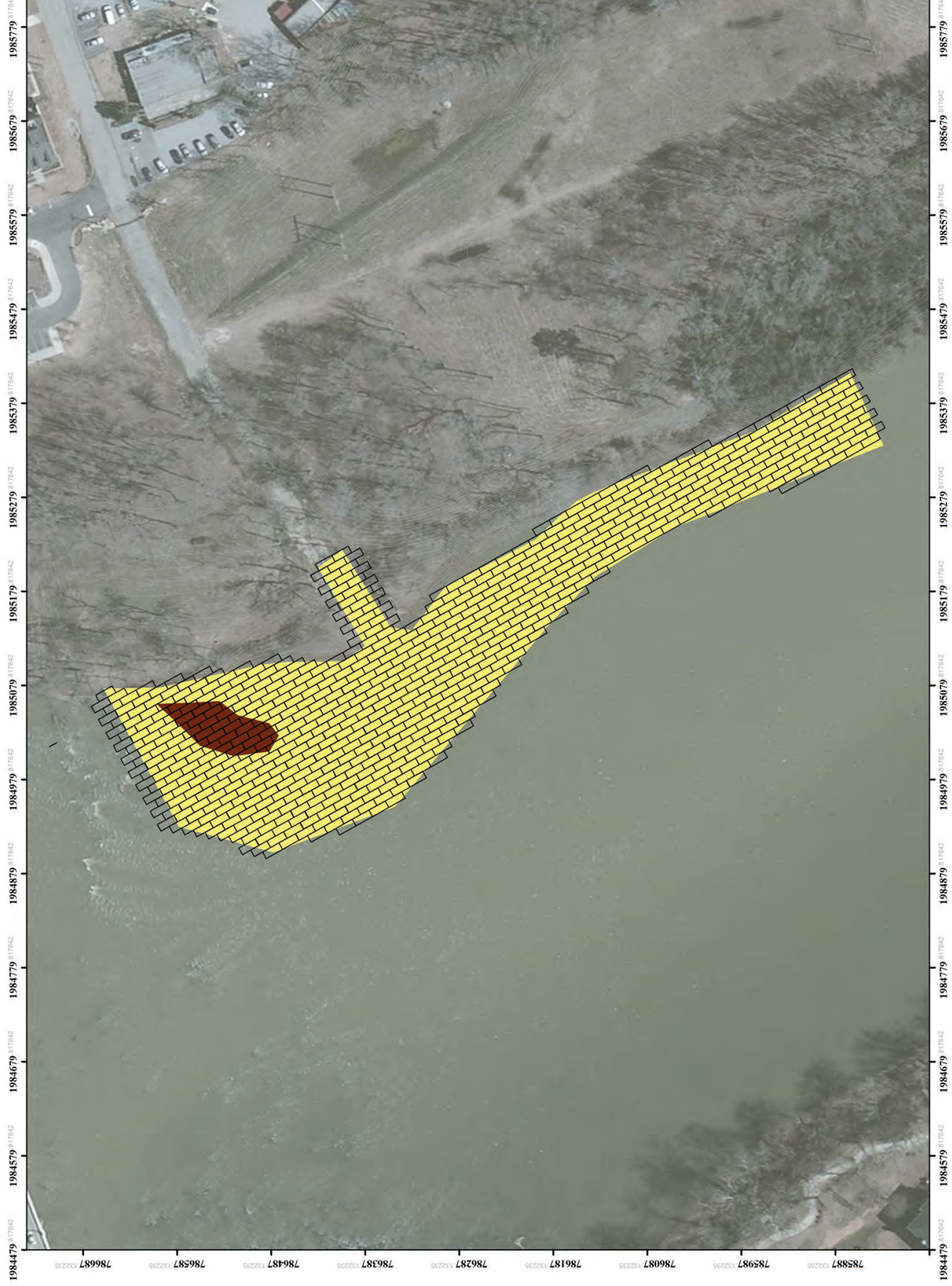
Site Location








FIGURE B-3 CAPPING AREA

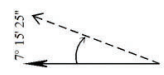
Columbia, SC

Prepared For:	Apex Companies LLC
Prepared By:	Explosive Ordnance Technologies, Inc.
VERIFIED	M. Norris
APPROVED	J. Duffron
FILE	D. Farmer
DATE	01/27/2017
PAGE #	B-3
SCALE	1 inch = 100 feet

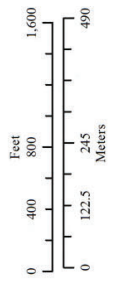


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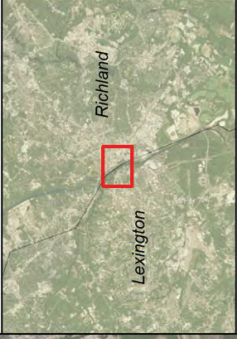
-  Approximate Sand Bar Location
-  Capping Area
-  Sandbag Mitigation MSD 220 ft
-  Hazardous Fragment Distance 237 ft
-  Hazardous Fragment Distance Horizontal 3060 ft



NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC



Site Location



**FIGURE B-4
INTENTIONAL AND UNINTENTIONAL
DETONATION DISTANCES**

Prepared For:
Apex Companies LLC

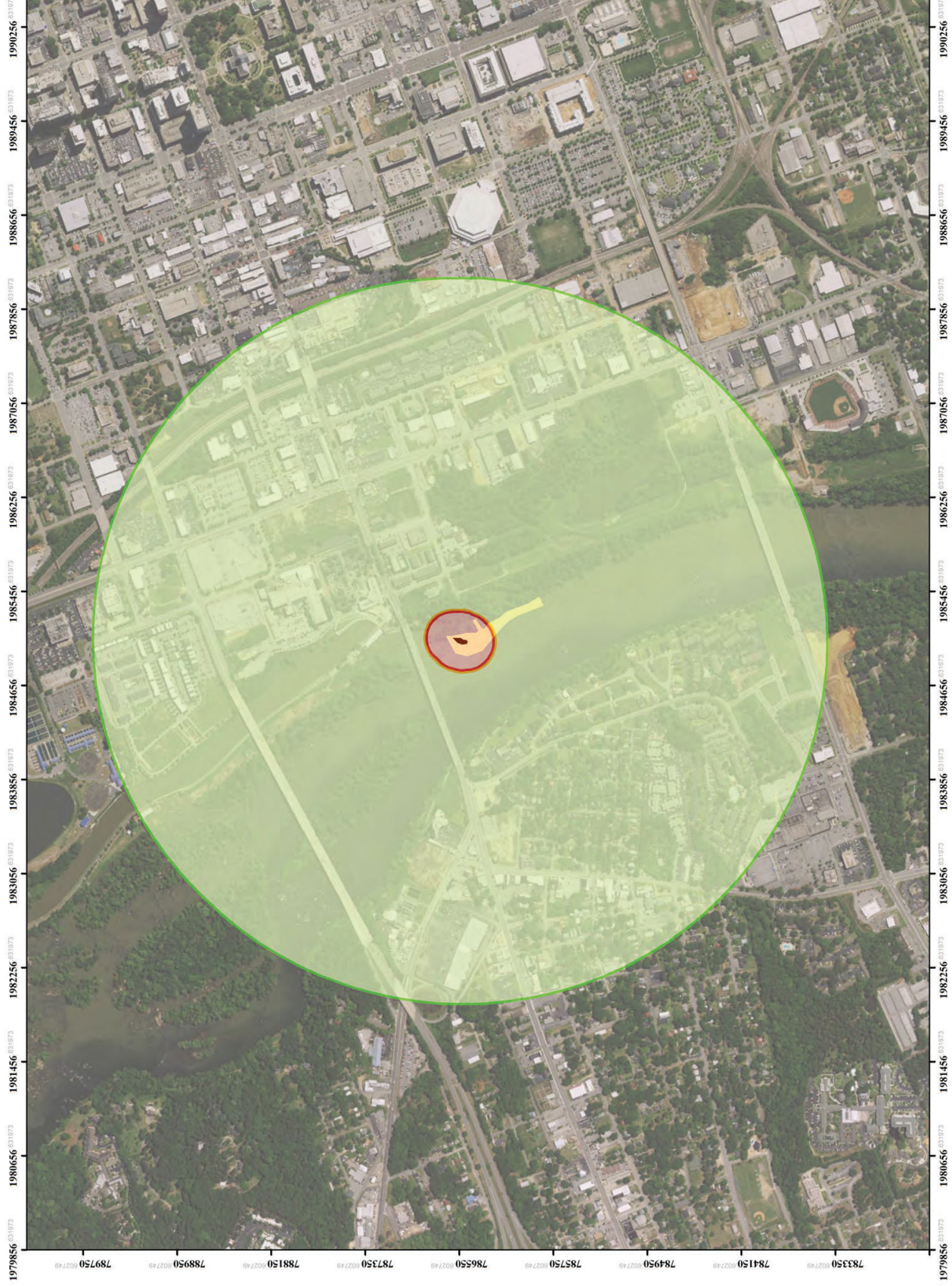
Prepared By:
Explosive Ordnance
Technologies, Inc.

VERIFIED: M. Norris
DRAWN: J. Duffron

APPROVED: D. Farmer

DATE: 01/27/2017
FILE: Map4.mxd

PAGE #: B-4
SCALE: 1 inch = 800 feet



**APPENDIX C
POINTS OF CONTACT**

**MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
REMOVAL ACTION AND CONSTRUCTION SUPPORT
COLUMBIA, SC**

Emergency Response / Services			
Ambulance Service			911
Emergency Medical Response			911
Police*			911
Police Department – Non emergency			803-545-3500
Hospital-Palmetto Health Richland 5 Richland Medical Park Dr Columbia, SC 29203			803-434-7000 * For Emergency Dial 911
Fire Department*			911
Fire Department – Non Emergency			803-545-3700
National Poison Control Center			800-222-1222
CHEMTREC (hazardous materials response)			800-424-9300
National Response Team (hazardous materials response)			800-424-8802
Centers for Disease Control (CDC) http://www.cdc.gov/health/diseases			800-311-3435
Project Management / Coordination			
EOTI			
	Program Manager	Wayne Lewallen	732-673-6017
	Project Manager	Brian Woods, P.G., PMP	865-200-8081
	Safety Manager	David Farmer	865-200-8081
APEX			
	Project Manager	Rusty Contrael	412-829-9650
USACE			
	TBD	TBD	TBD
Explosives Supplier			
	TBD	TBD	TBD

**APPENDIX D
ACCIDENT PREVENTION PLAN**

**MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
REMOVAL ACTION AND CONSTRUCTION SUPPORT
COLUMBIA, SC**

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APP APPROVAL

Project: Surface/Subsurface Clearance Site: Congaree River Project


Contract Number: 875001 Site Location: Columbia, SC

We have reviewed the attached Accident Prevention Plan (APP) for the referenced site. We recognize that when this form is completed, the attached APP is approved for field activities on the referenced site. Changes to this APP will be documented in writing.



Prepared by:
Robert J. Goodman, CIH, CSP
Certified Industrial Hygiene Consultant
EnSafe, Inc.
(513)-621-7233

December 18, 2014
Date



Reviewed by:
Wayne Lewallen
Program Manager
Explosive Ordnance Technologies, Inc.
(865) 220-8668

December 18, 2014
Date

Reviewed by:

Date

Reviewed by:

Date

Reviewed by:

Date

1.0 BACKGROUND INFORMATION

Contractor: Explosive Ordnance Technologies, Inc.

Contract Number: 875001

Project Name: MEC Clearance and Support
Congaree River Project
Columbia, South Carolina

2.0 PROJECT DESCRIPTION AND HISTORY

Explosive Ordnance Technologies, Inc. (EOTI) is to provide all Munitions Response (MR) services necessary to remove Material Potentially Presenting an Explosive Hazard (MPPEH), to include munitions debris and range related debris from approximately 13 acres of at Congaree River Project (CRP), Columbia, SC.

Site Location: The CRP area is located on the Congaree River in Columbia, SC. The site, also referred to as the “project area”, begins directly south of the Gervais Street Bridge, extends approximately 200-300 feet into the river from the eastern shoreline and approximately 2,000 feet downriver, towards the Blossom Street Bridge. The MEC intrusive activities will occur on eastern side of Congaree River between Gervais and Blossom Street Bridges, shown on **Figure B-1-Site Location**.

Site history: In 1865, during the Civil War, munitions and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman’s occupation and subsequent destruction of Columbia. The Union Army kept some of these items for its own use and the remainder was destroyed. One of the methods for destruction was dumping the items into the river.

Archeological investigations, conducted as late as 1980, recovered some MEC from the area as well as some other potentially historically significant artifacts. Specifically this work was focused in and adjacent to the unnamed tributary that enters the river just south of the Gervais Street Bridge. Several cannonballs were identified during this operation and properly disposed of by trained explosive ordnance disposal (EOD) personnel located at nearby Fort Jackson.

Due to the potential presence of munitions within the project area, an additional reconnaissance and screening of the area in question was conducted as part of the investigative activities. An acoustic (side scan sonar) and magnetic (magnetometer) remote sensing survey was performed to identify ordnance and other submerged cultural resources in the remediation area by Tidewater Atlantic Research, Inc. and a report submitted on 8 February 2012. Analysis of the survey data identified concentrations of anomalies with UXO potential in the immediate vicinity of the Senate Street landing and scatters extending into the river. A terrestrial magnetometer investigation of the unnamed tributary below the Gervais Street Bridge was also carried out and that investigation identified eight additional anomalies with a potential association with ordnance. **Figure B-2-Previous Investigation Results** shows the location of anomalies detected during the February 2012 investigation.

In June 2010, the occurrence of a tar-like material (TLM) within the Congaree River was reported to the South Carolina Department of Health and Environmental Control (SCDHEC). Preliminary testing

indicated that the material may be attributable to the Huger Street former Manufactured Gas Plant (MGP) that was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950s.

Preliminary sample results conducted on the material by SCDHEC and South Carolina Electric and Gas Company (SCE&G) indicated that the TLM had similar chemical and physical characteristics as coal tar, a by-product of Manufactured Gas Operations, which were common in cities from the late 1800s until the 1950s. Additional research found that the most likely source of the TLM was a former MGP located northeast of the river at 1409 Huger Street that operated from about 1906 until the mid-1950s. Later this was the location of the city bus terminal until 2008.

MGPs produced a flammable gas from coal that was used for heating, cooking, and lighting purposes prior to the construction of interstate natural gas pipelines. The coal tar material was a waste product from coal-gas production. Once the gas was produced, the coal tar by-product was discharged into a former stream, which originated at what is known today as Finley Park, past the MGP site, and into the Congaree River just below the Gervais Street Bridge.

SCE&G had previously entered into a Voluntary Cleanup Contract (VCC) with SC DHEC in August 2002 to conduct environmental assessment and cleanup activities at the former Huger Street MGP site. SCE&G has worked proactively and cooperatively with DHEC under its existing VCC to determine the extent of TLM in the Congaree River and to develop a plan for cleanup. Overall, the delineation activities extended from the Gervais Street Bridge downriver approximately 9,050 feet.

An Engineering Evaluation/Cost Assessment (EE/CA) was prepared and a Final was submitted in January 2013. A non-time critical removal action of the impacted river sediments was chosen as the alternative. The TLM-impacted sediment varies in thickness from a few inches to approximately 6 feet thick in some areas. The current total estimate of sediment requiring removal is approximately 40,000 tons. The total project area is estimated to be 23 acres, with 10.5 acres consisting of waters of the United States. The landside or upland portion of the project area consists of approximately 12.5 acres of mostly undeveloped land with a cleared utility right-of-way. Much of the area will not be disturbed.

On August 21, 2013 a public release was issued summarizing the project purpose and objectives detailing that this is an environmental clean-up project mandated by SCDHEC intended to remove approximately 40,000 tons of TLM and impacted sediment from the Congaree River. The removal of the impacted sediment will result in a permanent improvement to the aquatic environment in the project area. Upon completion of the removal activities in the Congaree River, the project area will be allowed to return to its original pre-impacted state.

The removal of Munitions and Explosives of Concern (MEC) from the riverbank, impacted sediments and assisting in the segregation and disposal of impacted sediment remove by APEX covered under this work plan is to protect worker safety and environment. The MEC clearance area is shown on **Figure B-3-Clearance Area**.

2.1 Chemical Warfare Material

The site is not suspected of containing Chemical Warfare Material (CWM). However, if a suspected Recovered Chemical Warfare Material (RCWM) is encountered during removal and / or support activities, the procedures listed below will be followed:

Upon an unexpected discovery of RCWM, all work will immediately cease. Project personnel will withdraw along a cleared path upwind from the discovery. A team, consisting of a minimum of two personnel, will secure the area to prevent unauthorized access. Personnel must position themselves as far upwind as possible while still maintaining visual security of the area. Upon evacuation, the Senior Unexploded Ordnance Supervisor/Unexploded Ordnance Safety Officer (SUXOS)/(UXOSO) will account for all work site personnel and immediately notify the United States Army Corps of Engineers (USACE) Ordnance and Explosive Safety Specialist (OESS) with detailed information regarding the suspected RCWM and assist, if requested, in making notifications in accordance with (IAW) CEMP-CE Memorandum, Notification Procedures for Discovery of RCWM during USACE Projects. At a minimum, the SUXOS will notify the EOTI project manager (PM) who will, in turn, notify the responsible Contracting Officer. Security will be maintained on the item until relieved by a military EOD unit or Technical Escort Unit.

Once RCWM item has been removed and site plans updated according to the additional site hazards encountered, work may continue.

2.2 Hazardous Chemical Contamination

By definition, hazardous substances are those materials that can threaten human health and/or environmental well being if released into the environment. This describes those hazardous substances or chemical contaminants present in soil or air that pose a threat to the environment, and as such may pose a threat to site personnel and the public during removal actions. From what is currently known about the site and its past, chemical contamination is not expected to be a problem at this site. However, it is prudent to be particularly aware of unusual smells, soils stains, or the presence of drums/containers that might indicate hazardous materials may be present. If there is reason to believe that a chemical hazard exists, the SUXOS/UXOSO will stop work and report to the Corporate Health and Safety Staff as much information as is known (i.e., names of chemicals if containers have labels, condition of containers, extent of problem, etc.) and plans will be updated to accommodate these additional site hazards prior to resuming work on the site.

2.3 Improved Conventional Munitions.

The site is not suspected to contain Improved Conventional Munitions (ICM). If suspect ICM munitions that are not determined to be practice munitions are encountered during any phase of site activities, EOTI will immediately withdraw from the work area, secure the site, and contact the USACE Safety Office for assistance and guidance.

3.0 ACCIDENT EXPERIENCE

EOTI has an excellent safety record. Since its inception in 1997, EOTI has never had a lost time accident / injury. EOTI's current Experience Modification Rate is 0.969. EOTI's lost time injury rate is 0.

4.0 PHASES OF WORK REQUIRING HAZARD ANALYSIS

The following phases of work on this project require an Activity Hazard Analysis:

- Site-Setup/Layout
- Surface Preparation / Vegetation Removal
- Subsurface Clearance using “Mag & Dig” Methods
- Transportation of Explosives
- Disposal of MEC
- Mechanical Excavation

Activity Hazard Analyses can be found in this Accident Prevention Plan (APP) at Section 14.0 of this Appendix.

5.0 STATEMENT OF SAFETY AND HEALTH POLICY

The EOTI Safety Policy is the first page in the Corporate Health and Safety Program, and sets the tone for all safety efforts. It is signed by Maureen McIntyre, President EOTI.

EOTI strongly believes that our people are our most important and valuable asset. It is the actions of our personnel, working together as a team, which ultimately determines the success of our endeavors as a company.

Accidental injuries and illnesses can cause needless pain and suffering of employees and their families, as well as increasing costs and decreasing productivity and morale among employees. EOTI is committed to providing a safe and healthful work environment for all of our employees in all locations. The company’s goal is an accident-free work environment. The management of EOTI is committed to doing all in our power to make this a reality.

The management staff alone cannot accomplish a goal of this magnitude. It is only with the entire organization working together as a team that we can hope to achieve this level of performance. It is up to each of us to follow applicable safety requirements and procedures while performing our job functions.

A truly successful safety program involves more than simply following procedures. It involves active participation by all employees constantly striving to make improvements. No person knows any job better than the person doing that job. No person knows the condition of the equipment, potential problems with the procedures, and the work environment of a job better than the person doing that job. It is up to all of us to be constantly observant of changes in our own work environment, and to bring any potentially harmful conditions to the attention of management as soon as possible. It is the responsibility of the management staff to promptly and effectively respond to employee concerns for their safety and health.

In addressing potential safety and health problems as soon as they are observed, we prevent these situations from developing into accidents. Keeping open lines of communication at all levels within EOTI will foster an increased understanding of the safety and health issues that face us all.

6.0 RESPONSIBILITIES AND LINES OF AUTHORITY

6.1 Identification and Accountability

The following personnel and their safety related responsibilities for this project work are listed.

President (Wayne Lewallen) is responsible for enforcement of the Corporate Safety and Health Program at all worksites within his area of responsibility. He must assure that personnel receive the required training, medical surveillance, and personal protective equipment necessary in order to perform their jobs in a safe and effective manner. The enforcement of the Corporate Safety and Health Program on the worksites will be a critical rating element for site personnel and managers.

Corporate Safety and Health Management Consultant (Robert J. Goodman) is a CIH and CSP. He assists in the development, implementation, and maintenance of the Safety Program and individual Site Safety and Health Plans (SSHPs). He visits projects as requested to ensure the effectiveness of the Health and Safety Program. He remains available for project emergencies. He develops or reviews modifications to SSHPs as needed. He evaluates occupational exposure monitoring / air sampling data and adjusts SSHP requirements as necessary. He serves as a QC staff member and approves the APP/SSHP by signature.

Corporate MEC Health and Safety Coordinator (Dave Farmer) meets all the requirements of a UXOSO, Unexploded Quality Control Specialist (UXOQCS), and SUXOS and is responsible for creating, updating, and managing the Corporate Safety and Health Program, as well as APP/SSHP for individual worksites under the direction of the Corporate Safety and Health Manager. He coordinates directly with the PM and the SUXOS/UXOSO routinely to answer technical questions and to provide assistance to the worksites. He also provides safety training, as needed, and performs safety and health program inspections with the Safety and Health Manager to assure compliance with EOTI safety and health policy.

Project Manager (Brian Woods) directly impacts the safety of the site by setting the tone for the job and encouraging safe performance among all team members. Any areas of concern or questions regarding safety and health issues are coordinated with the Corporate Health and Safety Staff, Corporate MEC Safety and Health Coordinator, and the UXOSO. In instances of noncompliance with safety requirements, the PM issues warnings and/or provides disciplinary action up to and including removal of the employee from site operations, should this action be warranted. The PM assures that every accident on the work site is investigated in order to determine the root cause(s), the accident report is filled out, and takes steps necessary to prevent recurrences.

Senior UXO Supervisor (SUXOS) is responsible for the successful accomplishment of the work on the project site. He directly supervises all site work and personnel and assures they are operating in a safe manner. He assures that all personnel, including visitors, are properly trained, qualified, equipped, and protected from the hazards associated with the worksite and site operations. The SUXOS reports directly to the Project Staff on all project issues. The SUXOS has stop work authority. The SUXOS has numerous onsite responsibilities including, but not limited to:

- Coordinating with all applicable emergency response agencies to ensure appropriate response should an emergency develop on site;
- Establish medical evacuation routes and emergency telephone number listing;
- Inventory first aid equipment, personal protective equipment (PPE), fire extinguishers and purchase replacements, as required, with concurrence from the PM;
- Survey the site for hazards;
- Provide daily safety briefings;
- Provide required safety training;
- Designate site control zones;

- Provide visitor briefing and training; and

UXO Safety Officer (UXOSO)

He is granted the authority to administer the safety and health program on the worksite. The UXOSO reports directly to the Vice President of MEC Operations on all project safety and health issues. He coordinates with the Corporate MEC Safety and Health Coordinator for technical assistance on safety and health issues at the worksite, for assistance in ordering safety equipment, medical surveillance program issues, etc. The UXOSO has stop work authority whenever an imminent danger situation is observed. The UXOSO has numerous onsite responsibilities to support the SUXOS in maintaining a safe work environment. These responsibilities may include, but are not limited to:

- Inventory first aid equipment, PPE, fire extinguishers and purchase replacements, as required, with concurrence from the SUXOS and PM;
- Survey the site for hazards;
- Provide daily safety briefings;
- Provide required safety training;
- Provide visitor briefing and training;
- Perform onsite monitoring, if required;
- Perform daily safety inspections of site activities to verify compliance with all safety and health requirements in this project APP/SSHP, as well as the Corporate Safety and Health Program and recording any deficiencies in the Safety Log; and
- Coordination of corrective actions for any deficiencies noted during safety inspections.
- Perform onsite monitoring, if required;

Team Members are responsible for performing their assigned tasks in a safe and effective manner. Questions must be immediately brought to the attention of their supervisor. Team members must not attempt to perform an assigned task for which they have not been properly trained. All personnel must attend required safety training and be aware of the operations going on around them at the work site. Any situations or conditions, which may affect the safety and health of any team member, must be immediately reported to their supervisor. Before, during, and after use, personnel must inspect each piece of personal protective equipment, as well as other tools and equipment, to assure it is in a safe operating condition. Any equipment that is deemed unsafe for use must be immediately turned in for repair or replacement. Personnel must know how to properly use all equipment assigned to them and must use required personal protective equipment at all times.

The minimum qualifications for on-site UXO personnel are as follows:

The SUXOS, UXOSO, UXOQCS, UXO Supervisors and UXO Technicians must be graduates of the U.S. Army Bomb Disposal School, Aberdeen Proving Ground, MD, the U.S. Naval School, Explosive Ordnance Disposal (EOD), or approved UXO School. All personnel will meet or exceed the standards established by the Department of Defense Explosives Safety Board (DDESB) in DDESB TP 18.

The SUXOS must have at least 10 years combined MEC/ military EOD experience, which shall include 5 years in supervisory positions, which may be a combination of active duty military EOD functions and/or civilian MEC time. A SUXOS must be fully able to perform all the functions enumerated for UXO Sweep Personnel and UXO Technicians I, II, and III.

All UXO Supervisors (Tech III) shall have at least 8 years combined MEC/ military EOD experience. The UXO Technician III must be fully able to perform all the functions enumerated for UXO Sweep Personnel and UXO Technicians I, and II.

The UXOSO and UXOQCS will have at least 8 years combined active duty military EOD and contractor UXO experience and documented Safety or Quality Control training. The UXOSO must have successfully completed an approved Occupational Safety and Health Administration (OSHA) 30-Hour Safety Training program.

The UXOSO and the UXOQCS must be fully able to perform all the functions enumerated for UXO Sweep Personnel and UXO Technicians I, II, and III. These individuals must have documented experience supervising UXO removal operations and personnel.

A UXO Technician II be a graduate of military EOD school of the United States or other approved nation and must have prior military EOD experience or be a graduate of an approved course of instruction as defined in TP 18 and have a minimum of 3 years experience in the UXO field. All UXO Technician II's must be fully able to perform all the functions enumerated for UXO Sweep Personnel and UXO Technicians I.

Any other team member(s) must be at least OSHA 40-Hour Hazardous Waste Site Trained, have received Site Specific Hazard and Ordnance Recognition Training. UXO Technician I's must also be graduates of an appropriate recognized training course and meet all requirements in DDESB TP 18. Copies of training records, including training required by 29 Code of Federal Regulations (CFR) 1910.120, will be available at the project site office.

6.2 Lines of Authority

The ultimate authority for enforcing health and safety requirements is the Vice President/UXO Program Manager. He reports directly to the President of EOTI, and he makes all decisions regarding UXO operations. The Project Manager and the Corporate Health and Safety Staff report directly to the Vice President/UXO Program Manager.

The Project Manager is responsible for all aspects of running the project, including the safety and health of employees and the general public. The SUXOS reports directly to him on all project and safety and health issues. If there are questions, he consults with the Corporate Health and Safety Staff for resolution of areas of concern. He reports directly to the Vice President/UXO Program Manager.

The Corporate Health and Safety Manager provides consultation and advice on health and safety issues to the UXOSO, MEC Safety and Health Coordinator, the Project Manager, and the Vice President/UXO Program Manager. He reports directly to the President/UXO Program Manager.

The UXOSO directly manages the health and safety issues on the site. He coordinates with client site personnel and visitors to the site regarding health and safety issues. If there are questions on safety and health policy or procedures, he consults with the Corporate Health and Safety Staff. He reports directly to the Project Manager.

6.3 SUBCONTRACTORS AND SUPPLIERS

Identification of Subcontractors and Suppliers

EOTI anticipates awarding a subcontract to a local surveying company to provide survey support for the project. EOTI does not intend to subcontract any other portion of the scope of work. However, suppliers may deliver equipment and materials to the project site. All subcontractor personnel will be trained to the approved work plan and the included AAP. All visitors, including suppliers supporting the project, will receive a safety brief from the SUXOS or the UXOSO prior to entering any area where work is ongoing. They will sign in and will be escorted as required to perform their functions on the site. Only essential personnel will be allowed in the exclusion zone (EZ) while intrusive operations are ongoing.

Means for Controlling and Coordinating Subcontractors / Suppliers

All subcontracted personnel working on the site will receive the same thorough site-specific training provided to all EOTI site personnel. This training will include detailed training on procedures in the Work Plan and AAP. All suppliers making deliveries on site will receive a safety briefing, which will include recognition and awareness of potential site hazards. Suppliers will not be permitted to enter the EZ of the project site unless escorted by an EOTI UXO-qualified employee.

Safety Responsibilities of Subcontractors / Suppliers

All subcontractor personnel and suppliers making deliveries on site are responsible for receiving a safety briefing. They are responsible for following all site safety and health procedures. They will not enter any EZ area without a UXO-qualified escort. They will wear all required personal protective equipment while on the site in areas where it is required. They will report any accidents of their personnel to the SUXOS/UXOSO for investigation.

7.0 TRAINING

Prior to commencement of site activities, the UXOSO will ensure that all employees engaged in hazardous waste operations are informed of the nature and degree of exposure to chemical and physical hazards that are likely to result from participation in site operations. EOTI will accomplish this by ensuring that all personnel entering the site have received the appropriate OSHA and site-specific training, prior to participation in site activities. The other employees working on the site in other capacities not involving hazardous waste operations will receive training on the hazards of the MEC operations on site and on MEC recognition and avoidance procedures, as well as emergency procedures. This training will be held at the time of site mobilization and will be reinforced during the daily safety briefings, to which all site workers (including subcontractor personnel) will be required to attend.

Safety Indoctrination Subjects

Safety indoctrination training will be presented by the UXOSO to all EOTI employees, as well as to subcontractor personnel who will be working on this project site. This is part of on the job training (OJT), which includes classroom type instruction on the topics specified for site-specific training and on site participation in the following:

- Details of the APP/SSHP;
- Employee rights and responsibilities;

- Safe work practices;
- Nature and extent of anticipated chemical, biological and physical hazards;
- Measures and procedures implemented for controlling site hazards;
- Emergency Response and Contingency Plan;
- Rules and regulations for vehicle use;
- Safe use of field equipment;
- Safe operation of heavy excavation equipment;
- Handling, storage, and transportation of hazardous materials;
- Use, care, and limitations of PPE;
- Hazard communication per OSHA 29 CFR 1910.1200.

If personnel who are not UXO-qualified come on the site, a UXO recognition and awareness training will also be presented. While there is a UXO hazard on the site, personnel will have a UXO-qualified employee escorting them. Once an area is cleared of surface UXO, these employees will be permitted to enter the area without escort as long as no intrusive operations are performed. The UXO recognition and awareness training provides an additional level of protection to these workers so that if they see something that could be ordnance related, they will know enough not to touch it and to immediately get a UXO-qualified employee to examine the item.

7.1 Initial Training

Initial site-specific training will include proper procedures to evacuate the work site. It will also provide a description of the basic characteristics, deployment and functioning of the following ordnance:

- Rockets/missiles
- Projectiles
- Bombs
- Grenades
- Small Arms

All EOTI and subcontractor employees who are involved in hazardous waste site activities receive 40 hours of OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) training in accordance with 29 CFR 1910.120 (General Industry) and 29 CFR 1926.65 (Construction). If it has been more than a year since any worker has received the 40 Hour OSHA HAZWOPER training, he or she must also have a current HAZWOPER 8-Hour Refresher Training in accordance with 29 CFR 1910.120 and 29 CFR 1926.65 prior to working on the site. All production workers will also receive site-specific OJT under the direct supervision of a trained/experienced supervisor when they mobilize at the site.

7.2 Mandatory Training and Certifications Applicable to This Project

The following training and certifications are required for work on this project:

- EOD School Certificates (UXO-qualified personnel only)
- OSHA HAZWOPER 40 Hour Training
- OSHA HAZWOPER 8 Hour Refresher Training (as applicable)
- OSHA HAZWOPER Supervisor Training (Supervisors only)
- OSHA 30 Hour Safety Course (UXOSO)
- Valid vehicle operator license (All vehicle operators)

- Heavy Equipment Operator Training (Heavy Equipment Operators only)

7.3 Supervisory Training

On-site managers and supervisors, who are responsible for directing others, will receive the same training as the general site workers for whom they are responsible. They will also receive an additional 8 hours of OSHA required supervisory training in accordance with 29 CFR 1910.120 and 29 CFR 1926.65 to enhance their ability to provide guidance and make informed decisions. This additional training includes the following:

- Review of the EOTI Corporate Safety and Health Program;
- Regulatory requirements;
- Management of hazardous waste site cleanup operations;
- Management of site work zones;
- How to communicate with the media and the public;
- PPE selection and limitations;
- Spill containment; and
- Monitoring site hazards.

The UXOSO, with specific responsibilities for safety and health guidance on site, will receive the training provided to general site workers and their supervisors. He also will receive advanced training in safety and health issues, policies and techniques. The UXOSO will have completed an OSHA-approved 30-hour Construction Safety Class.

7.4 Project-Specific Training

The SUXOS and UXOSO will conduct OJT. This training will include classroom type instruction covering the topics specified for site-specific training, and on site participation in the following:

- Details of the Site Specific Health and Safety Plan;
- Employee rights and responsibilities;
- Safe work practices;
- Nature and extent of anticipated chemical and physical hazards;
- Measures and procedures for controlling site hazards;
- Emergency Response and Contingency Plan;
- Rules and regulations for vehicle use;
- Safe use of field equipment;
- Handling, storage, and transportation of hazardous materials;
- Use, care, and limitations of PPE;
- Hazard communication per OSHA 29 CFR 1910.1200.

7.5 MEC Training

All employees performing work involving the handling and destruction of MEC must be graduates of the Naval Explosive Ordnance Disposal School or other appropriate recognized training per DDESB TP 18. A copy of their certificate of graduation will be kept on file at corporate headquarters. UXO qualified personnel must have knowledge and experience in military ordnance, ordnance components, and explosives location, identification, render safe, recovery/removal, transportation, and disposal safety precautions. UXO personnel must have the knowledge and experience to effect safe handling and transportation of found ordnance items.

7.6 Hazard Communication Training

All employees who will be performing work involving the handling of hazardous materials will receive Hazard Communication training detailing the hazards of the product, appropriate protective measures to prevent exposure to the product and work environment hazards, as well as safe procedures for storage and handling of the product, and response to emergencies. Personnel may request a Safety Data Sheet (SDS) for any hazardous material on the site at any time. The location of the SDSs for this site will be in an SDS binder in the site office, and all personnel will be made aware of that fact. This training will occur as part of the initial mobilization training at the site.

7.7 Tailgate Safety Briefing

Tailgate Safety Briefings consist of providing short training sessions in various subjects that give the site worker knowledge and confidence in performing duties in a potentially hazardous environment. The EOTI Documentation of Training Form doubles as the Tailgate Safety Brief Log/Form. The Tailgate Safety Briefing will be given prior to commencing work each day and will include such items as:

- Expected weather conditions;
- General site hazards;
- Biological hazards on site;
- MEC hazards;
- PPE required at each site;
- Emergency evacuation procedures;
- Heat or cold stress precautions;
- Buddy system procedures;
- A review of any safety violations from the previous day; and
- Any other significant events involving safety.

Additional briefings will be provided as needed concerning the use of safety equipment, emergency medical procedures, emergency assistance notification procedures, accident prevention, the work plan, and site orientation to ensure that accomplishment of the project can be carried out in a safe and effective manner.

7.8 Daily Debriefing

At the conclusion of each workday, debriefing for all employees will be held if appropriate, and the day's work will be discussed to determine if changes are warranted before commencing the next day's activities.

7.9 Periodic Site Training

On the first workday of each workweek / period or more frequently if needed, a pertinent topic will be selected and elaborated upon by the SUXOS/UXOSO during the Tailgate Safety Briefing. These safety meetings will help ensure the safety and health of site personnel in the performance of regular work activities and in emergency situations. Safety meetings will be documented in the appropriate log and the EOTI Documentation of Training Form will be completed.

7.10 Visitors

All visitors to the site, even if escorted, must receive as a minimum, a briefing on site conditions, hazards and emergency response procedures. The UXOSO will generally be the one providing the visitor briefing. All visitors to the EZ will be escorted at all times. When visitors who are not UXO qualified enter the EZ, all MEC operations will cease, and will resume again after the visitor has left the area. Visitors will not be permitted in the restricted work areas unless they have the appropriate level of OSHA training and are medically approved. Visitors not complying with the above requirements will not enter the restricted work areas; however, they may observe site conditions from a safe distance. All visitors will make appropriate entries in the Visitor's Log.

7.11 Emergency Response Training Requirements

All personnel will receive training in the Emergency Response and Contingency Procedures as part of their mobilization training. In addition to this training, First Responders will receive the following training in addition to being offered the Hepatitis B vaccine, if they have not already received it:

- First Aid/Cardiopulmonary resuscitation (CPR) Training,
- Bloodborne Pathogens Training.

7.12 Other Training Requirements

Tailgate Safety Briefings consist of providing short training sessions in various subjects that give the site worker knowledge and confidence in performing duties in a potentially hazardous environment. The EOTI Documentation of Training Form doubles as the Tailgate Safety Brief Log/Form. The Tailgate Safety Briefing will be given prior to commencing work each day.

Additional briefings will be provided as needed concerning the use of safety equipment, emergency medical procedures, emergency assistance notification procedures, accident prevention, the work plan, and site orientation to ensure that accomplishment of the project can be carried out in a safe and effective manner. Subcontractor personnel will also attend the daily tailgate safety briefings each morning.

At the conclusion of each workday, debriefings for all employees will be held if appropriate, and the day's work will be discussed to determine if changes are warranted before commencing the next day's activities.

7.13 Training Documentation

A training record will be kept in each employee's individual file to confirm that adequate training for assigned tasks is provided and that training is current. In addition, Documentation of Training Forms will be completed and kept on file at the work site for the duration of site activities, and made available for inspection upon request.

8.0 SAFETY AND HEALTH INSPECTIONS

Internal Safety and Health Inspections

The UXOSO will perform daily inspections on a scheduled and non-scheduled basis, of all site operations. The UXOSO will conduct non-scheduled safety and health inspections as deemed

appropriate based upon the ongoing site activities. Scheduled safety and health inspections will be conducted as outlined below. All inspections will be documented. When discrepancies are observed, follow-up will be documented in the UXOSO log until the corrective actions required have been completed. The following table lists the scheduled areas and frequency of inspection. More frequent inspections can be held at the discretion of the SUXOS/UXOSO.

AREA	FREQUENCY
Sanitation	Daily
Medical and First Aid	Daily
Temporary Facilities	Weekly
Personal Protective and Safety Equipment	Daily
Hazardous Substances, Agents, and Environments	Weekly
Lighting	Monthly
Accident Prevention Signs, Tags, Labels, and Signals and Piping System Identification	Monthly
Fire Prevention and Protection	Weekly
Hand and Power Tools	Daily, if applicable
Material Handling, Storage and Disposal	Weekly
Machinery and Mechanized Equipment	Daily, if applicable
Motor Vehicles	Weekly
Safe Access and Fall Protection	Weekly, if applicable
Hazardous, Toxic and Radioactive Waste (HTRW)	Daily, if applicable

External Inspections

Due to the location and type of work being performed on this site, it is anticipated that the only external inspections required would be an inspection by the USACE to confirm compliance with Work Plan and COE requirements. EOTI will also be prepared in the event that Local and State safety and health officials or other enforcement agencies may conduct inspections to ensure compliance with Local and State or Federal requirements.

9.0 SAFETY AND HEALTH EXPECTATIONS, INCENTIVES & COMPLIANCE

The goal for EOTI on this project is zero accidents. All managers and supervisors are responsible for implementing the provisions of this APP/SSHP and for answering team member questions about accident prevention. Management is responsible for ensuring that all safety and health policies and

procedures are clearly communicated and understood by all team members. Managers and supervisors are expected to enforce the rules fairly and uniformly. This will be accomplished by:

- Informing team members of the provisions of the Safety and Health Program;
- Evaluating the safety performance of all team members;
- Recognizing team members who perform safe and healthful work practices;
- Providing training to team members whose safety performance is deficient; and
- Disciplining team members for failure to comply with safe and healthful work practices.

All team members are responsible for using safe work practices, for following all directives, policies and procedures, and for assisting in maintaining a safe work environment. EOTI recognizes that open, two-way communication between management and all team members on health and safety issues is essential to an injury-free, productive workplace. To facilitate a continuous flow of safety and health information between all team members that is readily understandable, the following will be accomplished:

- Training all new team members, during the site-specific training, on the site safety and health policies and procedures, which will include this APP/SSHP;
- Training all new team members on the hazards associated with the job site;
- Conducting daily tailgate safety meeting for all team members;
- Conducting quarterly refresher type training;
- Posting and, if applicable, distributing safety information; and
- Encouraging open communications.

9.1 Incentive Program

Safety Performance is a critical element in all performance evaluations. Managers are evaluated on the safety of all operations on their project sites. Other workers are evaluated on their own participation in the safety program and compliance with safety procedures. EOTI takes a team approach to safety and expects all personnel to participate actively in continuously looking for ways to improve safety performance.

9.2 Policy and Procedures Regarding Noncompliance with Safety Requirements

Disregard for safety and health requirements will not be tolerated. If the SUXOS, UXOSO and Project Manager determine that a team member is not sufficiently committed to conforming to established safety standards, the team member's employment agreement will be terminated.

Safety rules and practices are established for the safety of all employees and to promote the welfare of the company. If the occasion arises whereby safety rules and practices established by the APP are violated, appropriate penalties will be imposed.

Infractions are divided into two categories: "Major" and "Minor". An example of a minor violation is reporting for work without the prescribed Level D PPE. Any violation of the APP that could have or did result in an accident involving personal injury or property damage is considered a major violation. The following guidelines are imposed for penalties:

Minor Violations

First Offense: Verbal warning to individual; offense to be noted in individual and supervisor's project file; discussion with individual's supervisor.

Second Offense: Written reprimand by the SUXOS will be entered in individual's file; discussion with individual and individual's supervisor.

Third Offense: Termination of employment recommended by the SUXOS to the Project Manager, who makes the final decision after discussion with the Corporate Health and Safety Manager and SUXOS.

Major Violations

Any Offense: Minimum penalty will consist of a written reprimand to be entered in individual's file and a discussion with individual and the SUXOS will be conducted. Depending upon severity of the violation, the SUXOS may temporarily dismiss the individual from the job site. If this occurs, the UXOSO or SUXOS will immediately report the incident to the Corporate Health and Safety Staff. Upon completion of a full investigation, the individual's employment may be terminated, if deemed appropriate, through a joint decision of the Program Manager, Project Manager, Corporate Health and Safety Staff, and SUXOS.

When a violation occurs:

- An investigation of the incident will be carried out by the UXOSO to determine if a violation has in fact occurred.
- If the UXOSO determines that a violation has occurred, the following actions will be accomplished:
 - Report of the violation will be submitted to the SUXOS and Corporate Health and Safety Staff by the UXOSO.
 - The UXOSO, in conjunction with the Corporate Health and Safety Manager and SUXOS, will determine if the violation is "major" or "minor".
 - The SUXOS, in conjunction with the Corporate Health and Safety Manager and the Project Manager, will determine the appropriate disciplinary action.

9.3 Procedures for Holding Managers Accountable for Safety

In all cases, supervisors are evaluated on the safety of project sites under their control. If investigation into project site accidents/incidents indicates negligence on the part of a supervisor, the investigation results will be discussed between the President/UXO Program Manager, the Project Manager and the Corporate Health and Safety Staff. If there is concurrence, and depending on the severity of the situation, the supervisor could be given a written reprimand or could be removed from duty in the case of serious negligence.

10.0 ACCIDENT REPORTING

10.1 Exposure Data

Exposure data on man-hours worked on a project, will be collected by the Project Manager. The Corporate Health and Safety Staff will be provided this information from the Project Manager in order to prepare accident statistics for the company and exposure reports for individual projects as required.

10.2 Accident Investigations, Reports, Logs

Investigation and documentation of emergency responses shall be initiated by the SUXOS/UXOSO. This is important in all cases, but especially so when the incident has resulted in personal injury, property damage, or environmental impact. The documentation will be a written report and will be inclusive of the following:

- Accurate, concise and objectively recorded information;
- Authentic Information: Each person making an entry must sign and date that entry. Nothing is to be removed or erased. If details are changed or revised, the person making the change should strike out the old material with a single line and initial and date the change;
- Titles and names of personnel involved;
- Actions taken, decisions made, orders given, to whom, by whom, when, what, where, and how, as appropriate;
- Summary of data available;
- Possible exposure of personnel; and
- Copies of the Employer's Report of Occupational Injury or Illness (OSHA Form 300) or the EOTI Accident Report, as appropriate will be completed and forwarded to the Corporate Health and Safety Manager.

Reportable injury and occupational illnesses fall into one of the following categories:

- Fatality, including missing and presumed dead;
- Permanent total disability;
- Lost workday case involving days away from work;
- Recordable case without lost workdays;
- Recordable first-aid case; and
- Non-recordable injury/illness.

The following unplanned events will also be investigated and reported:

- Damage to military property;
- Damage to contractor property; and
- Unplanned functioning of UXO.

All recordable and reportable accidents will be recorded on the OSHA Form 300, Log of Federal Occupational Injuries and Illnesses, which will be maintained at the EOTI Safety Office. [29 CFR 1904.2]

All accidents will be investigated and immediate steps will be taken to prevent recurrence. The APEX Project Manager and USACE Project Manager will be notified of any accidents occurring on this project site.

Should an accident occur on the site, all reports and records will be documented. Copies will be maintained on site for the duration of site activities. A permanent copy will be maintained in EOTI's Oak Ridge, TN Office.

10.3 Immediate Notification of Major Accidents [29 CFR 1904.8]

Within 8 hours after the death of any employee from a work-related incident or the in-patient hospitalization of three or more employees as a result of a work-related incident, the employer shall orally report the fatality/multiple hospitalization by telephone or in person to the nearest Area Office of OSHA. This will be accomplished by the Health and Safety Staff. In the event of an emergency, site personnel will be notified by either visual/verbal communication. Personnel will be notified to:

- Stop work activities;
- Evacuate to the designated assembly point;
- Begin emergency procedures; and
- Notify off site emergency response organizations.

In the event of an emergency, the SUXOS will be designated as the On-Scene Incident Commander and will have the overall responsibility for implementation of the response and coordination with responding off-site emergency services.

Once an emergency has occurred, the SUXOS will report the incident to the client representative, the Project Manager and the Health and Safety Staff as soon as the situation is under control.

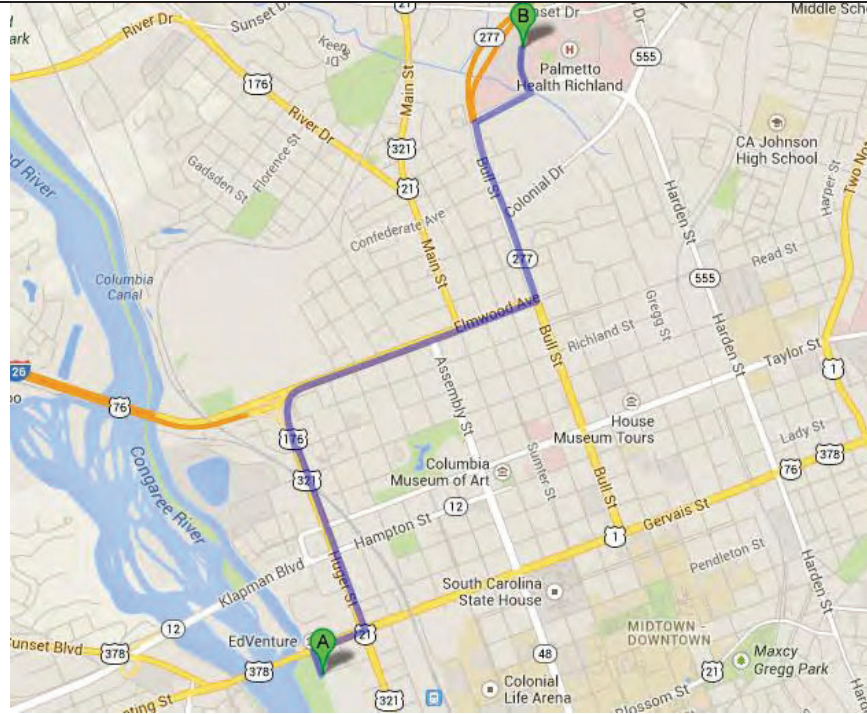
If the emergency involves employee injury, the UXOSO will complete the ENG Form 3394 Accident Report. The Health and Safety Staff will be responsible for notifying applicable Federal, state and local authorities/agencies where required. Once the emergency has been resolved, the UXOSO, Project Manager and Health and Safety Staff will conduct a follow-up investigation and critique. Actions will be taken to prevent recurrence.

11.0 MEDICAL SUPPORT

A first aid kit will be placed in the site vehicles and the project office. A CPR mask and a bloodborne pathogen kit will also be kept with each first aid kit. The SUXOS will have final authority on the decision to require additional professional medical services (i.e., paramedics, hospital visit, etc.) for any illness or injury. Two site employees will be certified in First Aid and CPR. They will be the first responders to any site emergency and will render first aid/CPR as needed until medical assistance arrives on the scene. A Trauma First Aid Kit will be kept in the UXOSO vehicle.

All supervisory personnel shall maintain a phone listing of the nearest available medical assistance in the event of an accident. This telephone listing will be kept beside each telephone. The SUXOS will ensure that an Emergency Medical Assistance list is updated and provided to all supervisors. Directions to the nearest medical facility will be kept in each vehicle.

The nearest medical facility address is: **Palmetto Health Richland**
5 Richland Medical Park Drive
Columbia, SC 29203
(803) 434-7000 * For Emergency Dial 911



Driving directions to Palmetto Health Hospital



Project Site

- 1. Head north on Gist St toward City Club Dr**
482 ft
- 2. Take the 2nd right onto Gervais St**
0.2 mi
- 3. Turn left onto US-21 N/US-321 N/Huger St**
Continue to follow US-21 N/US-321 N
0.8 mi
- 4. Keep right at the fork, follow signs for U.S. 21/U.S. 176/U.S. 321/Elmwood Avenue and merge onto US-176 W/US-21 N/US-321 N/US-76 E**
Continue to follow US-76 E
1.1 mi
- 5. Turn left onto Bull St**
0.7 mi
- 6. Turn right onto Harden Street Extension(signs for Harden St)**
0.2 mi
- 7. Turn left onto Richland Medical Park Dr**
Destination will be on the right
0.2 mi

12.0 PLANS, PROGRAMS AND PROCEDURES

12.1 PERSONAL PROTECTIVE EQUIPMENT PLAN

Whenever feasible, engineering controls as a priority and work practices, or a combination thereof, will be utilized to protect site workers from safety and health hazards and maintain personal exposures to hazardous substances below established exposure limits. The exposure limits used by EOTI will be the lower of the OSHA Permissible Exposure Limits (PELs) found in 29 CFR 1910 Subpart G and 29 CFR 1910.1000, or the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs). Other recognized published exposure levels, such as those found on SDSs, will be used if the substance is not listed by OSHA or the ACGIH. EOTI will not utilize a system of employee rotation as a means of complying with the PEL, TLV, or other published limits.

Due to the expected hazards at this site during most operations, modified Level D PPE will be the requirement. Level D PPE is a work uniform affording minimal protection, used for nuisance contamination only. The following modified Level D equipment will be required on this site:

- Leather gloves.
- Face shields – when working around chain saws, weed whackers and vegetation removal equipment.
- Tinted or clear safety glasses with side shields or goggles.
- Hearing protection, where required by high noise levels, in the vicinity of heavy equipment operations, and vegetation clearance operations involving gas-powered equipment.
- Leather work boots with ankle support and non-slip soles (no steel toes that interfere with magnetometers).
- Cotton work clothes.
- Leg chaps – when working around vegetation removal equipment or snakes.
- Hard hat – when working around heavy equipment, and in the vicinity of chain saws, weed whackers and powered vegetation removal equipment.

Selection of PPE

Each task outlined in the Statement of Work will be assessed prior to its initiation to determine the potential of personnel exposure to safety and health hazards, which may be encountered during its conduct. The hazard assessment will be based on available information pertaining to the historical use of the site, site contaminant characterization data and the anticipated operational hazards. This information will be provided to, or collected by EOTI site personnel. The PPE assigned as a result of the hazard assessment represents the minimum PPE to be used during initial site activities. Since hazard/risk assessment is a continuing process, changes in the initial types and levels of PPE will be made in accordance with information obtained from the actual implementation of site operations and data derived from the site monitoring. As a general rule, the levels of PPE will need to be reassessed if any of the following occur:

- Commencement of a new work phase, or work that begins on a different portion of the site.
- Change in job tasks during a work phase.
- Change of season/weather.
- When temperature extremes or individual medical considerations limit the effectiveness of PPE.
- Contaminants other than those previously identified are encountered.
- Change in ambient levels of contaminants.
- Change in work scope, which affects the degree of contact with contaminants.

During the selection of PPE the Health and Safety Staff and UXOSO will also take into consideration the following factors:

- Limitations of the equipment.
- Work mission duration.
- Temperature extremes.
- Material flexibility.
- Durability/Integrity of the equipment.

12.1.1 Eye and Face Protection

All personnel will use appropriate eye or face protection when exposed to eye or face hazards from flying particles, liquid chemicals, or other eye hazards. All personnel will use eye protection that provides side protection when there is a hazard from flying objects. Detachable side protectors (e.g. clip-on or slide-on side shields) or goggles meeting the pertinent requirements of this section are acceptable. If there is a likelihood for glare, tinted safety glasses are recommended.

All personnel who wear prescription lenses while engaged in operations that involve eye hazards shall wear eye protection that incorporates the prescription in its design, or wear eye protection that can be worn over the prescription lenses without disturbing the proper position of the prescription lenses or the protective lenses.

Eye and face PPE shall be distinctly marked to facilitate identification of the manufacturer. Protective eye and face devices will comply with ANSI Z87.1-1989, "American National Standard Practice for Occupational and Educational Eye and Face Protection," which is incorporated by reference as specified in Sec. 1910.6.

12.1.2 Head Protection

When working in the vicinity of heavy equipment, as well as vegetation clearance equipment, hard hats will be worn. While there is not expected to be a danger of impact to the head due to falling or flying objects during other operations, it is recommended that personnel wear caps or some type of head covering for protection from the sun.

12.1.3 Foot Protection

Due to the uneven working surfaces and potential for tripping hazards common to a UXO site, all EOTI personnel shall wear sturdy leather, work boots with ankle support and non-slip soles. Personnel using magnetometers for the detection of buried MEC will not wear steel-toe safety shoes, as they will affect the readings of the equipment. While working around heavy equipment, UXO personnel will wear steel or composite toe boots or slip on toe caps.

12.1.4 Hand Protection

EOTI selects and requires employees to use appropriate hand protection when employees' hands are exposed to hazards such as those from skin absorption of harmful substances; severe cuts or lacerations; severe abrasions; punctures; thermal burns; and harmful temperature extremes. For most operations on this site, leather gloves will provide adequate protection against minor cuts, which are a hazard in most site operations.

12.1.5 Hearing Protection

EOTI will make hearing protectors available to all employees exposed to an 8-hour time-weighted average of 85 decibels (OSHA Action Level) or greater at no cost to the employees. Hearing protectors will be replaced as necessary. Hearing protection will be required for all personnel working in and around any operations likely to produce high noise levels, such as during the use of chain saws and weed whackers during thinning and pruning operations and when working in the vicinity of heavy equipment.

12.1.6 Emergency Equipment

Emergency equipment will be maintained on site for the duration of site operations. An approved, emergency first aid kit, and bloodborne pathogen kit, will be kept in each site vehicle. Portable eyewashes will be located in the work area and in the site vehicles. A 5-lb. ABC fire extinguisher will be kept in each site vehicle for emergency use on site. A Trauma First Aid Kit will be maintained in the UXOSO vehicle.

12.1.7 Upgrading/Downgrading PPE

If work tasks are added or amended after completion and approval of the APP, the SUXOS/UXOSO will conduct the task hazard assessment and consult with the Corporate Health and Safety Manager. The level and type of PPE to be used will be identified. The Corporate Health and Safety Staff will allow any changes in PPE, which involve downgrading of the level of PPE, only after review of documentation demonstrating that the conditions and/or potential for hazardous exposure are reduced enough to justify the downgrade.

12.1.8 Purchasing PPE

The MEC Safety and Health Coordinator will maintain a list of sources for purchasing PPE and will assist the Project Manager in ordering the correct type and amounts of the PPE to accomplish the project objectives.

12.1.9 General Requirements

All personal protective equipment will be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary. PPE is required due to hazards of processes or environment, chemical hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact. All PPE will be used in the manner for which it was designed. The assignment of PPE will be based upon hazard analysis, and the equipment will be selected based on its protection factor against site hazards.

12.1.10 Inspection

Each piece of PPE will be inspected daily prior to use. Defective or damaged personal protective equipment will not be used. It will be removed from service and turned in for repair, or removed from the site for disposal and replaced with new PPE.

12.1.11 Training

EOTI will provide training to each employee who is required by this section to use PPE. Each affected employee will demonstrate an understanding of the training, and the ability to use PPE properly, before being allowed to perform work requiring the use of PPE. Each such employee will be trained to know at least the following:

- The decisions and justifications used to select each piece of PPE.
- The nature of the hazards and the consequences of not using PPE.
- What PPE will be required to conduct each task.
- When PPE will be required during the performance of each task.
- How to properly don, doff, adjust and wear each piece of PPE.
- The proper inspection, cleaning, decontaminating, maintenance and storage of each PPE item used.
- The limitations of the PPE.

All personnel receiving PPE training will be required to demonstrate an understanding of the training topics and the ability to correctly use the PPE. This will be accomplished through the UXOSO supervising and visually inspecting each individual's ability to properly don and use the PPE during initial use of the PPE.

When the SUXOS or UXOSO has reason to believe any affected employee who has already been trained does not have the understanding and skill required he should retrain each such employee. Circumstances where retraining is required include, but are not limited to, situations where:

- Changes in the workplace render previous training obsolete; or
- Changes in the types of PPE to be used render previous training obsolete; or
- Inadequacies in an affected employee's knowledge or use of assigned PPE indicate that the employee has not retained the requisite understanding or skill.

Upon completion of the training and after each employee has successfully demonstrated the requisite understanding, the SUXOS or UXOSO will complete the Documentation of Training form. This identifies: the employees who attended the training course and successfully demonstrated the required knowledge; the date(s) of the training and demonstration session(s); and the PPE covered by the training session.

12.1.12 Cleaning and Decontamination

The UXOSO will be responsible for ensuring that PPE is in good, clean, working order prior to issuing the PPE the first time. Once issued, site personnel will ensure that re-usable articles of PPE are maintained in a clean and sanitary fashion. For items used inside an EZ, site personnel will ensure that the PPE is properly decontaminated as appropriate before removing the item from the EZ or Contamination reduction Zone (CRZ).

12.1.13 Maintenance

Maintenance of PPE can vary greatly, based upon the complexity of the PPE and the intricacy of the repair involved. The UXOSO will become familiar with the manufacturer's recommended maintenance and when possible repair defective PPE. If unable or unauthorized to conduct the repair, the UXOSO will return the item to the manufacturer for repair, or procure a replacement.

12.1.14 Storage

PPE will be stored in a location, which is protected from the harmful effects of sunlight, damaging chemicals, moisture, extreme temperatures, impact or crushing. If needed, the SUXOS will designate a specified area for the storage of PPE.

12.2 LAYOUT PLANS

Layout plans are not applicable for this project, as temporary structures are not being constructed.

12.3 EMERGENCY RESPONSE PLANS

12.3.1 Procedures and Tests

The SUXOS and UXOSO will coordinate to perform the following pre-emergency tasks before starting field activities and during the mobilization and site specific training phase of the project, and will coordinate emergency response with emergency medical technician (EMT)/police/fire/adjacent industry personnel or other emergency response personnel when appropriate:

- Locate telephone stations;
- Post emergency telephone numbers at accessible telephone locations;
- Inspect all emergency equipment and supplies to ensure they are in proper working order;
- Provide a site map marked with planned evacuation routes, assembly points, and emergency equipment and supplies;
- Provide a map with the route to the hospital marked and highlighted, with copies of this map posted in the office/break area, in the emergency evacuation vehicle and all other site vehicles;
- Conduct an emergency response drill to test the effectiveness of the Emergency Response Contingency Plans (ERCP); and
- Review and revise the ERCP in the event of a failure of the plan in an actual or staged emergency, or when changes in site conditions or scope of work affect the ERCP.

Before normal activities are resumed, onsite personnel must be prepared and equipped to handle another emergency. These follow-up activities should be completed:

- The Corporate Health and Safety Staff will notify appropriate government agencies as required (Reminder: OSHA must be notified if there have been any fatalities or three or more hospitalizations).
- All equipment and supplies restocked, serviced and inspected; and
- Review and revise all aspects of the Health and Safety Plan as necessary to address and prevent future emergencies of this type.

12.3.2 Spill Plans

In the event of a spill or leak of any potentially harmful material (regardless of quantity) on site personnel will:

- Notify the SUXOS immediately;

- The SUXOS shall notify the Project Manager of the spill/leak with relative information (location, time, chemical identity, quantity, hazards listed on the SDS), and any corrective actions/measures taken;
- Locate the source and stop the leak/spill if it can be done safely (as dictated by the SUXOS);
- Begin containment and recovery of spilled material (as directed by the SUXOS), using appropriate PPE and spill clean-up equipment and materials; and
- Once notified, the EOTI Project Manager will in turn notify the APEX Project Manager and USACE Project Manager.

12.3.3 Firefighting Plans

The decision on whether or not to try to extinguish a fire using available site personnel and equipment will be made by the SUXOS and UXOSO and based on whether the fire is small, large or involves explosives.

12.3.4 Small Fires

A small fire is defined as a fire that can most likely be extinguished by site personnel using portable extinguishers. A small fire must also be free and clear of explosive materials, especially MEC. If a small fire occurs, the SUXOS or UXOSO will direct site personnel to perform the following, if safe to do so:

- Evacuate unnecessary personnel to an upwind position;
- Attempt to extinguish the fire using portable fire extinguishers or by smothering;
- Remove any essential or flammable items from the path of the fire; and
- Notify emergency response services (fire, police, ambulance, hospital, etc.) as needed.

If a fire extinguisher is used, this must be immediately reported to the SUXOS. The fire extinguisher must be immediately removed from service until it can be recharged. Another fire extinguisher must be made available to the operating area. The area around where the fire occurred must be watched for a minimum of 30 minutes after the fire has been extinguished to assure re-ignition does not occur. If personnel are not working in the area, the SUXOS should check the area of the fire periodically to assure re-ignition does not occur.

12.3.5 Large Fires

A large fire is defined as a fire, which due to its size, cannot be extinguished using portable fire extinguishers. In the event that a large fire occurs and the fire does not involve explosive materials, the SUXOS/UXOSO will direct personnel to conduct the following, if safe to do so:

- Evacuate all non-essential personnel from the site to an upwind location;
- Notify the Fire Department and other emergency response services (police, ambulance, hospital, etc.) as needed;
- Notify adjacent industries and neighbors;
- Order the appropriate level of protective equipment to be worn by personnel responding to the fire;
- Attempt to control the fire to the extent possible; and
- Remove any essential or flammable items from the path of the fire.

12.3.6 Fires Involving Explosive Materials

If a fire occurs which involves explosive materials such as chemicals, fuels or MEC, the SUXOS will order the immediate evacuation of all site personnel to an upwind assembly point at least maximum fragmentation distance from the fire site. The SUXOS will then notify the Fire Department, adjacent industries and any other emergency services (police, ambulance, hospital, etc.) as needed. At no time will EOTI personnel fight a fire involving explosive materials, nor will they allow outside emergency personnel to do so. The Fire Department personnel may not enter any closer than maximum fragmentation distance from the fire and they may spray water to surrounding buildings, structures, etc. in order to prevent the spread of fire.

After the fire has burned itself out, the site must be barricaded and entry prohibited until adequate cooling time has passed (at least 24 hours for a large fire). Explosive materials that may not have discharged during the fire may still be liable to function in the presence of extreme heat. After the site has cooled down, the SUXOS and UXOSO will inspect the site and conditions of any MEC involved in the fire, and make a determination as to whether or not the site is safe for others to enter.

If non-UXO qualified personnel must enter the site for purposes of fire investigation, etc. they must receive a briefing on the potential hazards of MEC on the site. They must be accompanied at all times by a UXO-qualified employee of EOTI. **NO OUTSIDE PERSONNEL WILL BE PERMITTED ONTO THE SITE WHILE THERE IS A KNOWN MEC HAZARD PRESENT.** If, during the course of the investigation, MEC is observed, the site will be evacuated of all non-UXO qualified personnel until the site can be rendered safe for re-entry.

12.3.7 Explosions

In the event of an accidental explosion, the SUXOS will order the evacuation of all site personnel to a safe, upwind assembly point at least fragmentation distance away. The SUXOS will then notify all necessary emergency response services. After an explosion has occurred the site will remain barricaded a minimum of 30 minutes before entry is permitted if no smoke/burning is observed.. If smoke or burning is observed wait 60 minutes after smoke/burning has stopped. The SUXOS/UXOSO will enter the site with a team member and inspect for presence and condition of MEC. Non-UXO qualified personnel may not enter the area until all known MEC has been removed or destroyed. If non-UXO qualified personnel need to enter the site, they must first be briefed on the potential hazards of the site. They must be accompanied at all times by an UXO-qualified employee. If MEC is discovered during the course of their visit, they must immediately leave the site until it can be rendered safe for re-entry.

12.3.8 Posting of Emergency Telephone Numbers

Emergency Response / Services	
Ambulance Service	911
Emergency Medical Response	911
Police*	911
Police Department – Non emergency	803-545-3500
Hospital-Palmetto Health Richland 5 Richland Medical Park Dr Columbia, SC 29203	803-434-7000 * For Emergency Dial 911
Fire Department*	911
Fire Department – Non Emergency	803-545-3700
National Poison Control Center	800-222-1222
CHEMTREC (hazardous materials response)	800-424-9300
National Response Team (hazardous materials response)	800-424-8802

Centers for Disease Control (CDC) http://www.cdc.gov/health/diseases			800-311-3435
Project Management / Coordination			
EOTI			
	Program Manager	Wayne Lewallen	732-673-6017
	Project Manager	Matthew Norris, GISP	865-200-8081
	Safety Manager	David Farmer	865-200-8081
APEX			
	Project Manager	Rusty Contrael	412-829-9650
USACE			
	TBD	TBD	TBD
Explosives Supplier			
	Austin Powder	TBD	423)-562-2227

12.3.9 Wild Land Fire Prevention Plan

A Wild Land Fire Prevention Plan is not expected to be needed on this site. It is anticipated that heavy vegetation will be cut prior to beginning work that could result in an accidental fire and therefore excess vegetation that could contribute to a fire is not expected. However, fire extinguishers will be present at the job site and would be used to immediately put out any small fire that would start in the area, thereby preventing large fires from developing.

12.4 Man Overboard/Abandon Ship

As work covered under this project will be conducted on dry land, a Man Overboard/Abandon Ship plan is not required.

12.5 Hazard Communication Program

As part of the EOTI Hazard Communication Program, an SDS binder will be maintained onsite, which includes copies of SDSs for all hazardous materials brought onto the site by EOTI. It will be kept in the site office during operations, and all site personnel will be made aware of that fact. This SDS binder will be available on request to all site personnel during all working hours. If site workers have further questions about any of the hazardous materials they encounter, the EOTI Corporate Health and Safety Staff will locate the required information and pass it on to the employee.

All employees who will be performing work involving the handling of hazardous materials will receive Hazard Communication training detailing the hazards of the product, appropriate protective measures to prevent exposure to the product, proper labeling of secondary containers, as well as safe procedures for storage and handling of the product, and response to emergencies. Personnel may request an SDS for any hazardous material on the site at any time. This training will occur as part of the initial mobilization training at the site and will be documented on the EOTI Documentation of Training Form.

12.6 Respiratory Protection Plan

Due to the type of work taking place, respirators are not expected to be required on this site. Should unforeseen hazards develop, which would require a respirator, the EOTI Respiratory Protection Program would be followed per Chapter 16 of the EOTI Corporate Health and Safety Program.

12.7 Health Hazard Control Program

Due to the type of work that will be taking place on this project site, toxic, high hazard environments are not anticipated.

12.8 Lead Abatement Plan

As lead is not expected to be a contaminant on this site, a Lead Abatement Plan will not be required. However, if lead should be encountered, a Lead Abatement Plan will be prepared in accordance with the requirements of Chapter 38 of the EOTI Corporate Health and Safety Program.

12.9 Asbestos Abatement Plan

As asbestos is not expected to be encountered on this site and therefore, an Asbestos Abatement Plan is not required.

12.10 Abrasive Blasting Plan

Abrasive blasting is not required on this project.

12.11 Confined Space Plan

Work in confined spaces is not expected to occur on this project, as the depth of excavation is not expected to exceed 48 inches. If deeper excavations are required, sides of the excavations will be sloped at a ratio of at least 2 horizontal feet for every 1 vertical foot of excavation to protect workers from cave-ins and allow easy in and out of the excavated areas. However, if confined space work becomes necessary, it will be accomplished in accordance with the EOTI Confined Space Program.

12.12 Power Tool and Equipment Hazardous Energy Control Plan

The work on this project may require the use of power tools and excavation equipment that would require a Tool and Equipment Hazardous Energy Control Plan.

By their very nature, power tools and heavy equipment have the capability of inflicting serious injury upon site personnel if they are not used and maintained properly. To control the hazards associated with power tool and equipment operation, the requirements outlined in USACE EM 385-1-1, Section 12 and the safe work practices listed below shall be observed when using power tools and equipment:

- Operation will be conducted by authorized personnel familiar with the tool or equipment, its operation, and safety precautions.
- Power tools and equipment will be inspected prior to use, and defective equipment will be removed from service until repaired or replaced.

- Power tools and equipment designed to accommodate guards will have such guards properly in place prior to use.
- Loose fitting clothing or unrestrained long hair will not be permitted around moving parts of power tools or equipment.
- Hands, feet, etc. will be kept away from all moving parts.
- Maintenance and/or adjustments to equipment will not be conducted while it is in operation; the power will be locked out according to the Lock Out/Tag Out protocol in OSHA 29 CFR 1910.147 prior to maintenance activities.
- All maintenance activities will be performed by personnel experienced and authorized to make the repairs, or it will be sent to the manufacturer for repair.
- An adequate operating area will be provided, allowing sufficient clearance and access for operation.
- Good housekeeping practices will be followed at all times.
- Safety glasses with side shields, goggles, or face shields shall be worn at all times while operating power tools and equipment or when working in the vicinity of operating power tools and equipment.

12.13 Critical Lift Procedures

EOTI will not be performing any crane operations on this project, so critical lift procedures will not be required. Should the scope of work change, EOTI will prepare critical lift procedures in accordance with the EOTI Heavy Equipment Program found in the EOTI Corporate Health and Safety Program.

12.14 Contingency Plan for Severe Weather

Rain, dust storms, electrical storms, and tornadoes in this geographic area can constitute a safety hazard to field operations at the project site. The SUXOS and UXOSO will monitor the weather closely. If the area becomes so windy, wet, muddy, or slippery that an unacceptable level of risk exists for personnel who are working in proximity to MEC items, then MEC operations will cease until the SUXOS and UXOSO determine it to be safe to continue.

No MEC operations will take place if an electrical storm is within ten miles of the site. An electrical storm monitor will be used to determine if an electrical storm is approaching. MEC operations will cease when an electrical storm is within ten miles of the site, and will not resume again until the SUXOS determines that the electrical storm is at least ten miles past the site.

12.15 Access and Haul Road Plan

There are no plans to create access and haul roads for this project, so the Access and Haul Road Plan is not required.

12.16 Demolition Plan (Engineering and Asbestos Surveys)

As work on this plan does not involve demolition of buildings containing asbestos containing material, the Demolition Plan is not required.

12.17 Emergency Rescue (Tunneling)

As work on this project does not involve tunneling operations, this Emergency Rescue plan is not required.

12.18 Underground Construction Fire Prevention and Protection Plan

As underground construction is not required on this project, the Underground Construction Fire Prevention and Protection Plan is not required.

12.19 Compressed Air Plan

As there are no plans to use compressed air on this project, a Compressed Air Plan is not required.

12.20 Formwork and Shoring Erection and Removal Plans

As this project will not involve formwork and shoring erection and removal, this plan is not required.

12.21 Jacking Plan (Lift) Slab Plans

As there will be no Lift Slab work on this project, this plan is not required.

12.22 Blasting Plan

EOTI will destroy MPPEH and potentially hazardous MEC by detonation in either consolidated shots or by Blow-In-Place (BIP) (if items are unacceptable to move). EOTI will also use explosive or mechanical means to vent MEC scrap prior to disposal. A detailed description of EOTI's Blasting plan and procedures is given in Section 3.7 of the Work Plan.

12.23 Diving Plan

Diving portions under this project are covered under a Diving Plan with accident prevention that has been submitted separately and is under a separate approval process.

12.24 Plan for Prevention of Alcohol and Drug Abuse

The use, sale, dispensing, possession, or manufacture of illegal drugs, alcohol, and narcotics on EOTI premises or work sites is prohibited. Employees will be subject to disciplinary action, up to and including termination, for bringing illegal, non-prescribed drugs and narcotics or alcoholic beverages to the workplace; being under the influence of such substances while working; using such substances while at work; or dispensing, distributing, or illegally manufacturing or selling these substances on EOTI premises and work sites.

EOTI does not regulate the conduct of employees during personal time off. However, misconduct due to the abuse of drugs, narcotics, or alcohol may bring discredit to EOTI its subcontractors and its clients. If, in the judgment of EOTI management, an employee's abuse of drugs, narcotics, or alcohol adversely affects his/her ability to perform the duties intended, that employee may be terminated for cause.

Any employee who notices another employee demonstrating unusual behavioral patterns that appear to be drug, narcotic, or alcohol related must report the observed behavior to management.

Employees may be required to submit to a test, whenever reasonable cause exists, to determine the presence of drugs, narcotics, or alcohol unless law prohibits such tests. Refusal to submit to testing constitutes grounds for termination of employment for cause. An employee judged to be under the influence of drugs, narcotics, or alcohol will be required to leave the premises. The Employee's Supervisor will arrange to have the employee escorted home.

Drug screening will occur as part of the annual physical. If the drug screen is positive for illegal drugs, the employee will not be permitted to work on the EOTI project site.

An employee who is diagnosed as an alcohol or drug abuser may be terminated or required to take a leave of absence without pay to undergo rehabilitation. The employee will not be permitted to return to work until medical certification is presented as evidence that the employee is drug-free and capable of performing his/her duties. Failure to cooperate with an agreed-upon treatment plan may result in disciplinary action, up to and including termination.

The status of an employee on drug/alcohol rehabilitation leave-of-absence will be reviewed by management on a case-by-case basis. Absences extending beyond six months will require medical recertification. Employees on leave for more than one year will be considered for termination without prejudice.

If an employee is taking prescription drugs for a medical condition while under a doctor's care, the SUXOS should be made aware of the situation. The side effects of some medications can reduce alertness and judgment, and may cause a potential safety hazard to the employee and/or others working in the vicinity, such as a heavy equipment operator becoming drowsy while operating equipment. In cases such as this, the SUXOS has the discretion to re-assign the individual to a less hazardous position on the site until the condition is cleared and medication is no longer required. If there are no other positions available on the site, which would be safe for the individual to perform, he may be placed on sick leave or leave without pay until the condition clears up and he is medically approved to resume work.

12.25 Fall Protection Plan

As work will be occurring at ground level and below, a Fall Protection Plan is not required. Excavations will be well marked with tape and/or barricades and personnel will be advised to stay away from the perimeter, as will the operators of the heavy equipment. Work will not occur during hours of darkness, when personnel might be less likely to see the excavation.

12.26 Steel Erection Plan

As no steel erection will be taking place on this project, this plan is not required.

12.27 Night Operations Lighting Plan

As there are no plans to operate during hours of darkness, there is no requirement for a Night Operations Lighting Plan.

12.28 Site Sanitation Plan

Adequate sanitation facilities will be provided at the work site to ensure proper personal hygiene. Site sanitation will be established and maintained in accordance with OSHA 29 CFR 1910.120(n).

An adequate supply of potable (drinkable) water shall be provided on site at all times, and will be supplied in accordance with the following provisions:

- Containers used for potable water shall be capable of being tightly closed, equipped with a tap and maintained in a clean and sanitary condition.
- A container used for distribution of drinking water shall be clearly labeled as to its contents and not used for any other purpose.
- Water shall not be dipped from the container and use of a common cup will not be allowed.
- Where single service cups are provided, separate sanitary containers will be provided for the storage of the unused cups and for the disposal of the used cups.

Outlets and storage containers for nonpotable water, such as water for firefighting or decontamination will be clearly labeled to indicate that the water is not suitable for drinking, washing or cooking. There will at no time be a cross connection or open potential between a system furnishing potable water and a system furnishing nonpotable water.

Permanent restroom facilities are located on the project site. If they are disabled for the season or otherwise not available, EOTI will locate chemical toilets in the support zone (SZ), as required to support field personnel. Toilets will be appropriately maintained, vented and will be capable of being locked from the inside. There will be at least one toilet for every 15 site personnel.

Hand and face washing facilities will be set up in the SZ of the work area. These will be utilized by all personnel exiting the EZ prior to eating, drinking, using tobacco or other hand to face activities. Portable eyewash will be available in site vehicles and the office trailer.

12.29 Fire Prevention Plan

Fire Protection: Portable fire extinguishers are rated and classified with NUMERAL and LETTER designations, based on fire tests conducted by the Underwriters Laboratories, Inc. (UL) or other nationally recognized testing laboratories. The numeral rating indicates the relative extinguishing effectiveness of extinguishers classified for Class A and B fires only. The Letter classified coincides with the class of fire. Extinguishers found to be effective on more than one class of fire have multiple letter classifications. Example: B:C

The rating of hand-portable fire extinguishers is based on the following:

- Class A fire extinguisher is used for ordinary combustible materials.
- Class B fire extinguisher is for flammable liquids.
- Class C fire extinguisher is for electrical fires.
- Class D fire extinguisher is for combustible metal fires.

Many fires are small at origin and may be extinguished by the use of proper hand-portable fire extinguishers. The fire department will be notified as soon as fire is discovered. This alarm should not be delayed awaiting result of application of portable fire extinguishers.

Fire extinguishers can represent an important segment of any overall fire protection program. However, their successful functioning depends upon the following conditions having been met:

- The extinguisher is properly located and in working order.
- The extinguisher is of proper type for a fire, which may occur.

- The fire is discovered while still small enough for the extinguisher to be effective.
- The fire is discovered by a person ready, willing, and able to use the extinguisher.
- Class A fires can be readily extinguished by quenching-cooling with water or a water-mixture agent. Class B fires are more effectively extinguished by an agent that blankets-smothers the fire through exclusion of oxygen surrounding the fire area. Those extinguishers containing bromochlorodifluoromethane, monobromotrifluoromethane, carbon dioxide, or dry chemical are generally best suited for extinguishing Class B fires. For Class C fires, the primary consideration in extinguishing this type of fire is the selection of nonconductive extinguishing agent to prevent dangerous electrical shock and possible death to user.
- Water or water-mixture type extinguishing agent must not be used under any circumstances on energized electrical equipment (Class C) fires. Whenever possible, electrical equipment and circuits should be de-energized before attacking a Class C fire. Due to its corrosive nature, dry chemical is not recommended for use on computerized, electronic or other equipment with extensive circuitry.

Fire Prevention: In order to prevent fire from occurring in the first place, every step will be taken to keep the site neat and clean. All equipment and materials not in use will be put away in designated locations. There will be trash cans with lids at the site, which will be emptied on a daily basis to keep trash from accumulating. All flammable liquids will be stored in approved flammable liquid cans in order to prevent spillage and ignition of the material. Bonding and grounding procedures will be in place whenever transferring flammable liquids from their designated containers and into equipment. Equipment will never be fueled in the back of a pick-up truck with a bed liner in it. Personnel handling explosive and/or flammable materials will wear cotton under and outer garments to prevent build-up and transfer of static electricity.

13.0 CONTRACTOR INFORMATION

EOTI is the prime contractor on this project. This APP has been prepared by EOTI based on EOTI procedures. In addition, subcontract site personnel will be familiar with and will comply with Project procedures and safety requirements.

14.0 HAZARD ANALYSIS

An activity hazard analysis (AHA) has been conducted and documented as outlined below for each activity warranted by the hazards associated with the activity. For this project, the following AHA have been prepared for all anticipated field operations:

- Site-Setup/Layout
- Surface Preparation/ Vegetation Removal
- Subsurface Clearance using “Mag & Dig” Methods
- Transportation of Explosives
- Disposal of MEC
- Mechanical Excavation

Should conditions, equipment, or types of operations change during the course of the project work, the Corporate Health and Safety Staff will review an updated existing AHA for continuing work, or prepare a new one for new types of operations.

Risk management is and will continue to be integrated into the planning, preparation, and execution of work at the site. Risk management is a dynamic process, and is continuously improved upon, as

personnel become more familiar with the site operations, equipment, environment, etc. Personnel are urged to continuously identify hazards and assess accident risks. Once identified, these hazards will be brought to the attention of the SUXOS/UXOSO. Control measures will be developed and coordinated. All personnel are responsible to continuously assess variable hazards and implement risk controls.

ACTIVITY HAZARD ANALYSIS		
ACTIVITY: Site Setup/ Lay-out		ANALYZED BY/DATE: D. Farmer June 2014
PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
<ul style="list-style-type: none"> • UXO personnel will accompany subcontracted survey personnel responsible for marking the work areas. • UXO personnel will lead the team into area and will clear the path of entry into the site. If MEC is encountered, path will be routed around it. • If MEC is encountered, the area will be marked and the item will be evaluated and disposed of in accordance with the work plan. • Where intrusive operations, such as driving stakes, are required UXO personnel, using geophysical equipment, will determine if there are potential MEC beneath the ground surface. • If potential MEC is located below the ground surface, the area for the intrusive operations will be moved. • Magnetometers will be used for each two feet of depth for intrusive operations to assure accuracy of readings. 	<ul style="list-style-type: none"> • MEC hazards • Experience Modification Rate (EMR) for Electric Fuzes • Uneven working surfaces – slip, trip, fall hazards. • Muscle strain carrying instruments • Heat/Cold Stress • Biological hazards - poisonous plants, bees, wasps, ticks, mosquitoes, rodents, and snakes. • Sunburn • Glare of sun 	<ul style="list-style-type: none"> • Training on MEC on site. • Controlled use of radios and cell phones. • Be observant while walking. Use sturdy, leather, work boots with ankle support and non-slip soles. • Follow appropriate lifting/ carrying procedures. (Corporate Safety and Health Plan) CSHP Chp21) • Heat stress monitoring, drinking water, work-rest schedule, and acclimatization. Proper cold weather clothing and warming areas in extreme cold. • Training in biological hazards avoidance. (CSHP Chp 21) • Long sleeved shirts, long pants, cap, and use sun screen. • Tinted glasses. • SUXOS ensures UXO personnel are qualified to perform assigned tasks, in accordance with of the Work Plan.
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ul style="list-style-type: none"> • Appropriate geophysical equipment / magnetometer. • Footwear with ankle support and non-slip soles. • Back braces (optional). • Communications to determine Wet Bulb Globe Temperature (WBGT) Index, drinking water. • Appropriate clothing and PPE (to include protective tinted eyewear, leather gloves and leg chaps). 	<p>SUXOS/UXOSO will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training.</p> <ul style="list-style-type: none"> • Equipment inspected daily prior to use. • PPE inspected daily prior to use 	<ul style="list-style-type: none"> • UXO personnel will be properly trained / qualified. • Site-specific MEC training will be presented to all site personnel. • Site specific training, slip/fall hazards. • Site-specific training/lifting techniques. • Heat Stress / Cold Stress symptoms/first aid. • Site-specific flora/fauna to include first aid. • PPE training. • Current HAZWOPER Training.

ACTIVITY HAZARD ANALYSIS		
ACTIVITY: Surface Preparation / Vegetation Removal (if required)		ANALYZED BY/DATE: D. Farmer June 2014
PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
<ul style="list-style-type: none"> • UXO personnel will visually examine the surface for MEC. • If there are areas where dense vegetation prevents a visual surface clearance, geophysical equipment (hand held magnetometers) may be used to detect surface MEC. • If vegetation is extremely dense in some areas, vegetation clearing may be required using rotary mowers, chain saws and weed whackers. • If MEC is encountered, the area will be marked and the item will be evaluated and disposed of in accordance with the work plan. • Following the surface clearance, the area will be cleared for entry. 	<ul style="list-style-type: none"> • MEC hazards • EMR for Electric Fuzes • Uneven working surfaces – slip, trip, fall hazards. • Heat Stress/Cold Stress • Biological hazards - poisonous plants, bees, wasps, ticks, mosquitoes, rodents, and snakes. • Muscle strain carrying instruments/equipment. • Lacerations and cuts from vegetation clearing equipment. • Eye/face injuries due to use of vegetation clearing equipment. • Noise • Sunburn • Glare of sun 	<ul style="list-style-type: none"> • Training on MEC and equipment on site. • Controlled use of radios and cell phones. • Be observant while walking. Use sturdy leather work boots with ankle support and non-slip soles. • Heat stress monitoring, drinking water, work-rest schedule, and acclimatization. Proper cold weather clothing and warming areas in extreme cold. • Training in biological hazards avoidance. (CSHP Chp 21) • Follow appropriate lifting/ carrying procedures. (CSHP Chp21) • PPE – leather gloves and leg chaps during vegetation clearance operations. • PPE – safety glasses and hard hat with face shield during vegetation clearance operations. • PPE – hearing protection during vegetation clearance operations • PPE – wear long sleeved shirts, long pants and a cap, use sunscreen • PPE – wear tinted glasses. • SUXOS ensures UXO personnel are qualified to perform assigned tasks, in accordance with the Work Plan.
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ul style="list-style-type: none"> • Geophysical equipment (handheld magnetometers). • Vegetation removal equipment: Rotary mowers, chain saws and weed whackers. • Footwear with ankle support and non-slip soles. • Communications to determine WBGT Index, drinking water. • Appropriate clothing / PPE (to include protective eyewear, gloves, and chaps if necessary) • Hard hat, face shield, hearing protection and leg chaps during vegetation clearance operations. • Steel toe or composite toe boots, or slip on toe guards 	<p>SUXOS/UXOSO will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training.</p> <ul style="list-style-type: none"> • Equipment inspected daily prior to use. • PPE inspected daily prior to use 	<ul style="list-style-type: none"> • UXO personnel will be properly trained / qualified. • Site-specific MEC training will be presented to all site personnel. • Site specific training, slip/fall hazards. • Heat Stress / Cold Stress symptoms/first aid. • Site-specific flora/fauna to include first aid. • Training in proper lifting techniques. • Training in use of equipment. • Noise prevention training • PPE training. • All site personnel will have current HAZWOPER training.

ACTIVITY HAZARD ANALYSIS		
ACTIVITY: Subsurface Clearance using “Mag and Dig” Methods		ANALYZED BY/DATE: D. Farmer June 2014
PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
<ul style="list-style-type: none"> • Lanes will be established throughout the footprint of each work site. • UXO personnel will walk down each lane with handheld magnetometers to identify subsurface anomalies. • If anomalies are identified that may be caused by MEC / MPPEH, it will be investigated by mechanical and / or hand digging. • If MEC is encountered, the area will be marked and the item will be evaluated and disposed of in accordance with the work plan. 	<ul style="list-style-type: none"> • MEC hazards • EMR for Electric Fuzes • Uneven working surfaces – slip, trip, fall hazards. • Heat Stress/Cold Stress • Biological hazards - poisonous plants, bees, wasps, ticks, mosquitoes, rodents, and snakes. • Muscle strain carrying instruments/equipment. • Lacerations and cuts from frag or tools. • Eye/face injuries due to use of vegetation clearing equipment. • Noise • Sunburn • Glare of sun • Heavy equipment operation (noise, crushing, etc.) 	<ul style="list-style-type: none"> • Training on MEC on site. • Controlled use of radios and cell phones. • Be observant while walking. Use sturdy leather, work boots with ankle support and non-slip soles. • Heat stress monitoring, drinking water, work-rest schedule, and acclimatization. Proper cold weather clothing and warming areas in extreme cold. • Training in biological hazards avoidance. (CSHP Chap 21) • Follow appropriate lifting/ carrying procedures. (CSHP Chap 21) • Training in heavy equipment operation and excavation procedures. • PPE – leather gloves and leg chaps during vegetation clearance operations. • PPE – safety glasses and hardhat with face shield during vegetation clearance operations. • PPE – wear long sleeved shirts, long pants and a cap, use sunscreen • Maintain minimum team separation distances and exclusion zones to protect workers and the public from unintentional detonation.
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ul style="list-style-type: none"> • Geophysical equipment (handheld magnetometers). • Excavation equipment: Shovels / backhoe/ excavator. • Footwear with ankle support and non-slip soles. • Back braces, optional. • Communications to determine WBGT Index, drinking water. • Appropriate clothing and PPE (to include protective tinted eyewear, leather gloves, and leg chaps if snakes are a problem) • Hardhat, face shield, hearing protection and leg chaps during vegetation clearance operations. 	<p>SUXOS/UXOSO will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training.</p> <ul style="list-style-type: none"> • Equipment inspected daily prior to use. • Ensure safety features such as backup warnings, seatbelts, lights, gauges, etc. are in place and functioning properly. • PPE inspected daily prior to use. 	<ul style="list-style-type: none"> • UXO personnel will be properly trained / qualified. • Site-specific MEC training will be presented to all site personnel. • Site specific training, slip/fall hazards. • Heat Stress / Cold Stress symptoms/first aid. • Site-specific flora/fauna to include first aid. • Training in proper lifting techniques. • Training in use of equipment. • Noise prevention training • PPE training. • All site personnel will have current HAZWOPER training.

ACTIVITY HAZARD ANALYSIS		
ACTIVITY: Transport of Explosives (If Required)		ANALYZED BY/DATE: D. Farmer June 2014
PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
<ul style="list-style-type: none"> • Inspect vehicles to ensure proper working condition. • Ensure vehicles are properly equipped with seat belts, placards, fire extinguishers, and equipment for securing load • Explosives will be packed so items are not touching one another. • Explosives transported on public roads will be packed and labeled in accordance with Department of Transportation rules and regulations. • Boxes are secured to prevent shifting. • Transport to designated disposal location 	<ul style="list-style-type: none"> • Explosive hazards • Vehicle accidents • Fire • Heat stress 	<ul style="list-style-type: none"> • Complete motor vehicle inspection form. • Licensed driver • Driver and all passengers will use seat belts when vehicle is in operation. • Vehicle will be placarded while traveling on public roads. • Explosives will be placed securely in back of vehicle and anchored to prevent movement. • Vehicles will not be left unattended. • Driver will observe posted speed limits. • A minimum of 2 persons in vehicle during transport.
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ul style="list-style-type: none"> • Vehicle • Safety Equipment: seat belts, first aid kit, two-way communication, emergency eyewash kit, bloodborne pathogen kit, Hazard Material spill response kit, 2 fire extinguishers • Explosive placards • Explosive storage boxes • Roadside emergency markers • Level D PPE: Cotton clothing, leather gloves, leather work boots, safety glasses • Drinking water and cups 	<p>UXOSO/QC will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training.</p> <ul style="list-style-type: none"> • Equipment inspected daily prior to use. • PPE inspected daily prior to use. • Inspect packing, labeling, and security of explosives. 	<ul style="list-style-type: none"> • UXO personnel will be properly trained / qualified. • Driver must have valid driver's license • Training in fire extinguisher usage and trained not to fight fire involving explosives. • Site-specific UXO training will be presented to all site personnel. • Heat stress training and first aid • Training in small quantity spill clean-up • All site personnel will have current HAZWOPER training.

ACTIVITY HAZARD ANALYSIS		
ACTIVITY: Disposal of MEC		ANALYZED BY/DATE: D. Farmer June 2014
PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
<ul style="list-style-type: none"> • Establish EZ based on MEC item around disposal area. • Make required notifications of demolition/venting operations. • Retrieve donor explosives. • Set up demolition charges IAW procedures • Use engineering controls, if required, to reduce the fragment travel range. • Post sentries outside Fragmentation Zone on all access roads • Ensure sentries have a full view of demolition and access areas. • Contact sentries to ensure that no pedestrian traffic is in the vicinity • Evacuate demolition crew to a safe location • Demolition occurs. • Inspect demolition site to ensure that demolition/venting has been completed properly. 	<ul style="list-style-type: none"> • MEC hazards • Slips, trips and falls • Biological hazards – plants, spiders, ticks, mosquitoes, snakes, rodents, etc. • Heat stress • EMR/static electricity hazards • Overpressure hazards due to blast. • Fragmentation hazard due to blast. • Eye hazard • Noise hazard • Cuts and abrasions hazard • Unauthorized personnel entering EZ during operations • Sunburn 	<ul style="list-style-type: none"> • Training on MEC on site. • Be observant when walking, and wear leather, work boots with ankle support and non-slip soles. • WBGT readings, drinking water, work/rest schedule. • Clothing, radios and cell phones will not be used in the area once the pit is primed or during the priming process, unless radios are at the firing point and the firing line is shunted. • Establish EZ to reduce blast and overpressure hazards. • Use PPE and distance to relieve fragmentation and overpressure hazards. • EZ sentries will be posted at access road barricades to prevent unauthorized entry. • EZ sentries will wear orange vests during operations and maintain radio communications with demolition team supervisor • Demolition crew will observe frag distance when seeking shelter from blasting. • Hearing protection. • Procedures for demolition operations in Work Plan will be followed.
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ul style="list-style-type: none"> • Donor explosive materials • Blasting circuits • PPE (Orange safety vests, cotton clothing, leather gloves, leather work boots with non-slip soles, safety glasses, hearing protection. • Radio communications 	<p>UXOSO/QC will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training.</p> <ul style="list-style-type: none"> • Equipment inspected daily prior to use. • PPE inspected daily prior to use 	<ul style="list-style-type: none"> • UXO personnel will be properly trained / qualified. • Site-specific UXO training will be presented to all site personnel. • Heat stress training. • Training in safe operating procedures, emergency procedures and PPE requirements during demolition operations. • All site personnel will have current HAZWOPER training.

ACTIVITY HAZARD ANALYSIS		
ACTIVITY: Mechanical Excavation (if required)		ANALYZED BY/DATE: D. Farmer June 2014
PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
<ul style="list-style-type: none"> Establish exclusion zone around project site footprint. Prior to intrusive operations, locate large anomalies using hand held magnetometer equipment. Investigate when within one foot of anomalies using hand-digging methods. Carefully dig around the item, so that it can be identified and examined for condition. Excavate soil in lifts of up to 1 foot and re-sweep the area for large anomalies If MEC is encountered, the area will be marked and the item will be evaluated and disposed of in accordance with the work plan. If inert Munitions Debris (MD) is encountered, it will be inspected and certified as inert and secured at a collection point 	<ul style="list-style-type: none"> MEC hazards EMR for Electric Fuzes Uneven working surfaces – slip, trip, fall hazards. Muscle strain carrying instruments Heat Stress / Cold Stress Biological hazards - poisonous plants, bees, wasps, ticks, mosquitoes, rodents, and snakes. Unauthorized personnel entering site during operations Heavy equipment operations (noise, dust, exhaust, crushing hazards). Fueling hazards Pinching/crushing hazards from moving equipment Moving equipment hazards within arc of bucket 	<ul style="list-style-type: none"> Training on MEC on site. Controlled use of radios and cell phones. Be observant while walking. Use sturdy leather work boots with ankle support and non-slip soles. Follow appropriate lifting/carrying procedures. (CSHP Chp21) Heat stress monitoring, drinking water, work-rest schedule, and acclimatization. Training in biological hazards avoidance; PPE. (CSHP Chp 21) Site control measures will be implemented and exclusion zone established. Training in heavy equipment operations and excavation procedures, PPE. Follow fueling precautions in Section 15.9. No one will be within the arc when equipment is operating.
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
<ul style="list-style-type: none"> Geophysical equipment (handheld magnetometers). Footwear with ankle support and non-slip soles. Communications to determine WBG Index, drinking water Appropriate clothing and PPE to include hard hats Hi-Visibility vests and hearing protection (around heavy equipment operations), leather gloves and leg chaps (as required), dust masks (as Required). Backhoes and/or Mini Excavators will be used for excavation 	<p>SUXOS/UXOSO will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training.</p> <ul style="list-style-type: none"> Equipment inspected daily prior to use. PPE inspected daily prior to use. 	<ul style="list-style-type: none"> UXO personnel will be properly trained / qualified. Site specific MEC training. All UXO personnel will receive refresher training in excavating of anomalies. Site specific training on slip, trip and fall hazards. Training-lifting techniques. Heat/Cold Stress symptoms. Site specific flora/fauna to include first aid. All site personnel will have current HAZWOPER training. Heavy equipment training.

SITE SAFETY AND HEALTH PLAN

The following procedures are attached and intended to address Site Specific hazards and controls for the CRP project. The Site Description and History for this site are in Section 2.0 of the APP. AHA's are located in Section 14.

15.0 GENERAL SAFETY

Due to the nature of planned site operations, the potential risk for exposure to safety hazards is high. Anticipated safety hazards, which may be encountered during site activities, and precautions to be followed are listed below and in individual Activity Hazard Analyses, above.

15.1 Slips, Trips, and Fall Hazards

The project site is located between a river and a park area. Site conditions consist of light to moderate terrain and light brush, which make for the possibility of slips, trips, and fall hazards. Site personnel shall be instructed to make themselves aware of the placement of their feet at all times to avoid site conditions that attribute to slips, trips, and falls. As there will be some shallow excavation work taking place, site personnel will be instructed to stay at least two feet away from the edge of excavations. The use of sturdy leather work boots with ankle support and non-slip soles will reduce the risk of slips, trips and falls.

15.2 Cuts/Laceration Hazards

Power tools, MD surfaces and other buried debris can be expected to have sharp and rusted surfaces. Project personnel should expect a high likelihood of cuts/lacerations if proper care is not taken. During all activities involving the handling of MEC, scrap, and site materials, personnel will wear leather work gloves to prevent injury to hands.

15.3 Pinched/Crushed Fingers and Toes

The weight of MEC scrap expected to be recovered and handled during surface sweep and MEC inspection activities is expected to pose only a light to moderate hazard to fingers and toes. The mishandling of even light materials can cause injuries to site personnel. All site personnel are required to wear leather work boots and gloves while activities are being conducted. Personnel will utilize proper lifting techniques and when appropriate, will use additional personnel or material handling equipment for heavy objects.

15.4 Hand Tool Operation

Use of improper or defective tools can contribute significantly to the occurrence of accidents on site. Therefore, the safe work practices listed below shall be observed when using hand tools:

- Hand tools will be inspected for defects prior to each use.
- Defective hand tools will be removed from service and repaired or discarded.
- Tools will be selected and used in the manner for which they were designed.
- Be sure of footing and grip before using any tool.
- Do not use tools that have split handles, mushroom heads, worn jaws, or other defects.

- Gloves will be worn whenever they increase gripping ability or if cut, laceration or puncture hazards may exist during the use of hand tools.
- Safety glasses with side shields, goggles, or a face shield will be used if tool use presents an eye/face hazard.
- Do not use makeshift tools or other improper tools.
- Use non-sparking tools where there are explosive vapors, gases, or residue.

15.5 Material Lifting

Many types of objects are handled in normal day-to-day operations. Care shall be taken in lifting and handling heavy or bulky items because they are the cause of many upper extremity and back injuries. The following fundamentals address the proper lifting of materials to avoid upper extremity and back injuries:

- The size, shape and weight of the object to be lifted must be considered. Site personnel will not lift more than 50 lbs, or any uncomfortable weight, individually. The lift will otherwise be performed mechanically or with additional personnel.
- A firm grip on the object is essential; therefore, the hands and object shall be free of oil, grease and water, which might prevent a firm grip.
- The hands and especially the fingers shall be kept away from any points that cause them to be pinched or crushed, especially when setting the object down.
- The item will be inspected for metal slivers, jagged edges, burrs, rough or slippery surfaces and pinch points, and gloves will be used, if necessary, to protect the hands.
- The feet will be placed far enough apart for good balance and stability.
- Personnel will ensure that solid footing is available prior to lifting the object.
- When lifting, get as close to the load as possible, bend the legs at the knees, making sure that the back is kept as straight as possible.
- To lift the object, the legs are straightened from their bending position.
- Never carry a load that cannot be seen over or around.
- When placing an object down, the stance and position are identical to that for lifting, with the back kept straight, the legs bent at the knees and the object lowered.
- If the item to be lifted is too large, bulky, or heavy for one person to safely lift, ask a co-worker for assistance. If a piece of material handling equipment is available that can do the job, use the equipment instead of trying to lift it yourself.
- When two or more people are required to handle an object, coordination is essential to ensure that the load is lifted uniformly and that the weight is equally divided between the individuals carrying the load. When carrying the object, each person, if possible, will face the direction in which the object is being carried.

15.6 Munitions and Explosives of Concern

MEC may be present and located during CRP site activities. UXO qualified personnel will follow the requirements of the EOTI Safety Program, EP 385-97, and the EP 385-1-95a Basic Safety Concepts and Considerations for MEC Response Action Operations, which outline the safety and health precautions to be taken if MEC are encountered and/or destroyed. All non-UXO qualified personnel will follow the safe work practices listed below:

- Non-UXO qualified personnel will receive site-specific MEC recognition training prior to participation in site activities.

- No soil penetrating activities will be allowed without the area first being cleared by UXO qualified personnel.
- Non-UXO qualified personnel will be escorted on site by UXO qualified personnel, until such time as the area is cleared.
- Once an area has been cleared and flagged, non-UXO qualified personnel may perform non-intrusive duties in the area unescorted, but shall not leave the cleared area unescorted.
- Non-UXO qualified personnel will not touch or disturb any object, which could potentially be MEC, related, and will immediately notify the nearest UXO qualified person of the presence of the object.

EOTI will establish an EZ based on the Hazardous Frag Distance of the Munition with the Greatest Fragmentation Distance (MGFD) for all CRP UXO operations other than MEC Disposal. For MEC Disposal Operations, the EZ will be based on the Maximum Frag Distance of the MGFD. If unexpected hazardous MEC is located, a review of the MGFD may result in an adjustment to the size of the EZ. EOTI will have control of the entrance to the project area until the area has been cleared. Should personnel not associated with the project operations need to enter the EZ in order to gain access to the area, all MEC operations will halt for the duration of time the person is within the EZ. Once they have departed the area, MEC operations may resume.

Hazardous MEC disposal operations will be performed by EOTI. MPPEH will be inspected and, if determined to be inert, certified as non-hazardous, and will be collected in a secured location until the conclusion of the project work. After the project work has been completed, the non-hazardous scrap will be transferred to metal recycling facility.

15.7 Chemical Hazards

The only anticipated chemical hazards expected during CRP site activities are those fuels and oils brought on-site, for equipment maintenance. All site personnel will follow the procedures and precautions outlined in appropriate SDS. The SDS binder will be kept in the site office and will be available to all employees on request. CWM procedures are outlined in Section 2.1 of this appendix, but are not anticipated as necessary during this site operation.

15.8 Physical Hazards

For the planned site activities to be conducted, the potential for exposure to physical hazards is high. The physical hazards that may be encountered during site operations and precautions to be taken are listed below.

15.9 Flammable/Explosive Hazards from Fueling Equipment and Site Vehicles

The chance of fire and/or explosion during vehicle and equipment refueling and maintenance is high when improper procedures are used. All site vehicles will be equipped with a portable fire extinguisher readily available to fight a fire. Equipment will never be refueled on the back of a pick-up truck with a bed liner. Cellular phones will not be used around Flammable Liquids. Grounding and bonding procedures will be used during all fueling operations.

15.10 Noise Hazards

Protection against the effects of noise exposure shall be provided when the sound pressure levels exceed those shown below when measured on the A-scale of a standard sound level meter at slow response.

When employees are subjected to sound exceeding those listed in the following table, feasible administrative or engineering controls shall be utilized. If such controls fail to reduce sound levels to within these levels, personal protective equipment shall be provided and used to reduce sound levels within the levels of the table. If the variations in noise level involve maximal intervals of 1 second or less, it is to be considered continuous.

PERMISSIBLE NOISE EXPOSURES (1)	
Duration per Day, (Hours)	Sound level dBA (Slow Response)
8.00	90
6.00	92
4.00	95
3.00	97
2.00	100
1.50	102
1.00	105
0.50	110
0.25	115

Footnote (1). When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions: $C1./T1. + C2./T2. + \dots + C(n)/T(n)$ exceeds unity, then, the mixed exposure should be considered to exceed the limit value. C(n) indicates the total time of exposure at a specified noise level, and T(n) indicates the total time of exposure permitted at that level. Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.

EOTI will make hearing protectors available to all employees exposed to an 8-hour time-weighted average of 85 decibels or greater at no cost to the employees. Hearing protectors will be replaced as necessary. Hearing protection will be required for all personnel working in and around any operations likely to produce high noise levels, such as during the use of chain saws and weed whackers during thinning and pruning operations and when working in the vicinity of heavy equipment.

15.11 Cold and Heat Stress

Due to the duration, location and the time of year of this project, there is a moderate probability of encountering extreme heat. Precautions for prevention of cold stress are also provided for the possibility of unseasonable cold temperatures. For unseasonable cool temperatures, workers will dress in warm layered clothing to protect against low temperatures. Fluids will be available on site and workers will be encouraged to drink frequently. If required for cold temperatures, workers will be given opportunities to warm up in heated facilities base on the ACGIH recommended Work-Warming Regimen.

Heat Stress

Heat stress is one of the most common (and potentially serious) illnesses that affect hazardous waste site workers. When site personnel are engaged in operations involving hot environments and/or the use of semi- or impermeable clothing, a number of physiological responses can occur which may seriously affect the health and safety of the workers. These affects can be eliminated or controlled through the use of a comprehensive heat stress prevention and monitoring program.

Level D PPE is being used at this site, so the heat stress program will be implemented if the ambient temperature exceeds 75°F according to the ACGIH Heat Stress Recommendations for unacclimatized workers.

Heat Stress Monitoring: Heat stress monitoring will be conducted using WBGT readings, in order to assure adequate work/rest cycles are implemented at the site if ambient dry-bulb temperatures exceed 75°F. Pulse monitoring may also be used in addition to the WBGT readings, particularly during acclimatization, to assure workers are adapting to the conditions safely. Monitoring will be performed by the UXOSO and results will be documented. Heat stress monitoring will be used to determine work-rest cycles to be implemented on site as referenced by the ACGIH TLV guidelines for Heat Stress.

Causes of Heat Stress

The most common cause of heat stress during site activities is the affect that PPE has on the body's natural cooling mechanism. Impermeable or semi-impermeable PPE interferes with the evaporation of perspiration and causes the body to retain metabolic and environmentally induced heat. Individuals will vary in their susceptibility and degree of response to the stress induced by increased body heat. Heat stress can result in health effects ranging from transient heat fatigue to serious illness or death. Heat stress is caused by a number of interacting factors including environmental condition, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of the most common (and potentially serious) illnesses at hazardous waste sites, regular monitoring and other preventive precautions are vital.

Factors, which may predispose a worker to heat stress, include:

- Lack of physical fitness.
- Lack of acclimatization to hot environments.
- Degree of hydration.
- Level of obesity.
- Current health status (i.e., having an infection, chronic disease, diarrhea, etc.).
- Alcohol or drug use.
- The worker's age and sex.
- Sunburn.

Prior to initiating site activities each day, and periodically throughout the day, the UXOSO will inspect the site personnel for evidence of the previously mentioned factors to determine those personnel who are at increased risk for heat stress related disorders. Evidence of extreme dehydration, illness or drug or alcohol use may require the SUXOS/UXOSO to restrict the worker's activities until such time as the worker is fit for duty. Personnel identified as being at high risk for heat stress, who are allowed to participate in site operations, will be monitored frequently by the UXOSO throughout the day.

Heat Stress Disorders

This Section outlines the major heat related illnesses that may result from exposure to high heat environments and/or the use of semi- or impermeable clothing. For the purpose of this Program, reference to "liquids" will indicate the use of water or an electrolyte replacement solution, and not tea or coffee (unless it is decaffeinated) or carbonated soft drinks.

Heat Rash

Heat rash is caused by continuous exposure to heat and humid air and is aggravated by wet chafing clothes. This condition can decrease a worker's ability to tolerate hot environments.

Symptoms: Mild red rash, especially in areas of the body, which sweat heavily.

Treatment: Decrease the amount of time in protective gear and provide powder such as cornstarch or baby powder to help absorb moisture and decrease chafing. Maintain good personal hygiene standards and change into dry clothes if needed.

Heat Cramps

Heat cramps are caused by a profuse rate of perspiration that is not balanced by adequate fluid and electrolyte intake. The occurrence of heat related cramps are often an indication that excessive water and electrolyte loss has occurred, which can further develop into heat exhaustion or heat stroke.

Symptoms: Acute, painful spasms of voluntary muscles such as the back, abdomen and extremities.

Treatment: Remove victim to a cool area and loosen restrictive clothing. Stretch and massage affected muscles to increase blood flow to the area. Have patient drink one to two cups of liquids immediately and every twenty minutes thereafter. Consult with physician if condition does not improve. If available, an electrolyte replacement solution should be taken along with liquids. For maximum benefit this should be taken in at least a 2:1 ratio with at least two glasses of water to one glass of electrolyte replacement liquid.

Heat Exhaustion

Heat exhaustion is a state of very definite weakness or exhaustion caused by increased stress on various organs to meet increased demands to cool the body due to excessive loss of fluids from the body. This condition leads to inadequate blood supply and cardiac insufficiency. Heat exhaustion is less dangerous than heat stroke, but nonetheless must be treated. If allowed to go untreated heat exhaustion can quickly develop into heat stroke.

Symptoms: Symptoms of heat exhaustion include pale or flushed, clammy, moist skin, profuse perspiration, and extreme weakness. The body's temperature is basically normal or slightly elevated, the pulse is weak and rapid, and breathing is shallow. The individual may have a headache, be dizzy or nauseated.

Treatment: Remove the individual to a cool, air-conditioned place, loosen clothing, elevate feet and allow individual to rest. Consult a physician, especially in severe cases. Have the patient drink one to two cups of liquids immediately, and every twenty minutes thereafter. Total liquid consumption should be about one to two gallons per day. If the signs and symptoms of heat exhaustion do not subside, or become more severe, immediate medical attention will be required.

Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of the heat regulating mechanisms of the body. The failure of the individual's temperature control system causes the perspiration system to stop working correctly. When this occurs the body core temperature rises very rapidly to a point (105+°F) where brain damage and death will result if the person is not cooled quickly.

Symptoms: The victim's skin is hot, and may or may not be red and dry, (due to the fact that the individual may still be wet from having sweat while wearing protective clothing earlier), nausea, dizziness, confusion, extremely high body temperatures, rapid respiratory and pulse rate, delirium, convulsions, unconsciousness or coma.

Treatment: Cool the victim immediately. If the body temperature is not brought down quickly, permanent brain damage or death may result. The victim should be moved to a shady area; lie down and keep the head elevated. Gradually cool the victim by either sponging or immersing the victim in cool water to reduce the core temperature to a safe level (<102°F). If they are conscious, give the victim cool liquids to drink. Observe the victim and obtain immediate medical help. Do not give the victim caffeinated or alcoholic beverages. Heat stroke is considered a medical emergency. Medical emergency assistance must be summoned.

Heat Stress Preventive Measures

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat exhaustion, that person may become predisposed to additional heat injuries. In order to avoid heat related illnesses proper preventive measures will be implemented whenever environmental conditions dictate the need. These preventive measures represent the minimal steps to be taken and will include the following procedures:

- SUXOS/UXOSO will examine each site worker prior to start of daily operations to determine the individuals susceptible to heat induced stress. Workers exhibiting factors ,which make them susceptible to heat stress will be closely monitored by the UXOSO.
- Site workers will be trained to recognize and treat heat-related illnesses. This training will include the signs, symptoms and treatment of heat stress disorders as outlined in this program.
- In order to maintain workers' body fluids at normal levels, workers will be encouraged to drink, as a minimum, approximately sixteen ounces of liquids prior to start of work in the morning, after lunch and prior to leaving the site at the conclusion of the day's activities.
- Disposable four (4) to twelve (12) ounce cups and liquids will be provided on site.
- Acceptable liquids will include water and an electrolyte replacement solution, with the recommended intake being two cups of water to each cup of electrolyte replacement solution.
- Liquids containing caffeine are to be avoided.

When ambient conditions and site workload requirements dictate, as determined by the SUXOS, workers will be required to drink a minimum of sixteen (16) to thirty-two (32) ounces of liquids during each rest cycle. The normal thirst mechanism is not sensitive enough to ensure that enough water will be taken to replace lost sweat. When heavy sweating occurs, workers should be encouraged to drink even though they may not be thirsty. The following strategies may useful in encouraging fluid intake:

- Maintain water temperature at 50°F to 60°F (10°C to 15.6°C).
- Provide small disposable cups that hold about 4 ounces (0.1 liter).
- Have workers drink 16 ounces (0.5 liters) of fluids (preferably water or dilute drinks) before beginning work.
- Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight.

Monitoring of ambient or physiological heat stress indices will be conducted to allow prevention and/or early detection of heat induced stress. Monitoring will be conducted in accordance with applicable paragraphs of this Program. Site workers will be given time to acclimatize to site work conditions, temperature, and workload. Acclimatization usually takes about a week of continued work in hot

environments, and allows the worker's body to become adjusted to this level and type of work. This process involves a gradual increase in the workload over the required period, the length of which depends upon the nature of the work performed, the ambient temperatures and the individual's susceptibility to heat stress. Work schedules will be adjusted as follows:

- Modify work/rest schedules according to monitoring requirements.
- Mandate work slowdowns as needed.
- Rotate personnel: alternate job functions to minimize overstress or overexertion at one task.
- Add additional personnel to work teams.
- Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.

Supplemental Preventive Measures

Workers will be encouraged to achieve and maintain an optimum level of physical fitness. Increased physical fitness will allow workers to better tolerate and respond to hot environments and heavy workloads. In comparison to an unfit person, a fit person will have less physiological strain, a lower heart rate and body temperature, and a more efficient sweating mechanism.

Administrative Controls and Work Practices

Training is the key to good work practices. Unless all employees understand the reasons for new or changing old work practices, the chances of such a program succeeding are greatly reduced. The following will be discussed during the site-specific training and repeatedly as determined by the SUXOS/UXOSO:

- Knowledge of the hazards of heat stress;
- Recognition of predisposing factors, danger signs, and symptoms;
- Awareness of first-aid procedures for, and the potential health effects of, heat stroke;
- Employee responsibilities in avoiding heat stress;
- Dangers of using drugs, including therapeutic ones, and alcohol in hot work environments;
- Use of protective clothing and equipment;
- Purpose and coverage of environmental and medical surveillance programs and the advantages of worker participation in such programs; and
- Dietary effects on heat stress.

Because the incidence of heat stress depends on a variety of factors all workers, even those not wearing protective equipment, should be monitored. Initially, the frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work (see Table 15.1). The length of the work cycle will be governed by the frequency of the required physiological monitoring.

For workers wearing permeable clothing (e.g., standard cotton or synthetic work clothes), recommendations for monitoring requirements and suggested work/rest schedules in the current ACGIH TLVs for Heat Stress shall be followed. If the actual clothing worn differs from the ACGIH standard ensemble in insulation value and/or wind and vapor permeability, change the monitoring requirements and work/rest schedules accordingly.

The goal of all heat stress monitoring is to ensure that the worker's body temperature does not exceed 100.4°F. The physiological monitoring methods listed below are to be implemented based upon the

severity of the heat and workload. As a minimum the UXOSO will perform WBGT monitoring. He may also choose to monitor the worker's heart rate as an indication of potential heat stress. The frequency of physiological monitoring will be determined using the information presented in Table 15.1.

Heart Rate Monitoring

The worker's baseline heart rate should be recorded prior to initiation of site activities by measuring the radial pulse rate for thirty seconds. After each work cycle the heart rate should be measured by taking the pulse rate (PR) for 30 seconds as early as possible into the resting period. Taking the radial (wrist) pulse rate is the preferred method however the carotid (neck) pulse rate may be taken if a worker has difficulty finding the radial pulse. The PR at the beginning of the rest period should not exceed one hundred and ten (110) beats per minute (bpm). If the PR is higher than 110 bpm, the next work period should be shortened by thirty-three percent, while the length of the rest period stays the same. If the PR exceeds 110 bpm at the beginning of the next rest period, the work cycle should be further shortened by thirty-three percent. This procedure will be continued until the worker's PR at the beginning of the rest cycle is maintained below 110 bpm.

Wet Bulb, Dry Globe Temperature (WBGT) Monitoring

For CRP site conditions where personnel are working in Level D PPE, and the ambient temperature is greater than 75°F, the UXOSO will conduct WBGT monitoring to assist in controlling the potential for site workers experiencing heat related adverse health affects. The SUXOS will use WBGT monitor readings obtained from the monitoring equipment, and after estimating the workload, use the values expressed in Table 15.2, to determine the work/rest schedule to be implemented. The values outlined in this table are designed such that nearly all acclimatized, fully clothed workers with adequate salt and water intake will be able to function without the body temperature exceeding 100.4°F.

Acclimatization is the adaptive process that results in a decrease of the physiological response produced by the application of a constant environmental stress. On initial exposure to a hot environment, there is an impaired ability to work and evidence of physiological strain. If the exposure is repeated on several successive days, there is a gradual return of the ability to work and a decrease in physiological strain. Within 4 to 7 days following initiation of the acclimatization process, a dramatic improvement in the ability to perform work is noticed, subjective discomfort practically disappears, body temperature and heart rate are lower, there is a more stable blood pressure, and the sweat is more profuse and dilute.

Alcohol should not be consumed in a hot environment because the loss of body fluids increases the risk of heat stress.

Heat Stress Documentation

Should it be required due to site conditions, the UXOSO will be responsible for recording all heat stress related information. This will include training sessions and monitoring data. Training sessions will be documented using the Documentation of Training Form. Pulse rate monitoring data will be recorded on the Heat Stress Monitoring Log, with the WBGT being recorded in the Site Safety Log and/or Site Monitoring Log.

Table 15.1
SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING
FOR FIT AND ACCLIMATIZED WORKERS^a

ADJUSTED TEMPERATURE ^b	NORMAL WORK ENSEMBLE ^c	IMPERMEABLE ENSEMBLE
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-28.1°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
75°-77.5°F (22.5°-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

^a For work levels of 250 kilocalories/hour.

^b Calculate the adjusted air temperature (at adj) by using this equation: $at\ adj\ ^\circ F = ta\ ^\circ F + (13 \times \% \text{ sunshine})$. Measure air temperature (at) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)

^c A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

Table 15.2
SCREENING CRITERIA WBGT HEAT EXPOSURE THRESHOLD LIMIT VALUES

Work - Rest Regimen	WORK LOAD		
	Light*	Moderate	Heavy
Continuous work	(29.5)	(27.5)	(26.0)
75% Work - 25% Rest, each hour	(30.5)	(28.5)	(27.5)
50% Work - 50% Rest, each hour	(31.5)	(29.5)	(28.5)
25% Work - 75% Rest, each hour	(32.5)	(31.0)	(30.0)

Consult the ACGIH TLV booklet for definitions of Light, Moderate and Heavy workloads. Values are given in (⁰C) WBGT, and are intended for workers wearing single layer summer type clothing. Use of semi or totally impermeable clothing requires monitoring IAW the EOTI Heat Stress Prevention Program. As workload increases, the heat stress impact on a non-acclimated worker is exacerbated. For non-acclimatized workers performing a moderate level of work, the permissible heat exposure TLV should be reduced by approximately 2.5⁰C.

15.12 Ionizing Radiation Hazards

Ionizing radiation is not expected to be an issue on this project site.

15.13 Biological Hazards

Biological hazards, which are usually found on site, include insects, such as ticks, spiders, poisonous snakes and hazardous plants. Employee awareness and the safe work practices outlined in the following paragraphs should reduce the risk associated with these hazards.

15.14 Hazardous Plants

During the conduct of CRP site activities the number and variety of plants that may be encountered is large and extensive. However, the plants presenting the greatest degree of risk to site personnel (i.e. potential for contact vs. affect produced) are those, which produce skin reactions and skin and tissue injury.

15.15 Plants Causing Skin and Tissue Injury

Contact with splinters, thorns and sharp leaf edges is of special concern to site personnel, as is the contact with the pointed surfaces found on branches, limbs and small trunks. This concern stems from the fact that punctures, cuts and even minor scrapes caused by accidental contact may result in non-infectious skin lesions, and the introduction of fungi or bacteria through the skin or eye. Personnel receiving any of the injuries listed above, even minor scrapes will report immediately to the UXOSO for initial and continued observation and care of the injury.

15.16 Plants Causing Skin Reactions

The poisonous plants of greatest concern are poison ivy, poison sumac and poison oak. Both poison ivy and poison oak thrive in all types of light and usually grow in the form of a trailing vine; however, it can also grow as a bush and can attain heights of 10 feet or more. Poison ivy has shiny pointed leaves that grow in clusters of three. Poison oak can have shiny or dull, pointed leaves that grow in clusters of three. Poison oak leaves are more rounded rather than jagged and the underside of poison oak leaves are covered with hair. Poison sumac has smooth leaves, grows only in wetlands and has 7-9 leaves per stem.



The skin reaction associated with contacting these plants is caused by the body's allergic reaction to toxins contained in oils produced by the plant. Becoming contaminated with the oils does not require contact with just the leaves. Contamination can be achieved through contact with other parts of the plant such as the branches, stems or berries, or contact with contaminated items such as tools and clothing. The allergic reaction associated with exposure to these plants will generally cause the following signs and symptoms:

- Blistering at the site of contact, usually occurring within 12 to 48 hours after contact.
- Reddening, swelling, itching and burning at the site of contact.
- Pain, if the reaction is severe.
- Conjunctivitis, asthma, and other allergic reactions if the person is extremely sensitive to the poisonous plant toxin.



If the rash is scratched, secondary infections can occur. The rash usually disappears in 1 to 2 weeks in cases of mild exposure and up to 3 weeks when exposure is severe. Preventive measures, which can prove effective for most site personnel, are:

- Avoid contact with any poisonous plants on site, and keep a steady watch to identify report and mark poisonous plants found on site.
- Wash hands, face or other exposed areas at the beginning of each break period and at the end of each workday.
- Avoid contact with, and wash on a daily basis, contaminated tools, equipment and clothing.
- Barrier creams, detoxification/wash solutions and orally administered desensitization may prove effective and should be tried to find the best preventive solution.
- Keeping the skin covered as much as possible (i.e., long pants and long sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure.
- If burning of these plants occurs, make sure personnel are located upwind of the smoke, as inhalation of the smoke or contact with airborne particles from these plants can still cause a reaction to occur.

15.17 Snakes

When site activities are conducted in warm weather on sites that are located in wooded, grassy or rocky environments, the potential for contact with venomous snakes becomes a very real danger. There are 38 snake species in South Carolina, only six of which are venomous. These are Copperhead, Coral Snake, Cottonmouth, Pigmy Rattlesnake, Eastern Diamondback Rattlesnake and Timber Rattlesnake.

Normally, if a person is approaching a snake, the noise created by the person is usually sufficient to frighten the snake off. However, during the warm months, extreme caution must be exercised when conducting site operations around areas where snakes might be found (i.e. rocks, bushes, logs, or in holes, crevices, and abandoned pipes). If venomous snakes are identified on the CRP site, EOTI will issue protective clothing, such as snake leggings, to site personnel. The rules to follow if a snake bites someone are:

- DO NOT cut “Xs” over the bite area, as this will intensify the effect of the venom.
- DO NOT apply suction to the wound since this has a minimal effective in removing venom.
- DO NOT apply a tourniquet since this will concentrate the venom and increase the amount of tissue damage in the immediate area.
- If possible, try to get a good look at the snake so it can be identified for proper selection of anti-venom.
- DO NOT allow the victim to run for help since running increases the heart rate and will increase the spread of the venom throughout the body.
- Keep the victim calm and immobile.
- Have the victim hold the affected extremity lower than the heart while waiting for medical assistance. Do not delay evacuation.
- Transport the victim to medical attention immediately.

15.18 Tick Bites

The Centers for Disease Control (CDC) has noted the increase of Lyme Disease and Rocky Mountain Spotted Fever (RMSF) which are caused by bites from infected ticks in and near wooded areas, tall grass, and brush. Ticks are small, ranging from the size of a comma up to about one quarter inch. They are sometimes difficult to see. The tick season extends from spring through summer. When embedded in the skin, they may look like a freckle.

Lyme disease has occurred in 43 states, with the heaviest concentrations in the Northeast, the upper Midwest, and along the northern California coast. It is caused by deer ticks and the lone star ticks which have become infected with spirochetes. Female deer ticks are about one quarter inch in size, and are black and brick red in color. Male deer ticks are smaller, and completely black. Lone star ticks are larger and chestnut brown in color.

Rocky Mountain Spotted Fever has occurred in 36 states, with the heaviest concentrations in Oklahoma, North Carolina, South Carolina, Texas, and Virginia. It is caused by Rocky Mountain wood ticks, and dog ticks which have become infected with rickettsia. Both are black in color.

Symptoms: The first symptoms of either disease are flu like chills, fever, headache, dizziness, fatigue, stiff neck, and bone pain. If immediately treated by a physician, most individuals recover fully in a short period of time. If not treated, more serious symptoms can occur.



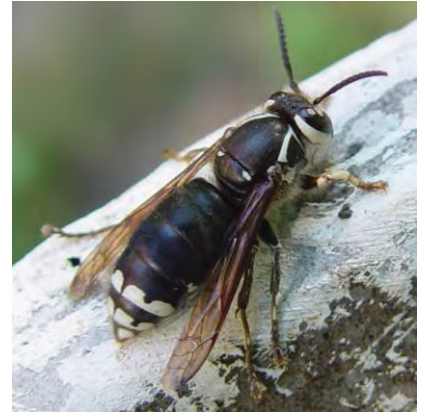
If you believe a tick has bitten you, or if any of the signs and symptoms noted above appear contact the UXOSO, who will authorize you to visit a physician for an examination and possible treatment.

Protective Measures: Standard field gear (work boots, socks and light-colored coveralls) provides good protection against tick bites, particularly if the joints are taped. Light-colored coveralls allow easier identification of ticks on clothing. However, even when wearing field gear, the following precautions shall be taken when working in areas that might be infested with ticks:

- When in the field, check yourself often for ticks, particularly on your lower legs and areas covered with hair.
- Spray outer clothing, particularly your pant legs and socks, BUT NOT YOUR SKIN, with an insect repellent that contains permethrin or permethrin. Apply deet (vapor-active repellent) to any exposed skin surface (except eyes and lips), and apply permethrin repellent spray to field clothing. Allow the permethrin to dry before using treated clothing. The repellent system, deet and permethrin, offer maximum protection.
- When walking in wooded areas, wear a hat, and avoid contact with bushes, tall grass, or brush as much as possible.
- If you find a tick, remove it by pulling on it gently with tweezers.
- If the tick resists, cover the tick with salad oil for about 15 minutes to asphyxiate it, then remove it with tweezers.
- DO NOT use matches, a lit cigarette, nail polish or any other type of chemical to “coax” the tick out.
- Be sure to remove all parts of the tick’s body, and disinfect the area with alcohol or a similar antiseptic after removal.
- For several days to several weeks after removal of the tick, look for the signs of the onset of Lyme disease, such as a rash that looks like a bulls-eye or an expanding red circle surrounding a light area, frequently seen with a small welt in the center.
- Also look for the signs of the onset of RMSF, such as an inflammation which is visible in the form of a rash comprising many red spots under the skin, which appears 3 to 10 days after the tick bite.

15.20 Bees, Hornets and Wasps

Contact with stinging insects like bees, hornets and wasps may result in site personnel experiencing adverse health affects that range from being mildly uncomfortable to being life threatening. Therefore, stinging insects present a serious hazard to site personnel, and extreme caution must be exercised whenever site and weather conditions increase the risk of encountering stinging insects. Some of the factors related to stinging insects that increase the degree of risk associated with accidental contact are as follows:



- The nests for these insects are frequently found in remote wooded or grassy areas.
- The nests can be situated in trees, rocks, and bushes or in the ground, and are usually difficult to see.
- Accidental contact with these insects is highly probable, especially during warm weather conditions when the insects are most active.
- If a site worker accidentally disturbs a nest, the worker may be inflicted with multiple stings, causing extreme pain and swelling, which can leave the worker incapacitated and in need of medical attention.
- Some people are hypersensitive to the toxins injected by a sting, and when stung, experience a violent and immediate allergic reaction resulting in a life-threatening condition known as anaphylactic shock.
- Anaphylactic shock manifests itself very rapidly and is characterized by extreme swelling of the body, eyes, face, mouth and respiratory passages.
- The hypersensitivity needed to cause anaphylactic shock, can in some people, accumulate over time and exposure, therefore even if someone has been stung previously, and not experienced an allergic reaction, there is no guarantee that they will not have an allergic reaction if they are stung again.

With these things in mind, and with the high probability of contact with stinging insects, all site personnel will comply with the following safe work practices:

- If a worker knows that he is hypersensitive to bee, wasp or hornet stings, he must inform the UXOSO of this condition prior to participation in site activities.
- All site personnel will be watchful for the presence of stinging insects and their nests, and will advise the UXOSO if a stinging insect nest is located or suspected in the area.
- Any nests located on site will be flagged off and site personnel will be notified of its presence.
- If stung, site personnel will immediately report to the UXOSO to obtain first aid treatment and to allow the UXOSO to observe them for signs of allergic reaction. If a breathing emergency (anaphylactic shock) occurs as a result of the sting, immediately call 911.
- Site personnel with a known hypersensitivity to stinging insects will keep required emergency medication on or near their person at all times, and will let the SUXOS, UXOSO and co-workers know where it is kept.



15.21 Spiders

A large variety of spiders may be encountered during CRP site activities.

While most spider bites merely cause localized pain, swelling, reddening and in some cases, tissue damage, there are a few spiders that, due to the severity of the physiological affects caused by their venom, are dangerous. These species include the black widow and the brown or violin spiders.

The black widow is a coal-black bulbous spider about ¾-inch in length, with a bright red hourglass on the underside of the abdomen. The black widow is usually found in dark moist locations, especially under rocks, rotting logs and may even be found in outdoor toilets where they inhabit the underside of the seat. Victims of a black widow bite may exhibit the following signs or symptoms:

- Sensation of pinprick or minor burning at the time of the bite.
- Appearance of small punctures (but sometimes none are visible).
- After 15 to 60 minutes, intense pain is felt at the site of the bite which spreads quickly, and is followed by profuse sweating, rigid abdominal muscles, muscle spasms, breathing difficulty, slurred speech, poor coordination, dilated pupils and generalized swelling of face and extremities.

The brown recluse or violin spider is brownish to tan in color, rather flat, about 5/8-inch long with a dark brown “violin” shape on the top. Of the brown spider, there are three varieties found in the United States, which present a problem to site personnel. These are the brown recluse, the desert violin and the Arizona violin. These spiders may be found in a variety of locations including trees, rocks or in dark locations. Victims of a brown or violin spider bite may exhibit the following signs or symptoms:



- Blistering at the site of the bite, followed by a local burning at the site 30 to 60 minutes after the bite.
- Formation of a large, red, swollen, postulating lesion with a bull’s-eye appearance.
- Systemic affects may include a generalized rash, joint pain, chills, fever, nausea and vomiting.
- Pain may become severe after 8 hours, with the onset of tissue necrosis.

There is no effective first aid treatment for either of these bites. Except for very young, very old or weak victims, these spider bites are not considered to be life threatening; however, medical treatment must be sought to reduce the extent of damage caused by the injected toxins.

Scorpions are stinging arachnids found over much of the United States. All known scorpion species possess venom and use it primarily to kill or paralyze their prey so that it can be eaten; in general, it is fast-acting, allowing for effective prey capture. It is also used as a defense against predators. The venom is a mixture of compounds (neurotoxins, enzyme inhibitors, etc.) each not only causing a different effect, but possibly also targeting a specific animal. Each compound is made and stored in a pair of glandular sacs, and is released in a quantity regulated by the scorpion itself. Of the 1000+ known species of scorpion, only 25 have venom that is dangerous to humans.

The SUXOS/UXOSO will brief site personnel as to the identification and avoidance of the spiders and scorpions. As with stinging insects, site personnel shall report to the SUXOS/UXOSO if they locate either of these spiders or scorpions on site or notice any type of bite or sting while involved in site activities.

15.22 Hantavirus Pulmonary Syndrome

Basic Transmission Cycle – some rodents are infected with a type of Hantavirus that causes Hantavirus Pulmonary Syndrome (HPS). In the United States, deer mice (plus cotton rats and rice rats in the southeastern states and the white-footed mouse in the Northeast) are the rodents carrying hantaviruses that cause hantavirus pulmonary syndrome. Common house mice do not carry Hantavirus.

These rodents shed the virus in their urine, droppings and saliva. The virus is mainly transmitted to people when they breathe in air contaminated with the virus. This happens when fresh rodent urine, droppings or nesting materials are stirred up. When tiny droplets containing the virus get into the air, this process is known as aerosolization.

There are several other ways rodents may spread Hantavirus to people:

- If a rodent with the virus bites them, the virus may be spread this way – but this is very rare.
- Researchers believe that you may be able to get the virus if you touched something that had been contaminated with rodent urine, droppings, or saliva, and then touched your nose or mouth.
- Researchers also suspect that if virus-infected rodent urine, droppings or saliva contaminates food that you eat, you could also become sick.

Symptoms of HPS: Early symptoms include fatigue, fever, and muscle aches, especially the large muscle groups – thighs, hips, back, sometimes shoulders. These symptoms are universal. There may also be headaches, dizziness, chills and/or abdominal problems, such as nausea, vomiting, diarrhea and abdominal pain. About half of all HPS patients experience these symptoms.

How long could it be between the time you get the virus, and the time you start showing these symptoms? Because there have been so few cases of HPS, it is not quite clear what this “incubation time” is. However, it appears right now that it may be between one to five weeks after you are exposed to potentially infected rodents and the rodent’s droppings before you will show any symptoms.

Late symptoms – 4-10 days later – symptoms include coughing and shortness of breath, with the sensation of, as one survivor put it, a “tight band around my chest and a pillow over my face” as lungs fill with fluid.

MINIMIZE RISK - do not disturb rodents, burrows, or dens.

Preventive Measures: If there are signs of a rodent nest or rodent droppings, make it known to the SUXOS/UXOSO. To clean and disinfect the area, spray a disinfectant on the area and leave a waiting time of 20 minutes. Then clean it up using rubber or plastic gloves, coveralls, rubber boots or disposable shoe covers, protective goggles, and a half-face mask air-purifying respirator with a high-efficiency particulate air (HEPA) filter. Bag the cleaning materials and dispose of it. Then, re-clean the area with disinfectant.

15.23 Mosquitoes

Mosquitoes are responsible for transmitting diseases such as malaria and West Nile Virus through bites to the skin. While malaria is much more contagious, it is not normally found in North America. West Nile virus is commonly found in Africa, West Asia and the Middle East. In recent



years, West Nile virus has been increasingly found in the continental United States. It is believed to have first appeared in the United States in 1999. It is most common in late summer or early fall, which is the active season for mosquitoes, but in warmer southern climates where the temperatures are milder, West Nile virus can be transmitted year round.

Transmission Cycle: Mosquitoes become infected with the virus when they feed on infected birds, which may circulate the virus in their blood for a few days. Infected mosquitoes can then transmit the virus to humans and animals while biting to take blood. The virus is located in the mosquito's salivary glands, and may be injected into the animal or human, where it can multiply, possibly causing illness. Even in areas where the virus is circulating, few mosquitoes are infected with the West Nile virus. Even if the mosquito is infected, less than 1% of people who get bitten and become infected will get seriously ill. The majority of cases of West Nile virus have been identified in birds, it has also been found in horses, cats, bats, chipmunks, skunks, squirrels, and domestic rabbits. It was recently found in a horse in New Mexico. Once West Nile virus has been contracted, the survivor of this illness is believed to carry a lifelong immunity to it. At this time there is no vaccine against West Nile virus.

Symptoms: West Nile virus is encephalitis, which causes an inflammation of the brain. Following transmission by an infected mosquito, West Nile virus multiplies in the person's blood system and crosses the blood-brain barrier to reach the brain. The virus interferes with normal central nervous system functioning and causes inflammation of the brain tissue. Fatality rates range from 3%-15% of persons who develop severe illness, and rates are highest among persons over 50 years of age and those with weakened immune systems. This disease is not transmitted from person-to-person, so touching or working in the vicinity of someone with the disease will not increase the risk.

The incubation period for West Nile virus is normally 3-15 days. Most infections are mild, and symptoms include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, rarely, death.

If symptoms develop, seek medical attention immediately.

Preventive Measures: Prevention and control of West Nile virus is most effectively accomplished through vector management programs. Be alert for dead animals on the site, particularly birds. If a dead bird or other animal is found on site, bare-handed contact should be avoided. Using gloves or double plastic bags, wrap animal and call the Health Department. If the Health Department wants to test the bird, they will come and pick it up. If they are not testing the bird, it should remain wrapped in the plastic and disposed of in accordance with established procedures.

Other ways of reducing risk of becoming infected with West Nile Virus include:

- Implement mosquito control measures on the site.
- Make sure that there are no open containers of standing water on the site in which mosquitoes can breed.
- Wear long sleeved shirts and long pants while outdoors.
- Stay indoors at dawn, dusk, and in the early evening when mosquitoes are most active.
- Spray clothing with repellants containing permethrin or DEET.
- Apply insect repellant sparingly to exposed skin. An effective repellant will contain 35% DEET. Higher concentrations of DEET provide no additional protection. Always read the manufacturer's directions on the repellant prior to applying it to the skin.

- Vitamin B and “ultrasonic” devices are NOT considered to be an effective deterrent to mosquito bites.

Treatment: If symptoms have developed that are consistent with West Nile virus, a blood sample will be taken and sent for analysis. There is currently no specific therapy. In more severe cases, intensive supportive therapy is indicated, normally involving hospitalization, intravenous fluids, airway management, respiratory support (ventilator), prevention of secondary infections (pneumonia, urinary tract, etc.) and nursing care.

15.24 Hazard Mitigation

The hazards listed above will be addressed through a combination of training, engineering controls, and personal protective equipment, with engineering controls as the method of preference, when feasible.

Implementation of Engineering Controls and Work Practices

Training for site procedures and the use of site equipment is instrumental in preventing accidents from occurring. Training in MEC recognition will be given to all site workers, and all will be watchful for MEC or pieces of MEC, which could be hazardous. When MEC or pieces of MEC are encountered, it is everyone’s duty to contact a UXO-qualified person to handle the situation. Other controls include the EZ, which will be used to keep unauthorized personnel out of the project site and shielding material to protect the operators of heavy equipment.

Upgrades/Downgrades in Levels of Personal Protective Equipment

Due to the types of hazards at the CRP site, Level D PPE will be required. This type of PPE is used for levels of contamination that may present a nuisance, but not an identifiable hazard. This consists of a hard hat, safety glasses, hearing protection, leather work gloves, rubber over-boots and non-steel-toed work boots to prevent interference with metal detectors. The hard hat will only be worn in head hazard areas, such as in the vicinity of the heavy equipment operations and during vegetation clearance operations. Rubber over-boots will only be worn over leather boots in watered areas. If hazards are encountered that are greater than estimated, the PPE level will be increased. This will be accomplished by the Corporate Health and Safety Staff, and the decision will be based on documented evidence of the hazards. If excessive dust levels near heavy equipment warrant via exposure monitoring, appropriate respiratory protection will be implemented in accordance with EOTI’s corporate respiratory protection program. If the site is not as hazardous as originally anticipated, the level of PPE can be downgraded by the Corporate Health and Safety Staff. This decision would also be based on definitive data that demonstrates the conclusion that the PPE can be lessened. Normally to downgrade PPE would require at least one week’s worth of data, during consistent site operation, demonstrating that the site is not as hazardous as originally suspected. PPE levels will conform to Section 5 of EM 385-1-1.

Work Stoppage and/or Emergency Evacuation of On-Site Personnel

All personnel are trained to be constantly aware of their work environment. Anyone has the ability to stop operations for safety reasons. No worker is expected to perform any operation for which he has not been trained, or to perform any operation that is considered to be unsafe. After operations are stopped for safety reasons, the SUXOS and UXOSO will be notified and they will evaluate the situation. The

SUXOS will, in consultation with the Corporate Health and Safety Staff, determine what steps need to be taken to make the situation safe for operations to continue.

Emergency Evacuation

In the event of an emergency that requires evacuation of the site, verbal instruction will be given by the SUXOS to evacuate the area. Personnel will exit the area to the pre-designated assembly point, which will be the office trailer.

After evacuation, the SUXOS will account for all personnel, ascertain information about the emergency and advise responding onsite personnel. The SUXOS will contact, advise and coordinate with responding off-site emergency personnel if deemed necessary by the situation.

In all situations that require evacuation, personnel shall not re-enter the work area until:

- The conditions causing the emergency have been corrected;
- The hazard has been reassessed;
- The Site Specific Safety and Health Plan has been revised and reviewed with onsite personnel, if needed; and
- Instructions have been given for authorized re-entry by the SUXOS.

Prevention and/or Minimization of Public Exposure to Hazards Created by Site Activities

Establishment and maintenance of an EZ creates separation between the CRP site footprint and the general public acts as a safety cushion to protect the public against site hazards. Controlling access to the site, closing roads, signs and barricades are all means of keeping the general public from accidentally wandering into the site during site operations. Training all site workers in the hazards of MEC will have more eyes looking for MEC. Any worker observing MEC or pieces of MEC will not touch or handle it in any way. He will inform a UXO-qualified EOTI worker, who will then handle the situation. If unauthorized personnel are observed in the EZ, all MEC operations will cease until the area is cleared of unauthorized personnel.

16.0 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

Descriptions of qualifications and responsibilities of Safety Staff members are contained in Section 6.0 of the APP.

17.0 PERSONAL PROTECTION EQUIPMENT

PPE requirements are contained in Section 12.1 of the APP. PPE requirements will be reevaluated as appropriate per Section 12.1 and section 15.24 and will comply with Section 5 of EM 385-1-1.

18.0 MEDICAL SURVEILLANCE

Medical surveillance of EOTI employees will be conducted IAW the requirements of OSHA 29 CFR 1910.120(f)(HAZWOPER), 29 CFR 1910.134(b)(10)(Respiratory Protection) and other established guidelines. Personnel to be included in the Medical Surveillance Program will be those who perform hazardous waste operations that may potentially expose the worker to hazardous substances or other significant safety and health threats. All EOTI personnel on the project site will be part of the EOTI

Medical Surveillance Program. Visitors desiring entry into the EZ must be on their employer's Medical Surveillance Program and must have a current physician's statement prior to entry.

18.1 Baseline Health Assessment Physical or Annual Physical

A baseline health assessment physical or annual physical will be conducted prior to participating in site operations, to determine the worker's ability to perform hazardous waste operations in a safe and healthful manner. The Project Manager, in conjunction with the SUXOS/UXOSO, will ensure that all health assessments address the site-specific health hazards to which workers may be exposed.

Physicals will be scheduled through the services of a board certified occupational medicine physician in the vicinity of the employee's home or job site. The designated physician will perform the medical assessments and review medical examination results to determine each worker's ability to perform his assigned hazardous waste duties. The physician will also be responsible for determining if supplemental or follow-up examinations are required and for maintaining medical and exposure records IAW OSHA 29 CFR 1910.120(d).

The purposes of the Medical Surveillance Program are to:

- Assess the individual's health status prior to participation in hazardous waste operations; determine the individual's ability to perform work assignments requiring the use of personal protective equipment (PPE) and clothing;
- Establish baseline data for comparison to future medical data in order to provide a means of monitoring a worker's health status;
- Establish facilities and procedures for emergency and non-emergency medical treatment;
- Establish procedures for maintenance and storage of medical and exposure records.

18.2 Physician's Statement

The results of this examination will be made available to the employee and a written physician's statement will be sent to EOTI. A copy of the physician's statement will be kept in each employee's file at the project site for the duration of site operations. The physician's statement will include the following:

- The physician's opinion regarding any conditions which would place the employee at an increased risk from working in hazardous waste operations;
- The physician's recommended limitations upon the employee's assigned work, if any; and
- A statement that the employee has been informed by the physician of the results of the examination, and any conditions which may require further examination or treatment.

18.3 Supplemental Examination

Any site worker will undergo a supplemental examination if they have been:

- injured;
- received health impairment;
- developed signs or symptoms from possible over-exposure; or
- received a documented over-exposure without the use of respiratory protection.

The contents of this examination will be based upon the type of injury, illness, signs or symptoms of exposure involved and will be determined by the physician. Prior to reassignment to site activities, the

physician will certify that the employee is fit to return to work. If necessary, the physician will specify in writing any activity restrictions or additional tests, which may be required.

18.4 Follow-up Health Assessments

If, during any pre-assignment, annual or supplemental examination, a condition is detected which requires follow-up tests, the physician will notify EOTI and the employee as to the nature of the follow-up health assessment. The physician will determine the schedule and content of the follow-up health assessment. A statement outlining the employee's fitness for work will be provided to EOTI and the employee upon conclusion of the follow-up health assessment.

18.5 Emergency and Non-emergency Medical Treatment

The medical treatment facility for use at this project site will be:

Hospital-Palmetto Health Richland
5 Richland Medical Park Dr
Columbia, SC 29203(803) 434-7000 * For Emergency Dial 911

Directions to the hospital can be found at Section 11.0 of this Appendix.

18.6 Record Keeping

EOTI will retain and maintain copies of all physician statements, exposure records, and associated information for all employees involved in hazardous waste operations. These records will be kept at the project site for the duration of site operations. When the site work is complete, the records will be retained by EOTI at the Knoxville, TN office. Examining physicians will be responsible for maintaining records related to laboratory and other tests for each employee examined. All records, whether maintained by EOTI or by the examining physician, will be kept on file for a period of thirty (30) years beyond an employee's termination OSHA 29 CFR 1910.1020(d).

18.7 Exposure Monitoring/Air Sampling Program

Due to the fact that there is not expected to be any significant exposure to hazardous chemicals or excessive levels of dust at this site, exposure monitoring will not be required. As the workers on this site will normally be in Level D PPE, heat stress monitoring will be required if the temperature goes above 75°F. Should it be required, site monitoring data will be recorded using the Site Monitoring Log and will be maintained as part of the project record.

18.8 Dust Monitoring

Dust or particulates created during excavation operations may be a nuisance to operators and those working around the equipment, but are not expected to exceed a permissible exposure level according to OSHA guidelines for total or respirable particulates. The team leaders will monitor the dust levels in the areas that their teams are working if airborne levels seem excessive.

18.9 Heat Stress Monitoring: Heat stress monitoring will be conducted using WBGT readings, in order to assure adequate work/rest cycles are implemented at the site if ambient dry-bulb temperatures exceed 75°F. Pulse monitoring may also be used in addition to the WBGT readings, particularly during acclimatization, to assure workers are adapting to the conditions safely. Monitoring will be performed by the UXOSO and results will be documented. Heat stress monitoring will be used to determine work-rest cycles to be implemented on site as referenced by the ACGIH TLV guidelines detailed in Section 15 above.

18.10 Meteorological Monitoring

Rain and/or other weather conditions can constitute a safety hazard to field operations at this site. The SUXOS and UXOSO will monitor the weather closely. If the area becomes so wet, muddy, or slippery that an unacceptable level of risk exists for personnel who are working in proximity to MEC items, then MEC operations will cease until the SUXOS determines it to be safe to continue.

No MEC operations will take place if an electrical storm is within ten miles of the site. An electrical storm monitor will be used to determine if an electrical storm is approaching. MEC operations will cease when an electrical storm is within ten miles of the site, and will not resume again until the SUXOS determines that the electrical storm is at least ten miles past the site.

19.0 STANDARD OPERATING SAFETY PROCEDURES, ENGINEERING CONTROLS AND WORK PRACTICES

Using common sense and following safe practices can reduce hazards due to normal site activities. Personnel must keep the prudent guidelines listed below in mind when conducting field activities.

- Hazard assessment is a continuous process. Personnel must be aware of their surroundings and constantly be aware of the MEC, chemical and physical hazards that are or may be present.
- The number of personnel in the EZ will be the minimum number necessary to perform work tasks in a safe and efficient manner.
- Team members will be familiar with the physical characteristics of each site including wind direction, site access, and the location of communication devices and safety/emergency equipment.
- The location of overhead power lines and underground utilities must be established.
- Contact with potentially contaminated surfaces, walking through puddles or pools of liquid, kneeling on the ground, or leaning, sitting, or placing equipment on the contaminated soil should be avoided.
- Detection or appearance of unusual liquids, odors or discolored soil could indicate the presence of contaminants and should be reported to the SUXOS/UXOSO immediately.
- Site personnel are to report any other unusual or potentially hazardous condition to the SUXOS/UXOSO for investigation and/or corrective action.

All personnel on site will be required to follow the safe work practices contained in this Program, as they relate to the hazards encountered during site activities. All site personnel will be required to read, understand and comply with the provisions of this APP. If new tasks or hazards are identified during site operations, which pose additional hazards, the APP will be amended by the Corporate Health and Safety Staff to include additional safe work practices and other control methods as needed.

19.1 Site Rules/Prohibitions

Safe practices can reduce hazards due to normal site activities. Personnel must keep the prudent guidelines listed below in mind when conducting field activities. General personnel requirements include:

- Horseplay or fighting is prohibited.
- Eating, drinking, smoking, chewing gum, tobacco, or any other hands-to-face activities are prohibited on-site, except in designated areas after both face and hands have been washed.
- Wearing contact lenses is prohibited in the EZ.
- When required to sit or kneel on the ground, avoid contaminated surfaces.
- Placing equipment on contaminated surfaces should be avoided.
- Climbing on or over obstacles is prohibited. Stacks of materials can be unstable and could cause injury.
- Open flames of any type are prohibited on-site.
- Bringing defective or unsafe equipment on-site is prohibited.
- Only authorized employees may enter the work site. Only essential personnel will be admitted within the EZ during MEC operations. Visitors must check in with the SUXOS, receive an appropriate safety briefing, and be escorted by UXO-qualified personnel at all times while on-site.

19.2 Buddy System

The buddy system is a safety practice in which each individual is concerned with the health and well being of co-workers. The buddy system will be implemented during all on-site activities and will be incorporated whenever workers may be isolated or as determined by the SUXOS/UXOSO. The objective of the Buddy System is to insure that no individual is ever alone on-site.

- A minimum of two UXO-qualified personnel will be present during all MEC operations. A UXO Technician I may assist in MEC operations with the supervision of a UXO Technician III or higher. Non-UXO-qualified personnel who have been determined essential for the operations being performed may be utilized to perform MEC-related procedures when supervised by a UXO Technician III or higher.
- At no time will an individual desert his assigned team unless while working in pairs, his partner goes down, and it is considered too hazardous to render assistance. Technicians will enter and exit EZ together and frequently monitor one another for signs of fatigue, heat stress, and any other problems. In such cases, the worker in danger may not even be aware he/she is having a problem. The technicians must always be alert to changes in the behavior of his teammate so that he can remove him from the situation immediately.
- Technicians should inspect each other's equipment, including PPE, to ensure that it is adequate and in proper working order.

19.3 Work Permit Requirements

At this time EOTI does not anticipate work permits for its work on this project. Under the contract there are no requirements for hot work. All site personnel, to eliminate the hazards from ignition sources, will utilize the general, fire safety precautions and procedures. Excavation work is generally expected to be less than four feet in depth, and there are expected to be no confined spaces or radioactive work on this project. Should this situation change, this SSHP will be updated to include these additional hazards, and

shall handle them in accordance with the EOTI Corporate Health and Safety Program, which addresses all of these issues.

19.4 Material Handling Procedures

Many types of objects are handled in normal day-to-day operations. Care will be taken in lifting and handling heavy or bulky items because they are the cause of many joint and back injuries. The following fundamentals address the proper lifting of materials to avoid joint and back injuries:

- The size, shape, and weight of the object to be lifted must be considered. Site personnel will not lift more than they can handle comfortably. They will use mechanical lifting equipment for lifts greater than 50 lbs that are unassisted.
- A firm grip on the object is essential; therefore, the hands and object will be free of oil, grease, and water, which might prevent a firm grip.
- The hands, and especially the fingers, will be kept away from any points that cause them to be pinched or crushed, especially when setting the object down.
- The item will be inspected for metal slivers, jagged edges, burrs, rough or slippery surfaces, and pinch points, and gloves will be used, if necessary, to protect the hands.
- The feet will be placed far enough apart for good balance and stability.
- Personnel will ensure that solid footing is available prior to lifting the object.
- When lifting, get as close to the load as possible, bend the legs at the knees, making sure that the back is kept as straight as possible.
- To lift the object, the legs are straightened from their bending position.
- Never carry a load that cannot be seen over or around.
- When placing an object down, the stance and position are identical to that for lifting, with the back kept straight, the legs bent at the knees, and the object lowered.
- If the item to be lifted is too large, bulky, or heavy (over 50 lb) for one person to safely lift, ask a co-worker for assistance. If a piece of material handling equipment is available that can do the job, the employee should use the equipment instead of trying to lift the object himself/herself.
- When two or more people are required to handle an object, coordination is essential to ensure that the load is lifted uniformly and that the weight is equally divided between the individuals carrying the load. When carrying the object, each person, if possible, will face the direction in which the object is being carried.

19.5 Spill Containment

Major spills are not expected on this site. Hazardous materials, where necessary, are being brought to the site in small quantity containers. This will minimize the amount of material involved, should a spill occur, as well as reducing the amount of hazardous material on hand to the minimum amount consistent with efficient operations. If a small amount of liquid hazardous material is spilled, it will be cleaned up with absorbent material by site personnel wearing appropriate chemical resistant gloves. It will then be containerized, labeled, and sent for disposal at an approved facility.

19.6 Drum/Container/Tank Handling

EOTI does not anticipate the use of drums/containers/tanks during activities under the PWS.

19.7 Comprehensive Activity Hazard Analysis of Treatment Technologies

Treatment technologies are not expected to be used on this project.

20.0 SITE CONTROL MEASURES

20.1 Site Map

A site map will be utilized during the Tailgate safety briefing to inform the workers of the location of hazardous areas on the site, the assembly areas to be used in the event of site evacuation, and any other information relevant to the day's activities. The site map will include:

- Site topography
- Site work zones
- Location of unusual/hazardous areas
- Prevailing winds
- Ingress and egress corridors
- Evacuation routes and assembly points
- Location of emergency supplies

20.2 Work Zone Delineation and Access Points

Site work zones will be established by the SUXOS/UXOSO prior to initiating operations to control site access. Establishment of site work zones is based upon site conditions, activities and exposure potentials. A site EZ will be set up, which includes the footprint of the area where work will take place and a distance based on the MGF around that to protect areas outside the site from potential fragmentation, depending on the site activities. Site work zones will be marked using barricades and signage closing roads into the area to unauthorized vehicular traffic. Barricades and signs will remain in place for the duration of site work.

20.3 Site Access Control

The SUXOS will control access to each work zone and will ensure that all site workers and visitors have received the proper training and medical surveillance required to enter a specific zone. Access will be denied to any potential entrant not meeting these requirements.

20.4 Exclusion Zone

The EZ includes all areas where significant hazards do or could occur and includes all areas where PPE is required to control worker exposure to chemical or physical hazards. All personnel entering the EZ will be logged in/out by the SUXOS. All visitors to the EZ must be escorted by a UXO-qualified EOTI employee. The EZ of this site will be designated as the footprint area of actual project operations and the required separation distance surrounding the area. This distance is based on the MGF during specifically defined site operations. When non-essential personnel are required to enter within the EZ, all UXO operations will cease until nonessential personnel are beyond the hazardous fragmentation area of the EZ.

20.5 Support Zone

The SZ is the area outside the EZ where site support activities are conducted. This zone includes break areas and sanitation facilities. Visitors desiring entry into the EZ must first meet with the SUXOS or UXOSO and receive the appropriate safety and emergency procedures briefing in the SZ before gaining admittance to the EZ, and they will be escorted at all times by a UXO-qualified employee while in the EZ.

Site access control will be implemented by the SUXOS/UXOSO and will be accomplished through a program that limits movement and activities of people and equipment at the project site. This control will be based on site-specific characteristics to include:

- Potential chemical, biological, physical or explosive hazards
- Terrain
- Expected weather conditions
- Planned site activities
- Site proximity to populated areas

The degree of site access control will include the following:

- Controlled site ingress/egress points – Work area will be clearly visible to anyone approaching the site and vice versa. Only authorized personnel will be permitted within the EZ during MEC operations. All others will remain in the SZ.
- Worker/visitor registration – All personnel working on the site sign in daily at the time of their daily safety briefing in the morning. All visitors to the site must sign the visitor log when they report to the site for their visitor briefing.
- Escort of visitors – All visitors to the site will be escorted by a UXO-qualified employee. Visitors will be briefed on site hazards, PPE requirements, and emergency procedures. Visitors who are not deemed essential will not be permitted within the EZ during MEC operations. If visitors need to access the EZ, all MEC operations will cease while they are in the area and the visitors will be escorted at all times.
- PPE requirements – PPE requirements have been established based on the site hazards. Personnel working in areas requiring PPE will wear required PPE for the duration of the operation. Visitors to the area will be required to have the required PPE for the area they will be visiting.

20.6 On and Off-Site Communication System

On and off-site communication will be established through the use of cellular telephones and radios. All personnel will have emergency phone numbers and understand how and under what conditions they are to be used. Cell phones will not be used around MEC where EMR may present a hazard, but will remain in the site vehicles with the emergency telephone number list for access during operating hours. Radios can be used to communicate to personnel on the site and in the site office.

21.0 PERSONAL HYGIENE AND DECONTAMINATION

Sanitation facilities will be provided in the SZ area so that employees can wash prior to eating, drinking, smoking, or engaging in any other hand-to-face activities. Chemical toilets may be available in the SZ of the work area and there are plumbed toilets. As chemical contamination is not expected to be an issue at this site, basic washing of equipment and standard hygiene practices are all that will be required. Site sanitation will be established and maintained in accordance with OSHA 29 *CFR* 1910.120(n) and USACE EM 385-1-1, Section 2. In particular:

Permanent restroom facilities are located on the project site. If they are disabled for the season or otherwise not available, EOTI will locate chemical toilets in the SZ, as required to support field personnel. Chemical toilets used in these locations and will be serviced every week. Each temporary toilet will be naturally lighted, have a toilet seat with a seat cover, have a urinal, have ventilation with vents screened, and be lockable from the inside. There will be at least one toilet for every 15 workers at the work site, if required.

Hand and face washing facilities will be set up at the EOTI work site and will be utilized by all personnel exiting the EZ prior to eating, drinking, tobacco use, or other hand-to-face activities. Paper towels will be provided for drying. A trash receptacle will be provided for discarded paper towels. In accordance with ANSI Z358.1-1998, eye-wash facilities will be available on the work site where operations in any of the work zones involve handling substances, which could be hazardous to the eyes. An eyewash kit will also be located in each site vehicle.

General work practices include the following:

- Safe work practices will be implemented whenever possible to eliminate or reduce the potential for employee exposure.
- Employees will wash their hands immediately or as soon as feasible after removal of gloves or other PPE.
- Employees will wash hands and any other skin with soap and water, or flush mucous membranes with water immediately following contact with blood or potentially infectious materials.
- If potentially contaminated sharps are encountered, the item will immediately be disposed of in an appropriate container or decontaminated.
- Eating, drinking, smoking, applying cosmetics or lip balm, handling of contact lenses, or storage/handling of food are prohibited in all areas where potentially infectious materials are present.
- Equipment that has become contaminated will be decontaminated prior to servicing or storage, unless decontamination is not feasible, in which case the equipment will be disposed of properly.

22.0 EQUIPMENT DECONTAMINATION

Due to the fact that chemical contamination is not anticipated at this site, basic washing of equipment is all that will be required.

23.0 EMERGENCY EQUIPMENT AND FIRST AID

Emergency equipment will be maintained on site for the duration of site operations. An approved, emergency first aid kit, bloodborne pathogen kit, and spill control kit will be kept in the UXOSO vehicle. Portable eyewashes will be located in the work area in the site vehicles. A 5-lb. ABC fire extinguisher will be kept in each site vehicle for emergency use on site. This equipment will be inspected on a weekly basis to assure they are maintained and ready to use. Any used items will be replaced immediately.

First aid kits are assigned by the Safety Office and approved by the Occupational Health Physician. The size and number of first aid kits shall be sufficient to accommodate the maximum number of people on

site at any given time. First aid kits will be located in all operational vehicles, each team, and the site office. A large medical kit, with trauma supplies, will be located with the UXOSO.

Biohazard kits will be available in each operational vehicle and with each team working inside the EZ. The kit will be used any time an injury occurs or where there is the release of body fluids.

Portable kits of eyewash will be available during operations at the site where the potential for hazardous materials may contact the eyes. Portable eyewash bottles will be used while the injured person is being transported to the site eye wash station or medical attention.

Fire extinguishers will be stored where they are well marked and readily accessible. Fire extinguishers shall be protected from the damaging affects of environmental elements. The SUXOS is responsible to ensure that all fire extinguishers are visually inspected monthly and that these inspections are documented. All site personnel will be familiar with the locations of fire extinguishers and will be trained in their use.

24.0 EMERGENCY RESPONSE AND CONTINGENCY PLAN

The ERCP address the emergencies, which could occur during site operations, and outlines the appropriate response actions. EOTI will investigate magnetic anomalies to locate, identify, and dispose of MPPEH. MPPEH will be destroyed by site personnel using donor explosive charges obtained from commercial sources.

24.1 Pre-Emergency Planning

The SUXOS and UXOSO will perform pre-emergency planning before starting field activities and will coordinate emergency response with EMT/police/fire personnel and the servicing medical facility when appropriate. Pre-emergency planning meetings shall be used to inform local authorities of the nature of site activities that will be performed under the PWS and the potential hazards that activities may pose to site workers, the environment, and the public. An agreement will be established between EOTI and emergency response personnel and the hospital regarding responsibilities of each party in responding to a project site emergency. The UXOSO will verify all on-site emergency services information, to include telephone numbers and procedures for requesting services. It will be the UXOSO's responsibility to post these procedures and telephone contact numbers IAW the requirements of this APP. Pre-emergency planning tasks include:

- Locate telephone stations;
- Post emergency telephone numbers at accessible telephone locations;
- Inspect all emergency equipment and supplies to ensure they are in proper working order;
- Provide a site map marked with planned evacuation routes, assembly points, and emergency equipment and supplies;
- Provide a map with the route to the hospital marked and highlighted, with copies of this map posted in the office/break area, in the emergency evacuation vehicle and all other site vehicles;
- Conduct an emergency response drill to test the effectiveness of the ERCP; and
- Review and revise the ERCP in the event of a failure of the plan in an actual or staged emergency, or when changes in site conditions or scope of work affect the ERCP.

24.2 Personnel and Lines of Authority

In the event of an emergency, the SUXOS will be designated as the On-Scene Incident Commander and will have the overall responsibility for implementation of the ERCP and coordination with responding off site emergency services.

Once an emergency has occurred, the SUXOS will report the incident to the client representative, the Project Manager and the Corporate Health and Safety Staff as soon as the situation is under control.

If the emergency involves employee injury, SUXOS and UXOSO will complete the ENG Form 3394 Accident Report. The Corporate Health and Safety Staff will be responsible for notifying applicable Federal, state and local authorities/agencies. Once the emergency has been resolved, the SUXOS, UXOSO, Project Manager, and Corporate Health and Safety Staff will conduct a follow-up investigation and critique. Actions will be taken to prevent recurrence.

24.3 Criteria and Procedures for Emergency Recognition and Evacuation

Prevention of emergencies will be aided by the effective implementation of this SSHP, personnel awareness, contingency planning, and onsite safety meetings. Anticipated emergencies may include physical injury, fire, explosion, chemical spill or release, inclement weather and natural disasters. The SUXOS and UXOSO will use the site-specific briefing and/or the Tailgate Safety Briefings to inform site workers of the recognition, prevention, and response procedures for each anticipated emergency.

In the event of an emergency, site personnel will be notified by either visual/verbal communication. Personnel will be notified to:

- Stop work activities;
- Evacuate to the designated assembly point;
- Begin emergency procedures; and
- Notify off site emergency response organizations and adjacent industries.

In the event of an emergency that requires evacuation of the site verbal instruction will be given by the SUXOS to evacuate the area. Personnel will exit the area to the pre-designated assembly point.

After evacuation, the SUXOS will account for all personnel, ascertain information about the emergency and advise responding onsite personnel. The SUXOS will contact, counsel with and coordinate with responding off-site emergency personnel if deemed necessary by the situation.

In all situations that require evacuation, personnel shall not re-enter the work area until:

- The conditions causing the emergency have been corrected;
- The hazard has been reassessed;
- The Site Specific Safety and Health Plan has been revised and reviewed with onsite personnel, if needed; and
- Instructions have been given for authorized re-entry by the SUXOS/UXOSO.

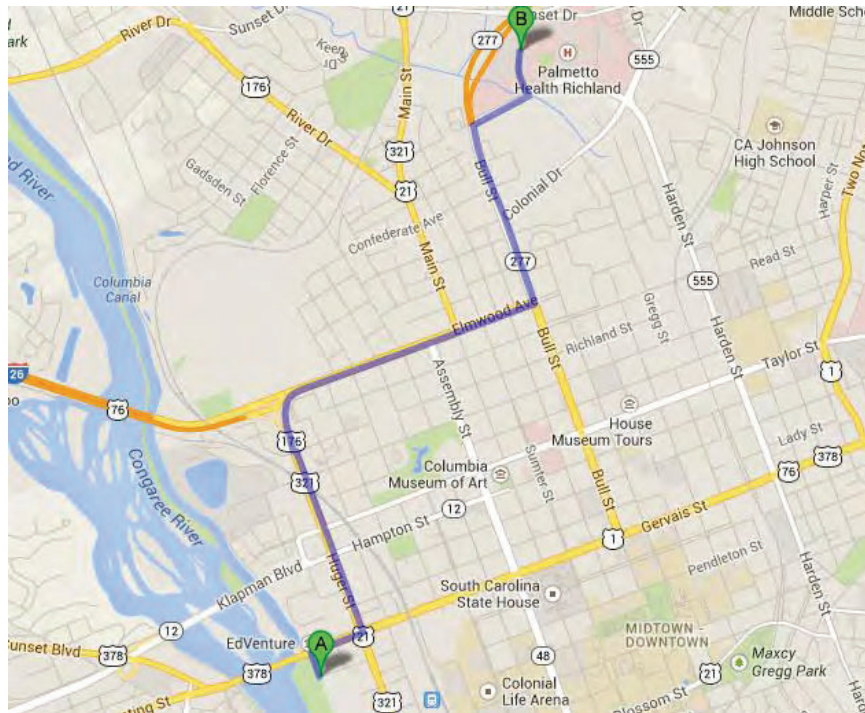
24.4 Decontamination and Medical Treatment of Injured Personnel

It is not anticipated that hazardous waste decontamination shall be required during any activities under the PWS. This determination has been made based upon archival documentation and past activities conducted at the site.

24.5 Emergency Medical Facilities

The nearest medical facility address is:

Palmetto Health Richland
5 Richland Medical Park Drive
Columbia, SC 29203
(803) 434-7000 * For Emergency Dial 911



Driving directions to Palmetto Health Hospital



Project Site

1. Head **north** on **Gist St** toward **City Club Dr** 482 ft
2. Take the 2nd right onto **Gervais St** 0.2 mi
3. Turn left onto **US-21 N/US-321 N/Huger St** 0.8 mi
Continue to follow US-21 N/US-321 N
4. Keep right at the fork, follow signs for **U.S. 21/U.S. 176/U.S. 321/Elmwood Avenue** and merge onto **US-176 W/US-21 N/US-321 N/US-76 E** 1.1 mi
Continue to follow US-76 E
5. Turn left onto **Bull St**

-
- | | |
|--|--------|
| 6. Turn right onto Harden Street Extension(signs for Harden St) | 0.7 mi |
| 7. Turn left onto Richland Medical Park Dr | 0.2 mi |
| Destination will be on the right | 0.2 mi |

The emergency telephone list can be found at Section 12.3.8 of this Appendix.

24.6 Criteria for Alerting the Local Community Responders

In the event of an on-site emergency the individual team leader or first person aware of the emergency will contact the SUXOS by field radio, cellular phone, or in person, as circumstances allow. The SUXOS will normally be responsible for requesting emergency services. If the order is given to evacuate the site of all personnel, each on-site team leader will assemble, account for, and evacuate all team personnel to the pre-designated staging area. The SUXOS/UXOSO will initially instruct the on-site CPR/First Aid trained personnel to respond to the emergency. These individuals shall render emergency first aid treatment and stay with the injured until relieved by off-site emergency services personnel, who would be called in at the discretion of the SUXOS.

24.7 Material Safety Data Sheets

As part of the EOTI Hazard Communication Program, an SDS binder will be maintained onsite, which includes copies of SDSs for all hazardous materials brought onto the site by EOTI. It will be kept in the site office during operations. This SDS binder will be available on request to all site personnel during all working hours of the site. If site workers have further questions about any of the hazardous materials they come into contact with, the EOTI Corporate Health and Safety Staff will locate the required information and pass it on to the employee.

24.8 Safe Distances and Places of Refuge

Normally, during an evacuation, personnel would evacuate to the office trailer and staging area in the SZ, where the SUXOS would take roll and account for all site personnel. An exception to this rule would be in the case of encountering a CWM item, in which case personnel would evacuate at least 450 feet upwind of the item. This location would change with the shifting winds, so it cannot be specifically identified.

24.9 Site Security and Control

During emergency procedures, the UXOSO will direct emergency vehicles into the site. The site personnel will also be notified that emergency vehicles are coming and be ready to assist where necessary. The UXOSO will assure that Fire Department personnel approach at no closer than fragmentation distance from any fire that might start in the area. EMT/ambulance personnel will be instructed by the UXOSO as to where to safely proceed to get to the injured worker. Site personnel will assist if required, at the direction of the SUXOS.

24.10 Evacuation Routes and Procedures

In the event of an emergency that requires evacuation of the site, an alarm will be sounded or verbal instruction given by the SUXOS/UXOSO to evacuate the area to the work site “Staging Areas.” This point will be established outside the EZ and in the SZ. Personnel will be shown the location of the staging areas daily, during the Site Safety Briefing. The location of the assembly point may change as work activity progresses within the project area. However, it will normally be at the office trailer.

After evacuation, the SUXOS will account for all personnel, ascertain information about the emergency, and advise responding on-site personnel. The SUXOS will contact, advise, and coordinate with responding off-site emergency personnel and points of contact for adjacent industries, if deemed necessary by the situation or the client Safety and Health Representative. In all situations that require evacuation, personnel will not re-enter the work area until the conditions causing the emergency have been corrected; the hazard reassessed; the APP has been revised and reviewed with on-site personnel, if needed; and instructions have been given for authorized re-entry by the SUXOS.

The route directions to the medical facility will be posted in the EOTI office, at the work site, and in site vehicles. This map also will indicate the evacuation route.

24.11 Decontamination

Due to the type of work on this project, it is not expected that a major chemical spill would occur that would require personnel decontamination prior to leaving the site. If a worker is accidentally injured using chemicals brought onto the site, the first aid procedures described in the SDS would be followed by co-workers to clean as much of the chemical off as possible before the ambulance arrives. In a case like this the SDS will be sent to the hospital with the worker to inform the medical staff of the exposure and how best to treat it.

24.12 Emergency Medical Treatment and First Aid

A minimum of two persons on the project site will be certified in First Aid/CPR. These persons will act as First Responders to any site emergency. First Aid kits will be available for their use in that capacity. The First Responders will perform first aid and/or CPR until medical personnel arrive on site. The SUXOS will contact the EMT/ambulance based on the type of injury received and send the injured worker to the designated emergency treatment facility. If the injury is not so serious, the SUXOS may ask a co-worker to take the injured worker to the hospital for treatment. Maps and directions to the hospital will be kept in all site vehicles. Directions to the hospital can be found in Section 11 of this Appendix.

Major hazardous substance spills are not expected due to the type of work taking place on this project. In the event of a minor hazardous substance spill causing an injury, the first responders would provide first aid based on the instruction in the SDS for the substances. The SDS would be taken with the injured worker to the hospital to provide information on treatment of that chemical.

24.13 Spill Alerting and Response Procedure

The emergency alerting procedure on the site will normally be a verbal warning to evacuate the site and the evacuation procedures outlined above would be implemented. Due to the fact that there should be no large quantities of chemicals found on this site, the only type of chemical spill would be a small one. If a small spill occurs, the individual who caused the spill will inform the SUXOS. He will then get the spill control kit, and use the absorbent material, clean up most of the spill. If some of the soil is

contaminated, that soil will be dug up and placed with the rest of the spill clean-up materials. It will all be disposed of in a licensed hazardous waste disposal facility. Personnel involved in this clean-up will wear chemical resistant gloves. Larger spills might require the use of Tyvek suit and respirator as well, but spills of that size are not anticipated on this site.

24.14 Critique of Response and Follow-Up

After any type of site emergency, the SUXOS/UXOSO, the Project Manager, MEC Safety and health Coordinator, and the Corporate Health and Safety Staff will review the situation and determine if changes need to be made to the emergency procedures to make them more effective. Applicable changes will be made to the APP and these changes will be reviewed with all employees, so they are aware of the new procedures.

24.15 Emergency Response Team

There will be a minimum of two persons on the project site who are certified in first aid and CPR. These persons will serve as the first responders. They will respond to any site emergency and assist the victim until medical assistance arrives. The SUXOS will call for outside emergency assistance if it is needed. As soon as the professional emergency response services arrive onsite, the first responders will turn over medical care of the injured worker to them. They will be on stand-by to assist the ambulance crew if requested to do so.

24.16 Personnel Training Requirements

Personnel acting as first responders will be certified in First Aid and CPR from the American Red Cross or a similar other training entity. They will be qualified to provide basic first aid and CPR and will relinquish authority to the EMT/ambulance crew when they arrive on site.

24.17 Emergency Response Team Responsibilities

The responsibility of the emergency response team is to respond to on-site emergencies. They will provide only first aid and CPR, and they will attempt to calm and stabilize the patient until the professional help arrives.

25.0 LOGS, REPORTS AND RECORD KEEPING

Each person on the site will have an individual file folder, which contains a copy of the following:

- 40 hr HAZWOPER Certificate.
- Current 8 hr HAZWOPER Annual Refresher Certificate.
- 8 hr HAZWOPER Supervisor Certificate, if applicable.
- EOD/UXO Training Certificate
- Any other applicable training certificates.

Personnel folders will be maintained by the SUXOS on-site. Training/Tailgate Safety Record will be completed for all on-site daily training. The SUXOS/UXOSO will maintain the file, which will be made available for the client as requested. This form may be completed in ink, but it is preferred that it be completed with a computer in Word.

25.1 Daily Safety Inspection Logs

The UXOSO will perform daily inspections on a scheduled and non-scheduled basis, of all site operations. The UXOSO will conduct non-scheduled safety and health inspections as deemed appropriate based upon the ongoing site activities. Scheduled safety and health inspections will be conducted as outlined in Section 8.0. All inspections will be documented. When discrepancies are observed, follow-up will be documented in the UXOSO log until the corrective actions required have been completed.

25.2 Visitor Log

The Visitor's Log will be maintained by the SUXOS. The log will document the visitor's name, company name, date, time, and reason for visit. There will also be documentation that the visitor was given a visitor safety briefing prior to being permitted to enter the EZ of the site. Visitors will be escorted at all times within the EZ and MEC operations will cease during the time they are within the EZ.

25.3 Medical Surveillance Records and Certifications

A copy of the Physician Statement from a licensed physician who is certified in Occupational Medicine by the American Board of Preventive Medicine, regarding the current annual HAZWOPER physical examination will be maintained in the personnel folder with the other HAZWOPER certificates. The Physician Statements will remain in the individual's file on the project site for the duration of site operations. The files will then be transferred to the Knoxville Office.

25.4 Air Monitoring Results

Due to the operations being performed on this project, air monitoring is not required.

25.5 Personal Exposure Records

As there is no chemical work taking place on this project, personal exposure records are not expected to be required.

25.6 Records Maintenance

All personal exposure and medical monitoring records, if generated, will be maintained in accordance with applicable OSHA standards, 29 CFR 1904, 1910, and 1926.

25.7 Final Report

EOTI will develop, retain and submit as part of the final report, all visitor registration logs, training logs, and daily safety inspection logs as part of the daily QC Reports.

25.8 Site Monitoring Results

All site-monitoring results will be documented. This will be kept in a file at the project site for reference, and will become a part of the permanent site record at the conclusion of site activities. At this site, heat exposure monitoring is the only monitoring anticipated to occur and that is dependent upon the site temperature.

25.9 Accident Reporting Records

Accidents/incidents shall be reported in accordance with DID MR-015 and EM 385-1-1 using the ENG Form 3394 Accident Report form in Appendix F. Should an accident occur on the site, all reports and records will be documented. Copies will be maintained on site for the duration of site activities. A permanent copy will be maintained in the Knoxville EOTI Office.

25.10 Safety Exposure Report

A Safety Exposure Report, a tabulation of field labor hours, lost workday accidents, and number of lost workdays shall be submitted.

26.0 UNFORESEEN HAZARDS

Should any unforeseen hazard become evident during the performance of work, the SUXOS and UXOSO shall bring such hazard information to the attention of the Corporate Health and Safety Staff and the on-site government representative (both verbally and in writing) for resolution as soon as possible. In the interim, necessary action shall be taken to reestablish and maintain safe working conditions until the procedures to address the new hazards can be put into place and the APP updated accordingly.

APPENDIX E
MUNITIONS CONSTITUENTS SAMPLING AND ANALYSIS PLAN

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
REMOVAL ACTION AND CONSTRUCTION SUPPORT
COLUMBIA, SC

NOT APPLICABLE

**APPENDIX F
CONTRACTOR FORMS**

**MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
REMOVAL ACTION AND CONSTRUCTION SUPPORT
COLUMBIA, SC**

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Daily Safety Attendance Sign-in	F-5
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Quality control corrective Action Log.....	F-8
MEC Accountability Log.....	F-9
DD1348-1A.....	F-10
Weekly Vehicle Inspection Checklist.....	F-11
Site Visitors Log	F-2
Magazine Data Card	F-13
ATF License.....	F-14

NOTE:

A CD containing all Contractor-specific forms will be maintained on site. The forms in this appendix are examples of the forms that the Contractors will be using during this project. Forms may be modified to meet specific project reporting needs.



EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.
DOCUMENTATION OF TRAINING

Training Course Name: _____
(General, UXO Equipment, Visitor, Special)

Presented By: _____ Date: _____

Topics Discussed

Work Plan/SSHP/APP: _____

UXO/MEC Hazards: _____

Chemical Hazards: _____

Physical Hazards: _____

Emergency Procedures: _____

Weather Conditions: _____

Other: _____

Attendees		
<u>Printed Name</u>	<u>Signature</u>	<u>Date</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Trainer: _____ Date: _____



SSHP ACKNOWLEDGMENT

Project: Removal Action Site: _____
 Contract Number: _____ Site Location: _____

Project Manager: _____
 SUXOS: _____
 UXOSO: _____

I acknowledge that I understand the requirements of this SSHP and agree to abide by the procedures and limitations specified. I also acknowledge that I have been given an opportunity to have my questions concerning the SSHP and its requirements answered prior to performing field activities. Health and Safety Training and Medical Surveillance requirements applicable to my field activities at this site are current and will not expire during onsite activities.

EOTI PERSONNEL:

<u>SIGNATURE</u>	<u>EMPLOYEE NO.</u>	<u>DATE</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
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_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

OTHER PERSONNEL:

<u>SIGNATURE</u>	<u>ORGANIZATION</u>	<u>DATE</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____



WEEKLY SAFETY CHECKLIST

Location: _____ Site: _____		
Description	Findings	Remarks
1. Personal Protection (PPE) per SSHP/APP	Pass/Fail	
2. Work Practices Follow SSHP/APP	Pass/Fail	
3. Site Control/Decon per SSHP/APP	Pass/Fail	
4. Eyewash Station(s)	Pass/Fail	
5. First Aid Kit(s)	Pass/Fail	
6. Fire Extinguisher(s)	Pass/Fail	
7. Monitoring Equipment	Pass/Fail	
8. Calibration	Pass/Fail	
9. Communications	Pass/Fail	
10. Overall Cleanliness of Site	Pass/Fail	
11. Other	Pass/Fail	
Printed Name: _____ Signature: _____ Date: _____ REMARKS: _____ _____ _____ _____		

DAILY SAFETY ATTENDANCE SIGN-IN SHEET

NAME	COMPANY	SIGNATURE	DATE

Person Presenting the Safety Briefing:

--	--	--	--



QUALITY CONFORMANCE INSPECTION (QCI) RECORD
See Reverse for Completion Instructions

DATE: _____ PROJECT SITE: _____

QC SPECIALIST: _____

TASK INSPECTED: _____

SCHEDULED INSPECTION () REINSPECTION ()
DAILY () WEEKLY () OTHER () _____

RESULTS:
() TASK IS BEING ACCOMPLISHED IN CONFORMANCE TO WP/SSHP.
() TASK IS NOT BEING ACCOMPLISHED IN CONFORMANCE TO WP/SSHP.

THE NOTED NONCONFORMANCE IS AS FOLLOWS: _____

REINSPECTION:
TASK AND DATE OF NONCONFORMANCE BEING REINSPECTED:

RESULTS:
() TASK IS BEING ACCOMPLISHED IN CONFORMANCE TO THE WP/SSHP.
() TASK IS NOT BEING ACCOMPLISHED IN CONFORMANCE TO WP/SSHP.

THE RE-OCCURRING NONCONFORMANCE IS AS FOLLOWS:

QUALITY CONFORMANCE INSPECTION (QCI) RECORD



INSTRUCTIONS FOR COMPLETION

A QCI record will be completed on each task inspected.

Date: Enter the date the inspection took place.

Project Site: Enter the project site's name.

QC Specialist: Name of the QC Specialist conducting the QCI.

Task Inspected: Enter the name of the task being inspected as per the QCI Schedule.

Scheduled Inspection: Place a "X" in the appropriate (). If Other is applicable, note the reason for the QCI.

Results:

Enter a "X" in the appropriate ().

If the task is in conformance, no other information is required on this form.

If the task is not in conformance, continue with the explanation in space provided.

Reinspection:

Date and Task being reinspected: Enter the date and pertinent task.

Results: Enter a "X" in the appropriate ().

If the task is still not in conformance, continue with the explanation in space provided.

Distribution of completed forms:

Conformances: 1- Project Manager
1 - On-site QC File (Inactive)

Nonconformances: 1 - Project Manager
1- Quality Manager
1 - On-site QC File (Active)

Reinspections: 1 - Project Manager
1 - Quality Manager
1 - On-Site QC File (Inactive) (if compliant)
(Active) (if noncompliant)

QUALITY CONFORMANCE INSPECTION (QCI) RECORD



EOTI
Quality Control
Corrective Action Log

Project: _____
Location: _____
SUXOS: _____
UXOQCS: _____

<u>Non Conformance</u>			<u>Correction</u>		
<u>Date</u>	<u>Activity</u>	<u>Nature</u>	<u>Action Taken</u>	<u>Completed By</u>	<u>Date</u>

Quality Control Corrective Action Log

MEC Accountability Log



ID #	Identification			Nomenclature	Description	Disposition					
	Anomaly #	Date	Grid/Area			Location	Fuze Condition	Method	Date	By Whom	Photo #

**APPENDIX F (CONTRACTOR FORMS) TO WORK PLAN
REMOVAL ACTION AND CONSTRUCTION SUPPORT
CONGAREE RIVER PROJECT
COLUMBIA, SC**

DD FORM 1348-1A, JUL 91 (EG) ISSUE RELEASE/RECEIPT DOCUMENT

27. ADDITIONAL DATA	28. RIC (4-6) UI (23-24) QTY (25-29) CON CODE (71) DIST (55-56) UP (74-80)	25. NATIONAL STOCK NO. & ADD (8-22)	24. DOCUMENT NUMBER & SUFFIX (30-44)	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>0</td> </tr> <tr> <td colspan="10">SUPPLIER'S ADDRESS</td> <td colspan="10">DISPOSITION</td> </tr> <tr> <td colspan="10">S U P P L I E R</td> <td colspan="10">D I S P O S I T I O N</td> </tr> <tr> <td colspan="5">Q U A N T I T Y</td> <td colspan="5">R E C E I P T</td> <td colspan="5">P R O J E C T</td> <td colspan="5">D O C U M E N T</td> </tr> <tr> <td colspan="5">Q U A N T I T Y</td> <td colspan="5">R E C E I P T</td> <td colspan="5">P R O J E C T</td> <td colspan="5">D O C U M E N T</td> </tr> <tr> <td colspan="5">Q U A N T I T Y</td> <td colspan="5">R E C E I P T</td> <td colspan="5">P R O J E C T</td> <td colspan="5">D O C U M E N T</td> </tr> <tr> <td colspan="5">Q U A N T I T Y</td> <td colspan="5">R E C E I P T</td> <td colspan="5">P R O J E C T</td> <td colspan="5">D O C U M E N T</td> </tr> <tr> <td colspan="5">Q U A N T I T Y</td> <td colspan="5">R E C E I P T</td> <td colspan="5">P R O J E C T</td> <td colspan="5">D O C U M E N T</td> </tr> </table>	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	SUPPLIER'S ADDRESS										DISPOSITION										S U P P L I E R										D I S P O S I T I O N										Q U A N T I T Y					R E C E I P T					P R O J E C T					D O C U M E N T					Q U A N T I T Y					R E C E I P T					P R O J E C T					D O C U M E N T					Q U A N T I T Y					R E C E I P T					P R O J E C T					D O C U M E N T					Q U A N T I T Y					R E C E I P T					P R O J E C T					D O C U M E N T					Q U A N T I T Y					R E C E I P T					P R O J E C T					D O C U M E N T				
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17. ITEM NOMENCLATURE	18. TV CONT	19. NO CONT	20. TOTAL WEIGHT	21. TOTAL CUBE	22. RECEIVED BY	23. DATE RECEIVED	4. MARK FOR																																																																																																																																																													

PerFORM (DLA)

PREVIOUS EDITION MAY BE USED



EOTI WEEKLY VEHICLE INSPECTION CHECKLIST

(This form to be used weekly for all site vehicles, EXCEPT explosive carriers, which must be inspected prior to EACH explosive transport)

Site Location: _____

Inspector: _____

Vehicle: _____ (MAKE AND LICENSE PLATE #) Owner: _____ (RENTAL, EOTI, GRE, CONT.)

Date Inspected: _____ Mileage: _____

Use [✓] For Pass, Use [X] For Discrepancy

1. DOCUMENTATION: Registration [] Insurance [] Emergency Route Map/ Phone Numbers []	2. BRAKES: Hand/Emergency [] Service []
3. TIRES: Pressure [] Condition []	4. BELTS: Proper tension [] Condition []
5. EQUIPMENT: Fire extinguishers [] First Aid/CPR/Burn/ Eyewash kits [] *Tie downs [] *Chocks [] *Placards []	6. LIGHTS: Headlights (high & low) [] Brake Lights [] Parking [] Back-up [] Turn Signals [] Emergency Flashers []
7. FLUID LEVELS: Oil [] Coolant [] Brake [] Steering [] Transmission [] Windshield Wiper [] Fluid Leaks []	8. GENERAL: Windshield Wipers [] Horn [] Seat Belts [] Steering [] Windshield/Windows [] Gas Cap [] Mirrors [] Exhaust System/ *Spark Arrester [] Cleanliness []

(Note: Items marked with * apply to explosive carriers only)

Description of deficiencies: _____

Deficiencies corrected by: _____ Date: _____

EOTI WEEKLY VEHICLE INSPECTION FORM



SITE VISITOR'S LOG

Site Name: _____

Site Location: _____

Date: _____

PRINT NAME	SIGNATURE	AGENCY	PURPOSE OF VISIT	PHONE #	DATE/TIME ARRIVED	DATE/TIME DEPARTED

Site Visitor's Log

U.S. Department of Justice
 Bureau of Alcohol, Tobacco, Firearms and Explosives

Federal Explosives License/Permit
(18 U.S.C. Chapter 40)

U.S. GOVERNMENT PRINTING OFFICE: 2011 O 540014

In accordance with the provisions of Title XI, Organized Crime Control Act of 1970, and the regulations issued thereunder (27 CFR Part 555), you may engage in the activity specified in this license or permit within the limitations of Chapter 40, Title 18, United States Code and the regulations issued thereunder, until the expiration date shown. **THIS LICENSE IS NOT TRANSFERABLE UNDER 27 CFR 555.53.** See "WARNINGS" and "NOTICES" on reverse.

Direct ATF Correspondence To ATF - Chief, FELC 244 Needy Road Martinsburg, WV 25405-9431	License/Permit Number 8-NJ-025-33-5D-12250
Chief, Federal Explosives Licensing Center (FELC) <i>Christopher R. Reeves</i>	Expiration Date April 1, 2015

Name
 EXPLOSIVE ORDNANCE TECHNOLOGIES INC

Premises Address (Changes? Notify the FELC at least 10 days before the move.)
**185 RUMSON RD
 RUMSON, NJ 07760-**

Type of License or Permit
33-USER OF EXPLOSIVES

Purchasing Certification Statement
 The licensee or permittee named above shall use a copy of this license or permit to assist a transferor of explosives to verify the identity and the licensed status of the licensee or permittee as provided by 27 CFR Part 555. The signature on each copy must be an original signature. A faxed, scanned or e-mailed copy of the license or permit with a signature intended to be an original signature is acceptable. The signature must be that of the Federal Explosives Licensee (FEL) or a responsible person of the FEL. I certify that this is a true copy of a license or permit issued to the licensee or permittee named above to engage in the business or operations specified above under "Type of License or Permit."

Mailing Address (Changes? Notify the FELC of any changes.)
 EXPLOSIVE ORDNANCE TECHNOLOGIES INC
 185 RUMSON RD
 RUMSON, NJ 07760-

Licensee/Permittee Responsible Person Signature	Position/Title
Printed Name	Date

Previous Edition is Obsolete EXPLOSIVE ORDNANCE TECHNOLOGIES INC-185 RUMSON RD 07760 8-NJ-025-33-5D-12250 April 1, 2015 33-USER OF EXPLOSIVES ATF Form 5400.14/5400.15 Part I
Revised October 2011

Federal Explosives License (FEL) Customer Service Information

Federal Explosives Licensing Center (FELC) 244 Needy Road Martinsburg, WV 25405-9431	Toll-free Telephone Number: (877) 283-3352 Fax Number: (304) 616-4401 E-mail: FELC@atf.gov	ATF Homepage: www.atf.gov
--	--	---------------------------

Change of Address (27 CFR 555.54(a)(1)). Licensees or permittees may during the term of their current license or permit remove their business or operations to a new location at which they intend regularly to carry on such business or operations. The licensee or permittee is required to give notification of the new location of the business or operations not less than 10 days prior to such removal with the Chief, Federal Explosives Licensing Center. The license or permit will be valid for the remainder of the term of the original license or permit. (The Chief, FELC, shall, if the licensee or permittee is not qualified, refer the request for amended license or permit to the Director of Industry Operations for denial in accordance with § 555.54.)

Right of Succession (27 CFR 555.59). (a) Certain persons other than the licensee or permittee may secure the right to carry on the same explosive materials business or operations at the same address shown on, and for the remainder of the term of, a current license or permit. Such persons are: (1) The surviving spouse or child, or executor, administrator, or other legal representative of a deceased licensee or permittee; and (2) A receiver or trustee in bankruptcy, or an assignee for benefit of creditors. (b) In order to secure the right provided by this section, the person or persons continuing the business or operations shall furnish the license or permit for that business or operations for endorsement of such succession to the Chief, FELC, within 30 days from the date on which the successor begins to carry on the business or operations.

(Continued on reverse side)

Cut Here ✂

Federal Explosives License/Permit (FEL) Information Card

License/Permit Name: **EXPLOSIVE ORDNANCE TECHNOLOGIES INC**

Business Name: 

License/Permit Number: **8-NJ-025-33-5D-12250**

License/Permit Type: **33-USER OF EXPLOSIVES**

Expiration: **April 1, 2015**

Please Note: Not Valid for the Sale or Other Disposition of Explosives.

**APPENDIX G
MUNITIONS FRAGMENTATION SHEETS**

**MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
REMOVAL ACTION AND CONSTRUCTION SUPPORT
COLUMBIA, SC**

Fragmentation Data Review Form



Database Revision Date 8/21/2014

Category:

Munition:

Case Material:

Fragmentation Method:

Secondary Database Category:

Munition Case Classification:

DODIC:

Date Record Created:

Record Created By:

Last Date Record Updated:

Individual Last Updated Record:

Date Record Retired:

Munition Information and Fragmentation Characteristics

Explosive Type:

Explosive Weight (lb):

Diameter (in):

Cylindrical Case Weight (lb):

Maximum Fragment Weight (Intentional) (lb):

Design Fragment Weight (95% Unintentional) (lb):

Critical Fragment Velocity (fps):

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):

MFD-H [Maximum Fragment Distance, Horizontal] (ft):

MFD-V [Maximum Fragment Distance, Vertical] (ft):

Overpressure Distances

TNT Equivalent (Pressure):

TNT Equivalent Weight - Pressure (lbs):

Unbarricaded Intraline Distance (3.5 psi), K18 Distance:

Public Traffic Route Distance (2.3 psi); K24 Distance:

Inhabited Building Distance (1.2 psi), K40 Distance:

Intentional MSD (0.0655 psi), K328 Distance:

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):

TNT Equivalent Weight - Impulse (lbs):

Kinetic Energy 10^6 (lb-ft²/s²):

Single Sandbag Mitigation

Required Wall & Roof Thickness (in):

Expected Max. Throw Distance (ft):

Minimum Separation Distance (ft):

Double Sandbag Mitigation

Required Wall & Roof Thickness (in):

Expected Max. Throw Distance (ft):

Minimum Separation Distance (ft):

Water Mitigation

Minimum Separation Distance (ft):

Water Containment System:

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	<input type="text" value="12.80"/>	<input type="text" value="7.40"/>
Mild Steel:	<input type="text" value="2.21"/>	<input type="text" value="1.23"/>
Hard Steel:	<input type="text" value="1.81"/>	<input type="text" value="1.01"/>
Aluminum:	<input type="text" value="4.07"/>	<input type="text" value="2.36"/>
LEXAN:	<input type="text" value="11.35"/>	<input type="text" value="7.93"/>
Plexi-glass:	<input type="text" value="9.75"/>	<input type="text" value="6.06"/>
Bullet Resist Glass:	<input type="text" value="9.20"/>	<input type="text" value="5.43"/>

Item Notes

The TNT equivalency for black powder rounds has been updated from 0.4 to 0.43 to agree with Rev 4 of TP 16. This has resulted in minor changes in values.

APPENDIX H
CONTRACTOR PERSONNEL QUALIFICATIONS CERTIFICATION LETTER

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
REMOVAL ACTION AND CONSTRUCTION SUPPORT
COLUMBIA, SC

RESUMES OF KEY PERSONNEL

The following personnel are proposed as key personnel for the activities on this project:

Matthew Norris	Project Manager	Resume included
James Haynie	SUXOS	CEHNC # 1142
Thomas Dailey	UXOSO/QCS	CEHNC # 1071
Wayne Madsen	UXO Technician III	CEHNC # 0184
Jay Johnson	UXO Technician II	CEHNC # 1418
Phillip Lewallen	UXO Technician II	CEHNC # 1843
Logan Daily	UXO technician I	CEHNC # 1989
De La Von Conner	UXO technician I	CEHNC # 2333

Personnel Qualifications Certification Letter

I, Tanya Leonard, Operations Manager, certify that the personnel listed above meet or exceed contract requirements for the function they will perform.

If changes in the identified personnel are required, due to the availability of the proposed personnel or schedule conflicts, EOTI will propose fully qualified personnel to fill the position. Resumes of proposed key personnel that are not in the CEHNC database will be submitted for review and approval.

Matthew Norris, GISP / Project Manager

Years Experience: With EOTI: 12 With Other Firms: 4

Education:

B.S., Business Administration—Bryan College (2014)

Active Registration:

GISCI GIS Professional (GISP) Certification: 90429

Chronological Job History:

2004-Present EOTI; Knoxville, TN; GIS Manager /Project Manager

2002-2004 AMERICAN TECHNOLOGIES, INC. (ATI), Oak Ridge, TN, GIS Specialist

2001-2002 SCIENCE APPLICATIONS INTERNATIONAL CORPORATION (SAIC), Oak Ridge, TN,

1999-2004 TN & Associates, Inc. Project Geologist; and Project Manager

EXPLOSIVE ORDNANCE TECHNOLOGIES, INC. (EOTI), Knoxville, TN 2004 - present
(Small business munitions response service provider with a core focus of investigation and remediation of military munitions and environmental services)

MMR Project Manager. Hired as one of the first employees with the company and holds a leadership role in developing/implementing leadership efforts in the areas of project management, logistics, procurement, proposal development, information technology, business development, and staff recruiting/hiring that expanded the company from five to 100 employees and escalated revenues from 500,000 to an average of 6 million a year. The following highlight specific management contributions and achievements:

Project Manager Key Projects-

- Project Manager- Managed Unexploded Ordnance (UXO) Services to perform inspection, certification, and disposal of previously certified inert range debris at Blossom Point Naval Research Facility in Welcome, MD. EOTI provided UXO Technicians to inspection, certification, and disposal of stored range related debris that was accumulated from previous NRL demonstration sites. Award Date: August 2015, Contract Value: \$20,141.83.
- Project Manager- Managed Unexploded Ordnance (UXO) Construction Support Services, in conjunction with ongoing construction efforts at the Joint Operations Center, East Campus at Fort Meade, MD. EOTI provided two UXO Technicians to perform UXO construction support surveillance and anomaly identification within the construction-building footprint. Award Date: July 2015, Contract Value: \$22,484.60.
- Project Manager- Managed Unexploded Ordnance (UXO) Services, in conjunction with an ongoing Remedial Action at Site 7 SWMU 3, Naval Activity Puerto Rico (NAPR), Ceiba, Puerto Rico. EOTI provided eight UXO Technicians to support landfill mitigation, separation and segregation of debris materials, MEC identification and disposal, and verification and certification of all debris materials removed over a two-acre site. Award Date: May 2015, Contract Value: \$365,844.53.

- Project Manager- Managed underwater intrusive anomaly detection and verification to support validation to support RI/FS efforts at MMRP AOC and SWMU at Joint Base Charleston (JB CHS) Weapons, North Charleston, SC. EOTI conducted dive operations to verify previously detected geophysical anomalies and detect and verify anomalies in AOC were no previous investigate had been conducted. EOTI utilized retired US Navy trained divers that were qualified UXO technicians to perform the investigation. Award Date: Sept 2014, Contract Value: \$287,623.15.
- Project Manager- Managed seed emplacement efforts to support validation efforts of data collection as part of an ongoing Munitions Response Technology geophysical demonstration. EOTI provided six UXO Technicians to emplace 96 surrogate munitions seed items within the demonstration area. The demonstration was conducted by SERDP-ESTCP. Award Date: June 2014, Contract Value: \$35,993.77.
- Project Manager- Managed Unexploded Ordnance (UXO) underwater services to perform intrusive investigation on 100 previously geophysically maps anomalies within proximity to Gorge H. Nice Bridge, MD. EOTI provided one UXO dive team to reacquire and remove anomalies that could be potential MEC/UXO related items. Award Date: Oct 2013, Contract Value: \$135,934.00.
- Project Manager- Managed Unexploded Ordnance (UXO) Services to perform magnetometer sweep and clearance of four bridges footprints and surrounding lay down areas within areas of Eglin AFB, FL. EOTI provided one UXO team to detect and remove anomalies that could be potential MEC/UXO related items. Award Date: Oct 2013, Contract Value: \$81,119.08.
- Project Manager- Managed Unexploded Ordnance (UXO) Services to perform magnetometer sweep and clearance of approximately 25 foot by 3200 ft or 3.67 acres of Park Road within Padre Island National Seashore to support rehabilitation of main park road. EOTI provided one UXO team to detect and remove anomalies that could be potential MEC/UXO related items. Award Date: Oct 2013, Contract Value: \$29,943.85.
- Project Manager- Managed Unexploded Ordnance (UXO) Avoidance/Standby Support Services, in conjunction with repair & demolish of utility poles and installation of underground service efforts at, Facility 2150– Langley Air Force Base, VA. EOTI provided two UXO Technicians to perform UXO construction support surveillance and anomaly identification within the planned utility footprint. Award Date: Oct 2013, Contract Value: \$78,513.00.
- Project Manager- Managed Unexploded Ordnance (UXO) Construction Support Services, in conjunction with ongoing construction efforts at High Performance Computing Center Fort Meade, MD. EOTI provided two UXO Technicians to perform UXO construction support surveillance and anomaly identification within the construction footprint. Award Date: April 2013, Contract Value: \$684,457.74.
- Project Manager- Managed Unexploded Ordnance (UXO) Clearance Services, EOTI provided a MEC clearance team to augment clearance activities that were performed by the client during MMRP activities at Barry M. Goldwater range, Luke AFB, AZ. Award Date: Jan 2013, Contract Value: \$195,456.60.
- Project Manager- Managed Underwater anomaly investigation and resolution Services, EOTI provided a MEC dive team to investigate geophysical anomalies during RI/FS activities within lakes Denmark and Picatinny adjacent to Pinatunny Arsenal, NJ. Additionally, EOTI conducted documentation of underwater anomalies and disposal of Munitions Debris (MD) and cultural debris (CD) retrieved from each lakebed. Award Date: Oct 2012, Contract Value: \$68,088.09.

- Project Manager- Managed Unexploded Ordnance (UXO) Avoidance to support Generation of Biodegradation Sorption Barriers for Munitions Constituents within a specified grenade court at Fort Bragg, NC. EOTI conducted UXO avoidance and trenching operations to facilitate installation of monitoring devices to detect leaching of Munitions Constituents within the grenade court. Award Date: April 2012, Contract Value: \$23,909.63.
- Project Manager-Performed management of Munitions and Explosives of Concern (MEC) identification and construction support services at Naval Support Facility Indian Head, Indian Head Maryland, Site 11 Caffee Road Landfill. EOTI conducted UXO construction support and identification operations to facilitate on-going landfill maintenance. Award Date: April 2012, Contract Value: \$75,027.29.
- Project Manager- Managed Munitions and Explosives of Concern (MEC) construction support services to support early earthworks at Camp Williams, UT. EOTI UXO Construction Support Team monitored all excavation activities and identified unearthed items to determine if the items contained an explosive hazard that might impede construction development. Award Date: April 2012, Contract Value: \$248,267.17.

Assistant Project Manager Key Projects-

- Assistant Project Manager- Supported day-to-day operations during Munitions Response (MR) services necessary to remove Munitions and Explosives of Concern (MEC) and Material Potentially Presenting an Explosive Hazard (MPPEH), to include munitions debris and range related debris, from areas of the construction footprint for a proposed Sanitary Forcemain line at Camp Rudder, Eglin AFB, FL. Oversaw data collection methods, mapping, liaison between field teams and the Project Manager, project budgeting, equipment ordering, project logistics, and final report development.
- Assistant Project Manager- Assisted in management of project and project personnel during EOTI's performance in remove of Munitions and Explosives of Concern (MEC) and Material Potentially Presenting an Explosive Hazard (MPPEH), to include munitions debris and range related debris from the historic impact areas D6 and E2 located within West Point Military Academy in New York. Developed project specific GIS deliverables, personnel and equipment logistics,
- Assistant Project Manager-Facilitated project planning and execution of Munitions and Explosives of Concern (MEC) and Material Potentially Presenting an Explosive Hazard (MPPEH), to include munitions debris and range related debris, from areas of the construction footprint for the proposed Multi Purpose Machine Gun (MPMG) at Fort Richardson, Alaska. performed personnel staffing, logistics, GIS development and data collection procedures, personnel management, scheduling of subcontractors.

Diving Operations Plan

Prepared by:

Explosive Ordnance Technologies, Inc. (EOTI)

9050 Executive Park Drive 106-A

Knoxville, TN 37923

Under contract to:

Apex Companies, LLC

1600 Commerce Circle

Trafford, PA 15085

Dated: November 2014

Date Reviewed:

Project: Congaree River Project UXO Support

Diving Operations Plan

This Diving Operations Plan is a general overview of the underwater diving operations to be performed while conducting underwater intrusive activities at Congaree River Project in Columbia, SC.

If for any reason the dive plan is altered in mission, depth, personnel, or equipment, the Designated Diving Coordinator (DDC) will be contacted in order to review and accept the alteration prior to actual operation.

Plan prepared by:

Name: CB Woods

EOTI

9050 Executive Park Drive 106-A

Knoxville, TN 37923

Plan reviewed by:

Name: _____

Apex Companies, LLC

1600 Commerce Circle

Trafford, PA 15085

Name: _____

SCANA Services, Inc.

4077 Haywood Road

Miles River, North Carolina 28759

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Acronyms and Abbreviations

°F	degrees Fahrenheit
AHA	activity hazard analysis
AOC	area of concern
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
CRP	Congaree River Remediation Project
DDC	Designated Dive Coordinator
DDESB	Department of Defense Explosives Safety Board
DFW	definable feature of work
DoD	Department of Defense
DOP	Diving Operations Plan
DQCR	Daily Quality Control Report
EM	Engineering Manual
EOD	Explosive Ordnance Disposal
EOTI	Explosive Ordnance Technologies, Inc.
ESP	Explosives Site Plan
EZ	exclusion zone
fsw	feet of salt water
GPS	global positioning system
HAZWOPER	Hazardous Waste Operation and Emergency Response
HE	high explosives
IAW	in accordance with
IRA	Interim Removal Action
MC	munitions constituents
MD	munitions debris
MEC	munitions and explosives of concern
mm	millimeter
NAVFAC	Naval Facilities Engineering Command
No.	number
NWS	Naval Weapons Station
OSHA	Occupational Safety and Health Administration
PM	Project Manager
QA	quality assurance

QC	quality control
RI	Remedial Investigation
SCUBA	self-contained underwater breathing apparatus
SI	Site Investigation
SOW	scope of work
SSHP	Site Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
SWMU	solid waste management unit
U.S.	United States
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USCG	United States Coast Guard USN
UXO	unexploded ordnance
UXOQCS	UXO Quality Control Specialist
UXOSO	UXO Safety Officer

1. Project Introduction

1.1 PROJECT WORK AUTHORITY

Apex Companies, LLC (Apex) has contracted EOTI to perform underwater clearance of Munitions and Explosives of Concern (MEC) in support of contaminated soil and sediment removal on the Congaree River Project (CRP), Columbia, South Carolina (SC).

This Diving Operations Plan (DOP) is a living document. A living document is one that can be modified, as necessary, to best achieve the goals and objectives stated within. Based on field observations, site conditions, and other unknown circumstances or conditions, this document may be modified in order to best achieve the objectives of the underwater intrusive activities. If for any reason the DOP is altered in procedures, depth, personnel, or equipment, the USACE Designated Dive Coordinator (DDC) will be contacted in order to review and accept the alteration prior to actual operation.

This DOP provides the technical approach, rationale, and field procedures to be followed in order to achieve the objectives of the underwater clearance activities during the CRP, Columbia, SC. This DOP was prepared in accordance with (IAW) the APEX Contract No. 875001, dated March 11, 2014 and EOTI proposal dated March 3, 2014.

1.2 PROJECT PURPOSE

The purpose of the CRP diving activities in remediation area shown on **Figure 1**, is to remove MEC in order to reduce hazards from Civil War era military munitions co-located within the coal tar contaminated soil and sediment removal area. EOTI will be performing dive operations to remove MEC from a coffer dam footprint prior to installation by Apex. The underwater intrusive activities will be completed IAW the USACE and the Department of Defense (DoD) Explosives Safety Board (DDESB) approved Explosives Safety Submission (ESS).

1.3 PROJECT LOCATION

The CRP area is located on the Congaree River in Columbia, SC. The site, also referred to as the “project area”, begins directly south of the Gervais Street Bridge, extends approximately 200-300 feet into the river from the eastern shoreline and approximately 2,000 feet downriver, towards the Blossom Street Bridge. The underwater intrusive activities will occur on eastern side of Congaree River between Gervais and Blossom Street Bridges, shown on **Figure 1**.



1.4 SITE BACKGROUND, AND DESCRIPTION

In 1865, during the Civil War, live munitions and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman's occupation and subsequent destruction of Columbia. The Union Army kept some of these items for its own use and the remainder was destroyed. One of the methods for destruction was dumping the items into the river.

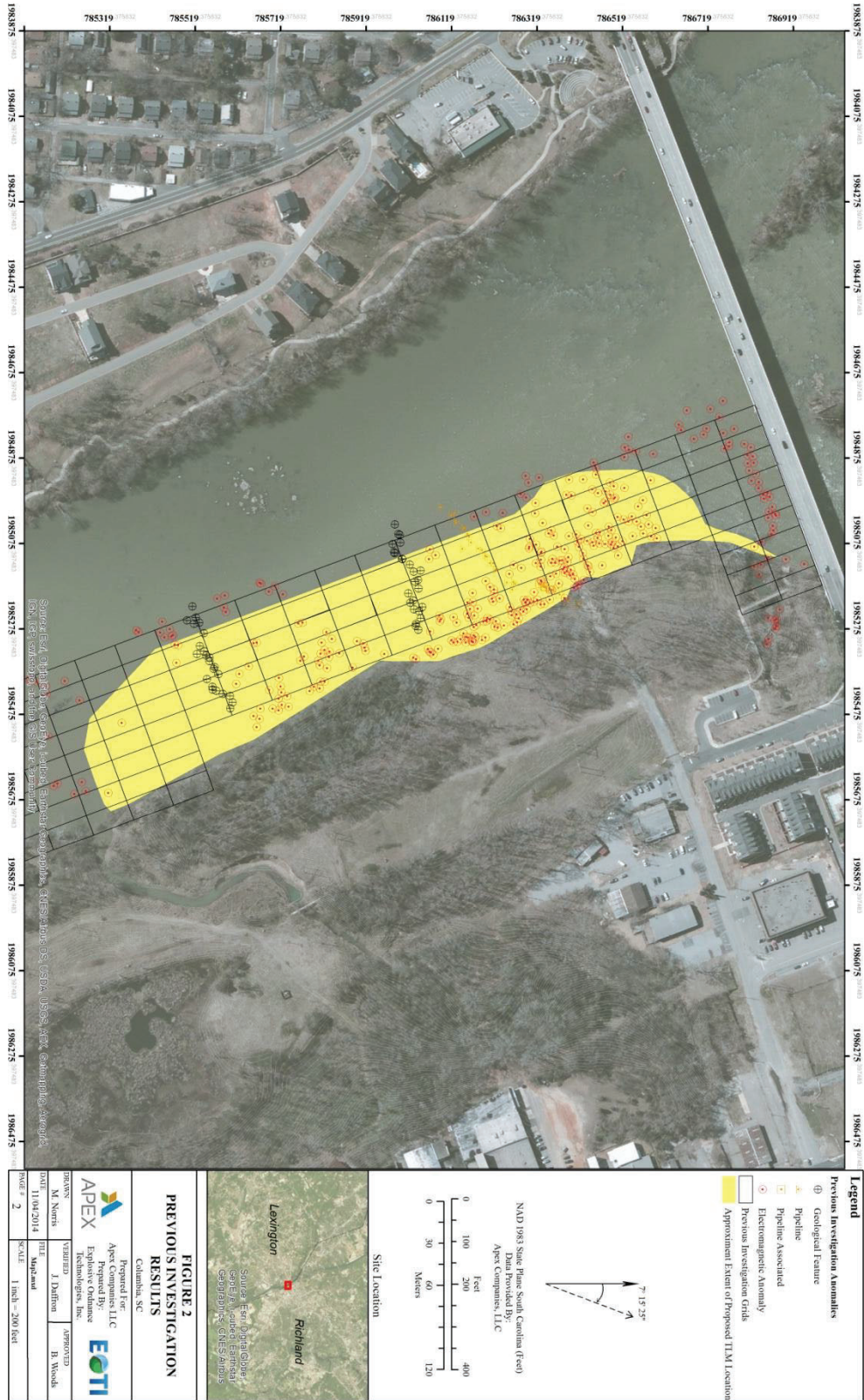
Archeological investigations, conducted as late as 1980, recovered some live and unstable munitions or unexploded ordinance (UXO) from the area as well as some other potentially historically significant artifacts. Specifically this work was focused in and adjacent to the unnamed tributary that enters the river just south of the Gervais Street Bridge. Several live cannonballs were identified during this operation and properly disposed of by trained explosive ordinance disposal (EOD) personnel located at nearby Fort Jackson.

Due to the potential presence of live munitions within the project area, an additional reconnaissance and screening of the area in question was conducted as part of the investigative activities. An acoustic (side scan sonar) and magnetic (magnetometer) remote sensing survey was performed to identify ordnance and other submerged cultural resources in the remediation area by Tidewater Atlantic Research, Inc. and a report submitted on 8 February 2012. Analysis of the survey data identified concentrations of anomalies with unexploded ordnance (UXO) potential in the immediate vicinity of the Senate Street landing and scatters extending into the river. A terrestrial magnetometer investigation of the unnamed tributary below the Gervais Street Bridge was also carried out and that investigation identified eight additional anomalies with a potential association with ordnance. Figure 2 shows the location of anomalies detected during the February 2012 investigation.

In June 2010, the occurrence of a tar-like material (TLM) within the Congaree River was reported to the South Carolina Department of Health and Environmental Control (SCDHEC). Preliminary testing indicated that the material may be attributable to the Huger Street former Manufactured Gas Plant (MGP) that was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950s.

Preliminary sample results conducted on the material by SCDHEC and South Carolina Electric and Gas Company (SCE&G) indicated that the TLM had similar chemical and physical characteristics as coal tar, a by-product of Manufactured Gas Operations which were common in cities from the late 1800s until the 1950s. Additional research found that the most likely source of the TLM was a former Manufactured Gas Plant (MGP) located northeast of the river at 1409 Huger Street that operated from about 1906 until the mid-1950s. Later this was the location of the city bus terminal until 2008.

MGPs produced a flammable gas from coal that was used for heating, cooking and lighting purposes prior to the construction of interstate natural gas pipelines. The coal tar material was a waste product from coal-gas production. Once the gas was produced, the coal tar by-product was discharged into a former stream which originated at what is known today as Finley Park, past the MGP site, and into the Congaree River just below the Gervais Street Bridge. The Huger Street MGP was operated by predecessor companies of South Carolina Electric & Gas (SCE&G) beginning in the early 1900s and ending in the 1950s, prior to the existence of environmental regulations and permitting.



SCE&G had previously entered into a Voluntary Cleanup Contract (VCC) with DHEC in August 2002 to conduct environmental assessment and cleanup activities at the former Huger Street MGP site. SCE&G has worked proactively and cooperatively with DHEC under its existing VCC to determine the extent of TLM in the Congaree River and to develop a plan for cleanup. Overall, the delineation activities extended from the Gervais Street Bridge downriver approximately 9,050 feet.

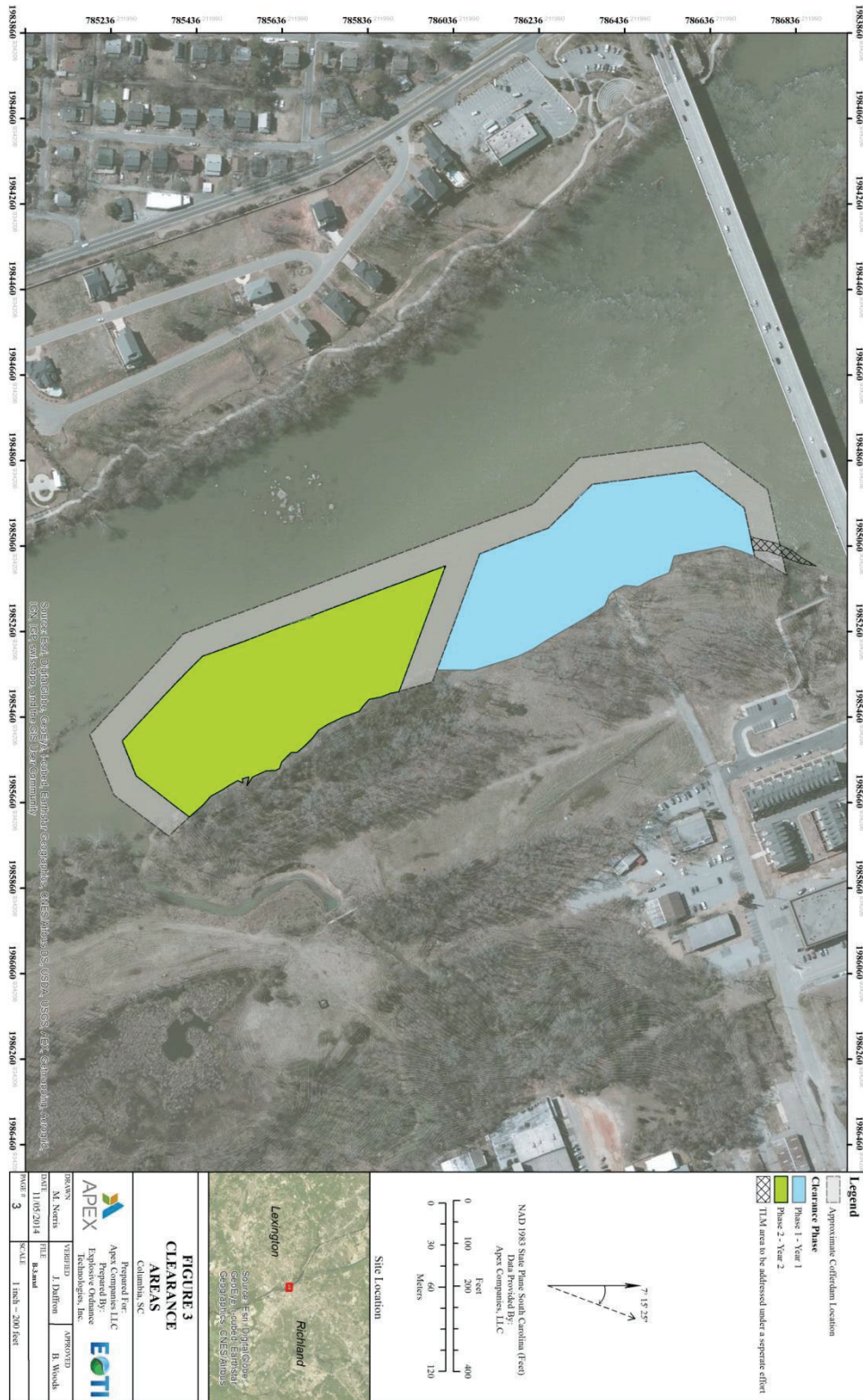
An Engineering Evaluation/Cost Assessment (EE/CA) was prepared and a Final was submitted in January 2013. A non-time critical removal action of the impacted river sediments was chosen as the alternative. The TLM-impacted sediment varies in thickness from a few inches to approximately 6 feet thick in some areas. The current total estimate of sediment requiring removal is approximately 40,000 tons. The total project area is estimated to be 23 acres, with 10.5 acres consisting of waters of the United States. The landside or upland portion of the project area consists of approximately 12.5 acres of mostly undeveloped land with a cleared utility right-of-way. Much of the area will not be disturbed.

On August 21, 2013 a public release was issued summarizing the project purpose and objectives detailing that this is an environmental clean-up project mandated by SCDHEC intended to remove approximately 40,000 tons of tar-like material (TLM) and impacted sediment from the Congaree River. The removal of the impacted sediment will result in a permanent improvement to the aquatic environment in the project area. Upon completion of the removal activities in the Congaree River, the project area will be allowed to return to its original preimpacted state.

The removal of MEC from the impacted sediments under the coffer dam structures under this dive plan is to protect worker safety, environment and assist in the segregation and disposal of impacted sediment.

1.5 REMOVAL OBJECTIVES

The objective of this dive plan is to locate and remove MEC from underwater sediment in the location of future cofferdam area footprints. The cofferdams are to be installed prior to coal tar contaminated soil/sediment removal. The dive clearance of the cofferdam footprints will be performed in three separate phases in coordination with Apex three phase cofferdam installations. Figure 3 shows the location of the footprint to be cleared during each phase of the project. The project is performed in two phases “to minimize the potential for over-topping events and impacts on potential endangered species in the river, the “in-river” construction season will start on May 1 and continue through October 31 for each of the three years.” The overall objective of removing MEC is to reduce the risk to environmental construction workers and reduce the potential of MEC within the removal action area boundaries.



**FIGURE 3
 CLEARANCE
 AREAS**

Prepared For: **Apex Companies LLC**
 Prepared By: **Apex Companies LLC**
 Date: **11/05/2014**

APEX Apex Companies, LLC 11000 N. North Charlotte, NC 28263	EOTI EOTI Environmental Operations 11000 N. North Charlotte, NC 28263
Drawn By: M. North	Approved By: B. Woods
Checked By: J. Dalton	Approved By: B. Woods
Scale: 1 inch = 200 feet	

1.6 SCHEDULE

The underwater intrusive activities are tentatively scheduled to begin in Spring/Summer 2015. The preliminary schedule is as follows:

- Respond to comments and finalize DOP in May 2014.
- Begin Phase 1 coffer dam underwater intrusive activities in May to October 2015.
- Begin Phase 2 coffer dam underwater intrusive activities in May to October 2016.
- Begin Phase 3 coffer dam underwater intrusive activities in May to October 2017.
- Project reporting activities November to December 2017.

During the course of the underwater intrusive activities, modifications to the schedule may be necessary. The schedule modifications will be submitted to USACE, and will include:

- Reasons for the modification
- Descriptions of the alternatives evaluated to increase productivity (e.g., increase manpower, lengthen work days, more efficient equipment, etc.)
- Methods that will be used to prevent similar delays from happening again

1.7 DIVING OPERATIONS PLAN ORGANIZATION

This DOP is organized as follows:

- **Section 1 – Introduction.** Presents the authority, purpose, project description and general scope, personnel, site description and history, removal objectives, and tentative schedule for CRP underwater intrusive activities.
- **Section 2 – Dive Team.** Summarizes the names and duties of personnel involved with diving operations for CRP.
- **Section 3 – Equipment.** Provides a description of required equipment and platform to be utilized during diving operations.
- **Section 4 – Tasks.** Summarizes the tasks for underwater intrusive activities.
- **Section 5 – Dive Operations.** Details the procedures to be followed during diving operations, underwater intrusive activities, field Quality Control (QC) procedures and requirements to be followed.
- **Section 6 – Key Personnel.** Describes project key personnel and organization for diving activities.
- **Section 7 – Project Records and Reporting.** Lists project reporting deliverables for the CRP underwater intrusive activities.
- **Section 8 – References.** Provides references used to develop this DOP.

This section provides information on the CRP Dive Operations Team for underwater intrusive activities.

2. Dive Team

2.1 PERSONNEL

Listed in the Table 2-1 below are the team requirements, as defined in Appendix O of EM 385-1-1, that will be met for self-contained underwater breathing apparatus (SCUBA) diving operations:

**TABLE 2-1
DIVE TEAM PERSONNEL COMPOSITION**

Personnel Assignments	Number of personnel
Dive Supervisor (Dive qualified, unexploded ordnance [UXO] qualified)	1
Stand-By Diver	1
Diver in the water (tethered with communications)	1
Tender	1
Total Team Requirements	4

It is anticipated that one diver will be in the water at a time. The diver in the water will be tethered using a safety harness equipped with a positive buckling device, an attachment point for the safety line, and a lifting point to distribute the weight over the diver's body while maintaining a heads-up attitude if unconscious. The safety line will be a positive control link to the surface that can also be used for line pull signals and diver recall. The tender will maintain constant communication with the tethered diver using two way voice communications or using line pull signals as described in Attachment B of EOTI's Diving Safe Practices Manual. In visibility of less than three feet two way voice communication will be maintained and the diver will be line tended. The tender will not perform any other duties while the diver is in the water. This will ensure that the diver is in constant contact with at least one other member of the dive team. If it becomes necessary for the stand-by diver to enter the water, the Dive Supervisor will serve as his tender.

The Project Dive Operations Team is identified on **Table 2-2**.

TABLE 2-2**DIVE TEAM PERSONNEL AND DUTIES**

NAME	DUTIES
Nelson Figeac	Dive Supervisor , Diver, Standby Diver, Tender, Senior Unexploded Ordnance Supervisor (SUXOS)-Qualified, Safety Boat Operator
Tom Dailey	Dive Supervisor, Diver, Standby Diver, Tender, UXOQCS
Rickey Hammer	Diver, Standby Diver, Tender, UXO Technician
Harry Craig or Kevin Kerns	Diver, Standby Diver, Tender, UXO Technician

If for some reason a diver is unable to complete the project (e.g., health, family problems, etc.) a qualified alternate diver will be substituted. Alternate diver qualification will be submitted to the USACE DDC prior to a new diver joining the dive operations.

Dive station will be manned by no less than a Dive Supervisor, Diver, Standby Diver and Tender. Under normal operations, one diver will be in the water at a time. The tender will maintain constant contact with the diver, tend the tether and monitor potential hazards to the diver. A standby diver will be dressed and ready to assist in an emergency any time that a diver is in the water. The primary Dive Supervisor is Nelson Figeac. He is the person responsible for all dive operations.

The Dive Supervisor is responsible for all dive-planning, briefings, monitoring diver depths and dive times, and recovering and deploying the dive teams accordingly.

Prior to mobilization, personnel training and requirements will be confirmed to ensure that dive personnel have the appropriate training, licenses, certifications, and experience. Copies of certifications/qualifications will be submitted for review two weeks prior to beginning dive operations and copies will be maintained on site and available for review by APEX and USACE representatives. The relevant personnel requirements for underwater intrusive activities at CRP will include the following:

- Workers who may be exposed to contaminated media will have completed 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) certification, 8-hour HAZWOPER refresher certification as appropriate, and medical monitoring set forth in 29 Code of Federal Regulations (CFR) 1910.120. Workers who are not in direct contact with contaminated media will be exempt from this requirement. Exempt workers include Quality Assurance (QA) representatives and project management, as long as they are protected from exposure to contaminated media and remain outside the exclusion zone (EZ) for intrusive activities.¹

¹ 29 CFR 1910.120(e)(3)(i) defines employees who are required to have 40-hour HAZWOPER training. It requires workers "...engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances and health hazards..." to receive 40 hours of HAZWOPER training. An OSHA Interpretation Letter dated November 19, 1991 states that "if potential for exposure is extremely unlikely the standard would not apply." Employees protected from exposure and that remain outside of the exclusion zone during intrusive operations are extremely unlikely to be

- Divers will meet or exceed the minimum qualification in accordance with DDESB Technical Paper (TP) 18.
- Site supervisors must successfully complete the Occupational Safety and Health Administration (OSHA) 8-hour HAZWOPER Supervisor Course.
- Diver personnel have completed the OSHA-approved basic 40-hour health and safety training HAZWOPER course, annual refreshers of the same, military diver course for the apparatus utilized onsite, oxygen administrator, first aid, and cardiopulmonary resuscitation (CPR). Field personnel, required training, and the most current completion date of training are presented in a separate stand-alone document submitted to USACE and are not included in this DOP.
- Diver will meet or exceed the training and experience requirements of EM 385-1-1, Section 30.A.08.

All workers will be required to read and understand the Site Safety and Health Plan (SSHP), Diving Safe Practices Manual, Emergency Management Plan, Activity Hazards Analysis (AHA), and daily safety briefings will be completed as work progresses.

exposed to safety hazardous substances or health hazards associated with the hazardous waste operations.

This section provides information on the anticipated diving and support equipment to be utilized at CRP.

3. Equipment

3.1 DIVE EQUIPMENT AND PLATFORM

The diving method will utilize SCUBA. The associated equipment to support SCUBA operations will include the following:

- SCUBA Tank -80 CF Steel or Aluminum Construction
- Diver Communications – Two way voice communication similar to Ocean Technologies System Model OTS-BUD-D2
- Emergency Gas Supply – 30 CF with separate regulator
- Diver Knife
- Full Face Diving Mask – with integral regulator
- Surface Communications
- Thermal Protection –Wet Suit or Dry Suite
- Diver Swim Fins
- Buoyancy Compensator
- Diver Computer
- Underwater Light

The minimum support equipment to be utilized will include the following:

- Dive Flag
- Medical Kit
- Underwater Camera
- Current Flow Probe
- Oxygen Kit
- Marine Radio
- Fathometer
- Litter/Backboard
- Cellular Phone

The diver will be walking in from the shore with safety boat attending in the water.

This section provides the required tasks for underwater intrusive activities at CRP.

4. Tasks

4.1 TASK 1 MOBILIZATION AND DEMOBILIZATION

Once pre-mobilization activities are complete, the dive crew and all associated materials and equipment necessary to perform the underwater intrusive activities will mobilize to CRP. The personnel and operations-specific equipment are summarized in **Sections 2 and 3**.

Demobilization of all diving-related personnel and equipment will occur after all underwater intrusive objectives have been safely completed and accepted by Apex and USACE.

4.2 TASK 2 DOCUMENTATION

EOTI will prepare all USACE required diving-related documents and plans for review by Apex and USACE. All plans will be approved by Apex and accepted by USACE prior to mobilization to CRP. Required documents include the Diving Safe Practices Manual and this Diving Operations Plan with its attachments including an Emergency Management Plan and AHA.

4.3 TASK 3 CRP REMOVAL ACTION

The goal of the removal action is to locate and remove MEC from within the cofferdam footprint. The Dive Operations Team will perform underwater mag and dig of anomalies encountered using the stationary jackstay method described in Section 2.7 of the EOTI Dive Safe Practice Manual. Each anomaly identified will be manually investigated not to exceed 12 inches below river bottom.

This section details the procedures to be followed during diving operations, underwater intrusive activities.

5. Dive Operations

Diving operations shall be performed IAW with USACE Engineering Manual (EM) 385-1-1 and dive activity will be coordinated with the USACE Dive Safety Office. If for any reason the dive plan is altered in mission, depth, personnel, or equipment, the DDC will be contacted in order to review and accept the alteration prior to actual operation.

Direct communications between the dive sites, project office, Apex Project Manager (PM), DDC and other involved personnel will be via cell phone. Divers will have communication with the surface, and diver-to-diver. Dive supervisor will positively control diver movement within the designated work area. Divers will be monitored by thru-water communication system.

Familiarization dives may be conducted to verify competency of the overall dive team.

5.1 CRP REMOVAL ACTION

The goal of the removal action is to locate and remove MEC from within the cofferdam footprint in three separate phases, as shown on **Figure 3**. The Dive Operations Team will perform underwater mag and dig of anomalies encountered. Each anomaly identified will be manually investigated not to exceed a depth of 4 feet or to bedrock whichever is encountered first. Removal of MEC from the area between the coffer dams will be done after the water has been removed under a separate effort covered under a work plan for dry land portion of the MEC clearance.

Divers will gather information describing the source of each anomaly, including the following; item description, item weight, MEC condition, MEC nomenclature, bottom type/condition, and any other notable features. Acceptable to move MEC and MD will be transferred to land for final disposition. Unacceptable to move MEC will be detonated in place. Non-munitions-related debris will be left in place during this task.

Each MEC or MD item found will be marked using a GPS unit to an accuracy of +/- 3 meters. Once an item has been positively identified, and determined acceptable to move, it will be relocated within the land portion of the removal area. The final explosives safety status of a discovered MEC item as acceptable or not acceptable to move will be made by the SUXOS-qualified Dive Supervisor in consultation with the diver who investigated the item. Information such as the munition type, nomenclature, condition, and surrounding environment will be considered when determining if an item is acceptable to move or not.

Divers will use an all metals locator along grid lines established as part of the stationary jackstay method described in Section 2.7 of the EOTI Dive Safe Practice Manual. Each target anomaly location will be manually investigated and resolved not to exceed 12 inches below river bottom. The anticipated maximum depth of dives is 30 fsw. Divers will be utilizing a “no decompression limit” of 30 fsw for a maximum bottom time of 371 minutes (U.S. Navy Diving Manual, Rev. 6, 15 April 2008). A maximum single dive bottom time will be no greater than 180 minutes.

Munitions Constituent (MC) sampling of the sediment is not required for this field effort. Should MC sampling be needed it may be conducted by divers either during the removal process or as a separate dive. In the event that sediment sampling is needed, the EOTI Dive Supervisor will coordinate underwater sampling activities.

At the end of each diving day, all data including field notes, site photographs, and positioning data will be consolidated and submitted to the EOTI PM.

5.2 DIVING CONDITIONS

The Dive Operations Team will perform all assigned tasks during daytime within allowed current restrictions. Other factors that affect diving operations include:

- Surface conditions - No diving will be performed if the surface conditions do not permit the diver to maintain depth control. Dive operations will be suspended at Beaufort scale Sea State 3.
- Boat Traffic – Anticipate some boat traffic during the operation period. Whenever boat traffic is present in the vicinity of diving operations, the EOTI safety boat will keep other boats away from the area of dive operations. The safety boat will be positioned with visibility of the dive operation and avenues for approaching boats. Communication will be maintained between the safety boat and dive location. If possible the safety boat will divert boat traffic around the exclusion zone. If a boat enters the exclusion zone the dive supervisor will be notified and will immediately halt intrusive operation until the boat is safely outside of the exclusion zone.
- Underwater conditions – Shallow dives are heavily influenced by the surface conditions and may impact diving operations. No dives will be performed if conditions do not permit the diver to maintain depth control. The dive supervisor will have ultimate decision to cease diving operations if unsafe conditions occur.
- Visibility – Visual survey will be suspended when nominal visibility is less than 1 foot. A tactile survey with tethered divers may be conducted if visibility is degraded below 3 feet.
- Water Temperature – Thermal protection for the divers will be provided by a wetsuit or dry suit, as needed, to ensure diver protection and comfort. Divers will choose dive dress, and selection will be approved by the EOTI Dive Supervisor/SUXOS.
- Currents – Prior to conducting dive operations and prior to deploying any divers, the Dive Supervisor will measure current velocity using an FP 211 Global Flow Probe or similar instrument. If currents exceed 1-knot, divers will not be deployed and dive operations will be suspended until the current falls below 1-knot.

5.3 QUALITY ASSURANCE OVERSIGHT

Oversight of field activities may be requested by Apex or other stakeholders. At least 48 hours prior notice will be given to EOTI by those requesting oversight for purposes of coordination.

It is anticipated that Apex will have one person assigned in a safety and quality oversight role and may also be present during diving operations. If there is a need to answer questions, etc. the EOTI dive team leader/SUXOS will be the primary point of contact.

This section presents the project team, key personnel, and responsibilities for underwater intrusive activities during the MEC clearance dive activities.

6. Key Personnel

6.1 RESPONSIBILITIES

Project team responsibilities are discussed below.

6.1.1 Dive Supervisor

The Dive Supervisor is responsible for implementing the DOP, Diving Safe Practices Manual, Emergency Management Plan, and applicable AHA's. The Dive Supervisor will also serve as the UXOQCS and is responsible for field equipment calibration, oversight of diving operations, field documentation, submittal of Daily Quality Control Reports (DQCRs) to the EOTI PM and Apex PM, and assisting in the preparation of progress reports.

The Dive Supervisor will report directly to the EOTI PM and is responsible for leading and coordinating the day-to-day activities of the various resource specialists. Specific Dive Supervisor responsibilities are identified in Section 3.3 of the EOTI Diving Safe Practices Manual.

6.1.2 Diving UXO Specialist (Diver)

The diving UXO Specialist is the diver in the water. He is a U.S. Navy trained diver that is UXO qualified with the proper diving and MEC experience to perform assigned tasks. Specific requirements and responsibilities for the position are described in Section 3.3 of the EOTI Diving Safe Practices Manual.

6.1.3 Standby Diver

The standby diver meets all of the requirements of the Dive UXO Specialist and is dressed and prepared to enter the water to assist the diver anytime the diver is in the water. Specific requirements and responsibilities for the position are described in Section 3.3 of the EOTI Diving Safe Practices Manual.

6.1.4 Tender

A dedicated tender will be assigned to the diver while he is in the water. If the standby enters the water, the Dive Supervisor will serve as his tender. Responsibilities of the Tender are described in Section 3.3 of the EOTI Diving Safe Practices Manual.

This section presents the Project Records and Reporting for underwater intrusive activities during the MEC clearance diving activities.

7. Project Records and Reporting

7.1 PROJECT RECORDS

7.1.1 Field Documentation

Field documentation includes daily reports for each day of fieldwork that present information pertaining to field activities. These reports will be maintained by the Dive Supervisor and include field notes, photographs and positioning data. Reports are submitted to the EOTI PM and the Apex PM.

7.1.2 Dive Logs

Dive logs/records will be completed for each diver on each diving day during underwater intrusive activities. The individual dive logs will document conditions and exposure to diving. Dive logs will be maintained by members of the dive team and crosschecked for completeness at the end of each day by the Dive Supervisor. They will be signed and dated by each individual diver making their personal entries, their dive buddy (if applicable), and the Dive Supervisor. Dive logs will be submitted to USACE upon completion of dive operations per EM 385-1-1, Sec. 30.A.28.

7.2 PROJECT REPORTING

Project reporting requirements include preparation of reports that document all diving-related field activities completed at CRP. These will include draft/draft final deliverable project reports, as well as documents summarizing field activities. These reports will be based on project records that include field logbooks; discrepancy reports; and records of conversations, meetings, and correspondence.

8. References

- Apex Companies, LLC. 2013. Design Drawings Figures 1 through 5. February - November
- Department of the Army (DA). 2008. Technical Manual (TM) 60A-1-1-31, Explosive Ordnance Disposal Procedures, General Information on EOD Disposal Procedures (Revision 5). October.
- Department of Defense Explosives Safety Board (DDESB). 2004. Technical Paper (TP) 18. Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel. 20 December.
- Department of Defense (DoD) Ammunition and Explosives Safety Standards. 2012. DoD Ammunition and Explosives Safety Standards DOD Manual 6055.09-M
- Department of Defense (DoD). 2008. DoD Instruction (DoDI) 4140.62, Material Potentially Presenting an Explosive Hazard. November.
- DDESB. 2012. TP 16. Methodologies for Calculation Primary Fragment Characteristics.
- Management and Technical Resources, Inc. 2013. Final Engineering Evaluation/Cost Analysis (EE/CA), Congaree River Sediments, Columbia, South Carolina. January.
- Revision 4. August United States Army Corps of Engineers (USACE) 2006. Safety and Health Requirements Manual EM 385-1-97 (with Erratas)
- South Carolina Department of Health and Environmental Control (SCDHEC) 2013. Public Notice-Congaree River Project. 21 August.
- Tidewater Atlantic Research, Inc. 2012. A Terrestrial Remote-Sensing Survey of the Congaree River Below the Gervais Street Bridge, Phase IV Report, Columbia, South Carolina. 8 February.
- United States Army Corps of Engineers (USACE) 2013. Safety and Health Requirements Manual EM 385-1-1
- United States Army Corps of Engineers (USACE) 2010. USACE Dive Program. ER 385-1-86. September.
- United States Navy (USN). 2008. USN Diving Manual. Revision 6. April.

Note: *This Emergency Management Plan is to be used in conjunction with the Site Safety and Health Plan. Ensure that all personnel are familiar with the policies, procedures, and requirements outlined in both plans.*

Emergency Service (Ambulance, Fire, Police)—911

Columbia Fire Dept.

1800 Laurel St
Columbia, SC
(803) 545-3700

Palmetto Health Richland

5 Richland Medical Park Drive
Columbia, SC 29203
(803) 434-7000

Nearest Hyperbaric Chamber Facility**Palmetto Health Richland**

5 Richland Medical Park Drive
Columbia, SC 29203
(803) 434-7000

Divers Alert Network (D.A.N.)

Emergency +1-919-684-9111 Phone 1-800-446-2671

Poison Control Center

(800) 962-1253

United States Corps of Engineers

(Name) TBD
Office:
Email:

District Ordnance and Explosives Safety Specialist (OESS)

(Name) TBD
Cell:
Email:

Apex Project Manager

Rusty Contrael
Office: 412-829-9650
Cell: 412-721-6494
rcontrael@apexc.com

EOTI Project Manager
James Daffron, PE
Office: 865-200-8081
jdaffron@eoti.net

Nearest Hospital Information and Route

Name: **Palmetto Health Richland**
Address: 5 Richland Medical Park Drive
Columbia, SC 29203
Phone: (803) 434-7000

See description and map of the route below.

Nearest Recompression Chamber

Name: **Palmetto Health Richland
Hyperbaric Medicine**
Address: 5 Richland Medical Park Drive
Columbia, SC 29203
Phone: (803) 434-7000

From the Project Area



Project Site

1. Head **north** on **Gist St** toward **City Club Dr** 482 ft
2. Take the 2nd right onto **Gervais St** 0.2 mi
3. Turn left onto **US-21 N/US-321 N/Huger St**
Continue to follow US-21 N/US-321 N 0.8 mi
4. Keep right at the fork, follow signs for **U.S. 21/U.S. 176/U.S. 321/Elmwood Avenue** and merge onto **US-176 W/US-21 N/US-321 N/US-76 E**
Continue to follow US-76 E 1.1 mi
5. Turn left onto **Bull St**

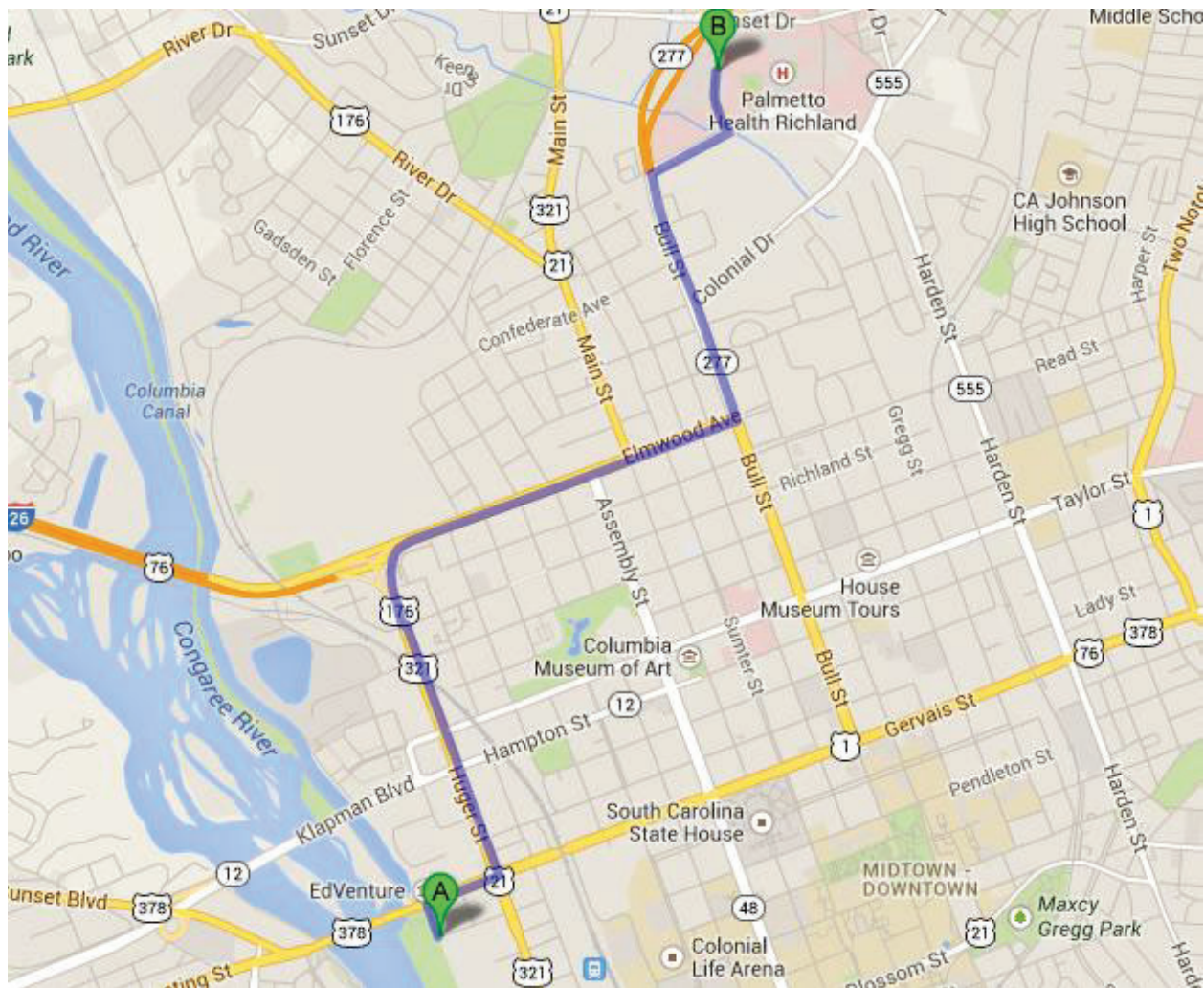
0.7 mi
6. Turn right onto Harden Street Extension(signs for **Harden St**)

0.2 mi
7. Turn left onto Richland Medical Park Dr

Destination will be on the right



0.2 mi
5 Richland Medical Park Dr
Columbia, SC 29203



Emergency Procedures

In every diving operation, the possibility of an accident occurring must be considered. The need for a prompt, decisive plan of action in an emergency is essential for the safety of all diving personnel. The Dive Supervisor will implement the following procedures for the respective situations described below.

1. Buddy Separation

- The divers will look/feel 360 degrees around for his dive partner; and
- Both divers will come to the surface with one hand above head.

2. Lost Diver

- Initiate diver recall and wait one (1) minute for response;
- Mark the last known position of the lost diver with a buoy to establish a reference point where searches can start;
- Deploy the standby diver (Dive Supervisor direction) to swim after bubbles or to conduct a circle line search starting at the lost diver buoy;
- Notify ship/boats in the area to look out for the lost diver;
- Request emergency medical help and report situation to Apex Project Office and EOTI Corporate Offices; and
- Ensure stricken divers recovered get immediate, effective treatment.

3. Loss of Air/Equipment Malfunction

- Signal dive partner and abort dive;
- Buddy breath/activate reserve; and
- Exhale to the surface.

NOTE: No diving will proceed until the equipment is replaced/repared (with functional checks performed) and the Dive Supervisor has given the OK to proceed with the operation.

4. Mechanical Injury

- Diver will inform the Dive Supervisor of any mechanical injuries no matter how slight they may seem;
- Dive Supervisor will rule out any doubt of decompression sickness; and
- If immediate treatment is required, recall all divers and transport to recompression chamber/emergency Room.

5. Decompression Sickness (“The Bends”) or Arterial Gas Embolism (air embolism)

- Recall all divers from the water;
- Arrange immediate transport of stricken diver(s) to chamber;
- Notify Apex Project Office and EOTI Corporate Office of circumstances;
- Perform neurological exam and record on (EOTI Diving Safe Practices Manual, Attachment J); and

- Treat for shock.

6. Fouled Diver

- Diver will notify dive partner, if appropriate, otherwise will notify Dive Supervisor through line pull signals;
- If only one diver is in the water, then the standby diver will assist the fouled diver under the direction of the Dive Supervisor;
- Diver and dive boat personnel must remain calm; and
- Take additional cylinders of air to the fouled diver, if needed.

7. Explosive Detonation with Diver (s) in the Water

- Attempt to establish communications with the diver via tending line:
- If communications are established with the diver immediately recall diver to the surface;
- If no communications are reestablished slowly pull the tending line to the surface to recover the diver. If the tending line is fouled deploy the standby diver;
- If the tending line has parted, mark the last location of the diver and begin a surface search of the area. If no contact is made, deploy the standby diver in the last known diver location and begin a systematic search of the area.

8. Diver Emergency Recall

- If diver is tended use standard line-pull signals to recall diver (See Attachment B of the EOTI Diving Safe Practices Manual);
- If diver is untended use diver audible (Metal-on-metal in the water) or mechanical recall; and
- Upon notification of recall by any means the diver will surface immediately.

9. **Injured Diver:** If a diver is injured and unable to enter the boat under his/her own power, the remaining team aboard the boat/platform (Dive Supervisor, Tender/assistant, etc.) will be used to assist or place the injured diver into/on the boat/platform or may hold onto the diver and use the boat/platform to get to the shoreline. Contact first responders immediately and render emergency first aid as necessary.

10. **Fire:** Fire extinguishers will be maintained ready at the dive site location. Only attempt to put out small fires as necessary of prevent injury or loss of life. Contact first responders immediately upon discovery. Also see Site Safety and Health Plan submitted as part of the Work Plan.

11. **Inclement weather:** All diving operations will be suspended if lightning is located within 10 nautical miles of the dive site. During high winds greater than 30 miles per hour, boating and platform operations will be suspended. Also see Site Safety and Health Plan submitted as part of the Work Plan.

12. **Medical Injury or Illness:** See Attachment A to the EOTI Diving Safe Practices Manual as well as the Site Safety and Health Plan submitted as part of the Work Plan. Contact first responders immediately. Render first aid as necessary until an emergency medical team arrives.
13. **Critical Equipment Failure:** In the event of an equipment failure of a critical component of the dive operations, all dive operations will be discontinued until the equipment is replaced or repaired and the Dive Supervisor has given authorization for dive operations to continue.
14. **Injury/illness of surface crew:** If a severe injury or illness occurs while a diver is in the water, the diver will be recalled immediately to the surface. Diver will either enter the boat/platform to help render assistance or head to the shore and provide assistance as necessary.
15. **Dive Blow Up / Over Rapid Ascent to the Surface:** Depths of dives for the project are unlikely to produce a requirement for decompression during ascent. If a diver is believed to have ascended too rapidly, the Dive Supervisor will evaluate the situation to confirm that no decompression stop was required. Dive tables will be consulted. The diver will be observed on the surface for one hour. If symptoms of decompression sickness are observed or suspected, the diver will be treated for decompression sickness as described above.
16. **Loss of Communications:** If communications are lost between a tender and diver and cannot be regained quickly, an audible recall signal will be sounded. If the diver does not surface in a reasonable amount of time after the audible re-call signal has been initiated the stand-by diver will be dispatched to the last known location of the diver. If communications are lost between the diver and the tender and cannot be regained quickly, the diver will surface immediately. The reason for the loss of communications will be investigated and remedied prior to continuation of the dive.
17. **Emergency Victim Transportation:** If an injury or illness requires treatment beyond first aid, the victim will be transported to the appropriate medical facility, identified above (or as determined by first responders). The first aid-trained technician treating the victim will make the initial assessment related to the need for additional treatment. First responders will be notified of the situation through a call to 911. If the situation requires transportation by ambulance the victim will be moved (if determined safe and necessary to do so) to a pick-up location where first responders can be directed. Two personnel will remain with the victim until emergency responders arrive. One will administer first aid and monitor the victim and the other will maintain communication with the first responders. If it is appropriate or necessary for EOTI to transport a victim for follow-up care, three personnel will accompany the victim. One will administer first aid and monitor the victim, one will drive and the third will maintain communication with the treatment facility, as necessary.

FIRST AID FOR DIVING RELATED INJURIES

1. FIRST AID FOR INJURIES REQUIRING IMMEDIATE TRANSPORT TO A CHAMBER FACILITY

1.1 Air Embolism

Recognition - Usually occurs during or immediately after surfacing

Symptoms (one or more of the following)

- Disorientation or Fatigue
- Skin Itch
- Chest Pain
- Numbness, Tingling, Paralysis or Weakness
- Dizziness, Vertigo, or Ringing in the Ears
- Blurred Vision
- Personality Change

Signs (one or more of the following)

- Bloody froth from nose or mouth
- Paralysis or Weakness
- Unconsciousness
- Convulsions
- Shortness of Breath or Cessation of Breathing
- Apparent Death

Note: Symptoms and signs usually appear within 15 minutes to 12 hours after surfacing; in severe cases, symptoms may appear immediately or even before the dive is completed. Delayed occurrence of symptoms is rare but can occur, especially if air travel follows diving. The quicker treatment begins, the better the chances of a full recovery.

Early Management

- CPR, if required
- Open airway, prevent aspiration, and incubate if trained person available
- Give O₂; remove only to open airway or if convulsion ensue

If conscious, give nonalcoholic liquids

Place in horizontal, neutral position

Restrain convulsing person loosely and resume O² as soon as airway is open

Protect from excessive cold, heat, water, or fumes

Arrange emergency transport, send divers profile with the diver, and send all diving equipment for examination or have it examined locally.

1.2 Decompression Sickness

Recognition - Symptoms usually appear 15 minutes to 12 hours after surfacing

Symptoms (one or more of the following)

Tired Feeling

Itching

Pain, arms, legs or trunk

Dizziness

Numbness, tingling or paralysis

Chest compression or shortness of breath

Anything unusual after the dive

Signs (one or more of the following)

Blotchy Rash

Paralysis or weakness anywhere in the body

Coughing Spasms

Staggering or instability

Unconsciousness

Personality change

Early Management

Stabilize patient the same way as for Air Embolism

Arrange for emergency transport, send divers profile with the diver, and send all diving equipment for examination or have it examined locally

2.0 FIRST AID FOR INJURIES REQUIRING TRANSPORT TO A HOSPITAL FACILITY

2.1 Pneumothorax

Symptoms (one or more of the following)

Pains in the chest

Shortness of breath

Signs (one or more of the following)

- Shallow Rapid Breathing
- Cyanosis (blue skin, lips, fingernails)
- Possible crackling under the skin of the neck
- Possible mediastinal shift (heart sounds not in the usual place)

Emergency Actions:

Call for help and immediate transport

2.2 Mediastinal Emphysema (Lung over pressure accident)

Recognition - Always associated with pneumothorax

Symptoms (one or more of the following)

Pain in the chest (beneath the breastbone)

Faintness

Shortness of breath

Signs (one or more of the following)

Obvious difficulty breathing

Brassy change in voice

Emergency Actions:

Transport to medical facility for evaluation

2.3 Drowning-Near Drowning

Recognition

Unconsciousness

Lack of respiration
Cyanosis (blue skin, lips, fingernails)

Management

Try to identify the time the victim was last seen breathing
Assess ABC's airway, breathing and circulation
Removal of gear
Transport to the boat or shore
Immediate call for help and transport to facility
Start CPR

2.4 Oxygen Toxicity (with convulsions)

Signs (one or more of the following)

Decreased or loss of consciousness; followed by
Convulsions

Symptoms (one or more of the following)

Nausea
Dizziness
Ringing in the ears
Abnormal Vision
Confusion
Prevention

Avoidance of gases with high O² concentrations (as in Nitrox at inappropriate depth)

Avoid CO² retention that can precipitate O² convulsions at any depth

If convulsions occur at depth, be prepared to treat near drowning and/or air embolism

TREATMENT - Call for help and immediate transport

2.5 Severe Trauma or Large Predator Injury (Head Injury, Limb Injury due to falls, Equipment Crush, Prop Injuries)

- call for help and immediate transport

- open airway
- treat for shock on site and stabilize before evacuation
- face up neutral position
- direct pressure over bleeding wounds
- CPR if no pulse or respiration
- keep warm
- be mindful of the possibility of neck injury
- splint limb injuries
- call for help and immediate transport

2.6 Suspected Heart Attack or Stroke

- Call for help and immediate transport
- Treat for shock
- CPR if no pulse or respiration
- Keep warm
- Call for help and immediate transport

2.7 Severe Allergic Reaction

- Remove any remnant of allergen (i.e., jellyfish tentacles, foreign material)
- Wash out wounds of injury with alcohol, vinegar, or water
- Call for help and immediate transport
- Treat for shock
- CPR if no pulse or respiration
- Keep warm
- Pain Relief, if available
- Transport to medical facility for evaluation

2.8 Stinging Fishes (Stingrays, Scorpion fish)

- Immobilize
- Remove spine and debride (scrub the wound)
- Irrigate wound
- Soak in hot water (thermolabile toxin) 50° C, for 30-90 minutes
- Call for help and immediate transport
- Treat for shock, hydrate

2.9 Hypothermia

- Keep core temperature above 95° F
- Keep airway open
- Immobilize
- Wrap in blankets, preferably next to another person
- Basic life support, CPR, if needed
- Warm liquids, if alert, unless very cold - then avoid due to possibility of ventricular tachycardia (rapid, useless fluttering of the heart)
- Call for help and immediate transport

2.10 Hyperthermia (Heat Exhaustion due to excessive fluid loss)

- Remove from source of heat
- Lower temperature (cool compresses at arterial points and head)
- Keep calm
- Keep airway open
- Call for help and immediate transport if unstable

2.11 Heat Stroke

- Remove all clothing
- Cover with cool wet sheet

- Place in air-conditioned area
- Cold packs to neck, scalp, groin and armpits
- If convulsions occur ensure victim does not cause further harm to themselves
- Call for help and immediate transport

3.0 AID FOR INJURIES THAT CAN BE TREATED ON BOARD

3.1 Nitrogen Narcosis

Signs (one or more of the following)

Inappropriate behavior at depth
Ignoring hand signals and instructions
Stupor or coma

Symptoms (one or more of the following)

Inflexible thinking and attitude
Decrease or loss of judgment
False sense of security
Lack of concern for safety
Inability to think through problems
Panic
Near unconsciousness or loss of consciousness at depth

Treatment

Ascend until free of symptoms
Surface with controlled ascent
Transport to medical facility for evaluation

3.2 Carbon Dioxide Poisoning

Symptoms (one or more of the following)

Rapid breathing
Feeling of suffocation or shortness of breath

Headache, nausea, dizziness
Rapid heartbeat
Confusion and unclear thinking

Signs (one or more of the following)

Slowed responses
Muscle irritability (twitching)
Loss of consciousness

Treatment

Remove the cause (over-exertion, equipment failure, rebreathers, etc.)
Stop and rest during early symptoms to avoid loss of consciousness
Surface; Transport to medical facility for evaluation

3.3 Ear Disorders

Middle Ear Barotrauma

Keep quiet and calm
Without DCS or rupture of the round or oval windows, give Benadryl 25 mg
Transport to medical facility for evaluation
Discontinue diving until cleared by EMT

Inner Ear Barotrauma

Recognize round or oval window damage (loss balance, ataxia, tinnitus, deafness)
Keep head up and affected ear elevated
Discourage straining
Transport to medical facility for evaluation
EMT evaluation, no more diving until cleared by EMT

3.4 Sea Sickness

The best medications have been found to be Meclizine, Bonine, Dramamine and Trans-derm Scope.

Keep your eyes on the horizon

Stay on deck

Keep yourself well hydrated with non-alcoholic beverages

Try antacid tablets or lemon drops

If diving, try to be the first diver in water.

ATTACHMENT B MOBILIZATION ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project

Job: **Mobilization**

Risk Assessment Code (RAC):

M

Prepared By: Brian Woods Reviewed By: James Daffron

Minimum Protective Clothing and Equipment:

PPE Level D (outside exclusion zone):

General work clothes, traffic vest, safety glasses, hard hat, steel-toed boots, hearing protection, work gloves

		PROBABILITY				
		Frequent	Likely	Occasional	Seldom	Unlikely
S	Catastrophic	E	E	H	H	M
E	Critical	E	H	H	M	L
V	Marginal	H	M	M	L	L
E	Negligible	M	L	L	L	L
R						
I						
T						
Y						

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS
<p>Movement of materials to the site</p> <p>Installation of temporary facilities and utilities, to include:</p> <p>Ground preparation for trailer (site</p>	<p>Driving/vehicle movement (including trucks, heavy equipment)</p>	<p>EM 385-1-1 (PARA REF)</p> <p>18.A 18.B 08.B</p>
		<ul style="list-style-type: none"> Obey traffic rules. 15 miles per hour is the maximum speed allowed in the work area. Use caution when entering roadways. Do not operate vehicles in unsafe conditions (e.g., on steep slopes, in deep mud). Do not use cell phones when operating vehicles. Secure all loads, including equipment within the cab, containerize small equipment and secure container. Wear seat belts, including those provided in cabs of heavy equipment. Use caution and wear orange vests if working near active roads or around heavy equipment.

**ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS**

Date Prepared: 04/01/14

Project: Congaree River Remediation Project

Job: **Mobilization**

Risk Assessment Code (RAC):

M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
office) and milvan pads, dumpsters, and sanitary stations, Electricity connections to site office Explosive storage establishment Field engineering (survey of preliminary conditions)		<ul style="list-style-type: none"> • Leave enough time to get to your destination without hurrying. • Be aware of heavy equipment and do not park or conduct work in the blind spot of the equipment operator; “blind spots” of some equipment can be very large. • Verify back-up alarms are functional for all heavy equipment for pick-ups or SUVs with obstructed rear view; use a back-up alarm or a spotter when backing up. • 	18.B.03 18.B.03 16.B.02 18.B
		<ul style="list-style-type: none"> • • Minimize generation of dust. • Stay out of visible dust clouds. • Wet soil if necessary to eliminate visible dust. 	06.A.04

**ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS**

Date Prepared: 04/01/14

Project: Congaree River Remediation Project

Job: **Mobilization**

Risk Assessment Code (RAC):

M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Noise	<ul style="list-style-type: none"> Reduce the volume of detection equipment before donning a headset. Site-specific training and daily tailgate briefing. 	05.C.01
	Electricity	<ul style="list-style-type: none"> Assure electrical work is performed by qualified personnel with verifiable credentials who are familiar with applicable code requirements. 	11.A.01.c
	Slips, trips, and falls	<ul style="list-style-type: none"> Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible. Inspect areas daily and findings are recorded on daily inspection reports. Personnel will wear sturdy all leather work boot with traction sole and composite safety toe. 	14.C
	Hand tools	<ul style="list-style-type: none"> Inspect tools prior to use. Use tools for their intended use only. Don't use damaged tools. Push, don't pull wrenches. 	13.A.02 13.A.02 13.A.02

**ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS**

Date Prepared: 04/01/14

Project: Congaree River Remediation Project

Job: **Mobilization**

Risk Assessment Code (RAC):

M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Biological hazards	<ul style="list-style-type: none"> Use repellents and proper clothing for protection against insects including ticks and mosquitoes. Check the area for poisonous plants, insects, snakes, spiders, and scorpions. Avoid animal droppings they may contain the Hanta Virus. Avoid holes and rocks that are potential animal habitats. If contact with insects, animals, animal droppings, or poisonous plants then wash area immediately. Avoid walking through dense foliage. Wear protective clothing in areas where poison oak and poison ivy are present. Wear protective clothing, including long pants and sturdy boots for protection against snakes and spiders. Site-specific training and daily tailgate briefings. 	<p>06.D.01</p> <p>06.D.01</p> <p>06.D.01</p> <p>06.D.01</p> <p>06.D.01</p> <p>06.D.01</p> <p>06.D.01</p> <p>06.D.02</p> <p>06.D.02</p> <p>06.D.01</p>
	Material handling	<ul style="list-style-type: none"> Use safe lifting techniques, bending at the knees and lifting with the legs. Use caution and do not twist the back when carrying a load. Use mechanical devices to move loads when possible. Wear protective gloves when handling materials. 	<p>14.A.01</p> <p>14.A.01</p> <p>14.A.04</p> <p>05.A</p>

**ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS**

Date Prepared: 04/01/14

Project: Congaree River Remediation Project

Job: **Mobilization**

Risk Assessment Code (RAC):

M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Cold stress	<ul style="list-style-type: none"> Wear cold weather clothing and provide shelter as needed based on site conditions. Conduct temperature monitoring when temperatures fall below 45°F. Site-specific training and daily tailgate briefing. 	06.J.10 06.J.11
	Heat stress	<ul style="list-style-type: none"> Make drinking water available to all workers and encourage workers to drink small amounts of water frequently. Adjust work/rest regimens during hot weather. Use sun screen. Avoid consuming caffeine. Site-specific training and daily tailgate briefings. 	06.I.03 06.I.04
	Extreme weather	<ul style="list-style-type: none"> When there are warnings or indications of severe weather, monitor conditions and take precautions to protect personnel. Monitor conditions and will call a safety stand down in the event of inclement weather. 	06.J.01
	Fire	<ul style="list-style-type: none"> Provide portable fire extinguishers in all equipment and in the field trailer. Inspect fire extinguishers monthly. Obtain hot work permits prior to any welding or torch cutting activities. 	09.E 09.E 06.C

**ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS**

Date Prepared: 04/01/14

Project: Congaree River Remediation Project

Job: **Mobilization**

Risk Assessment Code (RAC):

M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Temporary facilities (if used, not anticipated)	<ul style="list-style-type: none"> Anchor trailers with rods and cables or by steel straps to ground anchors designed to withstand winds and meet applicable standards. Post signs warning of the presence of construction hazards every 300 feet. Provide one portable toilet with adequate ventilation on site. Provide washing facilities at the portable toilet location to maintain sanitary conditions. Provide type II 16-unit first aid kits and make these kits accessible at the site. 	<p>04.A.03</p> <p>04.A.04/08.A</p> <p>02.C</p> <p>02.D</p> <p>03.B</p>
	Powered machine tools	<ul style="list-style-type: none"> Use, inspect, and maintain power tools according to manufacturer's recommendations. Equip power tools with designed guards. Provide electrical power control on each power tool to make it possible for the operator to cut off the power without leaving the point of operation. Connect all electrical power tools to an in-line GFCI. 	<p>13.A.02</p> <p>13.A.03</p> <p>13.A.15</p> <p>11.C.05</p>

**ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS**

Date Prepared: 04/01/14

Project: Congaree River Remediation Project

Job: **Mobilization**

Risk Assessment Code (RAC):

M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Temporary haul roads (if used, not anticipated)	<ul style="list-style-type: none"> • Construct haul roads with suitable width for safe operation at the speed anticipated. • Post speed limits on haul roads. 	08.D.05 08.D.06

BOAT USE ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project

Job: **Boat Use**

Prepared By: Brian Woods Reviewed By: James Daffron

Risk Assessment Code (RAC):

L

Minimum Protective Clothing and Equipment:	
PPE Level D:	
General work clothes, safety glasses, hard hat, safety-toed boots, leather work gloves, and respirator (when working in dry, dusty conditions).	

	E = Extremely High Risk H = High Risk M = Moderate Risk L = Low Risk	PROBABILITY				
		Frequent	Likely	Occasional	Seldom	Unlikely
S	Catastrophic	E	E	H	H	M
E	Critical	E	H	H	M	L
V	Marginal	H	M	M	L	L
E	Negligible	M	L	L	L	L
R						
I						
T						
Y						

JOB STEPS	HAZARDS	EM 385-1-1 (PARA REF)
ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS		

BOAT USE ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

L

Risk Assessment Code (RAC):

Project: Congaree River Remediation Project Job: **Boat Use**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Mobilization, Demobilization, Loading and Unloading	<p>Driving/vehicle movement (including truck/trailer bringing the boat to the job site)</p> <p>Unloading the boat from the trailer</p> <p>Loading the boat onto the trailer</p>	<ul style="list-style-type: none"> • Obey traffic rules. • Use caution when entering roadways. • Do not operate vehicles in unsafe conditions (e.g., on steep slopes, in deep mud). • Do not use cell phones when operating vehicles. • Secure all loads, including equipment within the cab, containerize small equipment and secure container. • Wear seat belts, including those provided in cabs of heavy equipment. • Use caution and wear orange vests if working near active roads or around heavy equipment. • Leave enough time to get to your destination without hurrying. • Be aware of heavy equipment and do not park or conduct work in the blind spot of the equipment operator; “blind spots” of some equipment can be very large. • Verify back-up alarms are functional for all heavy equipment for pick-ups or SUVs with obstructed rear view; use a back-up alarm or a spotter when backing up. • 	<p>16.A/18.A</p> <p>08.B</p> <p>16.B.08/18.B.03</p> <p>16.B.01/18.B.03</p> <p>16.B.02</p> <p>16.B/18.B</p>
Congaree River Remediation	UXO Support Project	Attachment B—Activity Hazard Analysis-Diving	16.B.12b

BOAT USE ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

L

Risk Assessment Code (RAC):

Project: Congaree River Remediation Project Job: **Boat Use**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Boat Use	<p>Potential MEC (If in an area where MEC is suspected)</p> <p>Boat Operations to include: Diving, Sediment Sampling, water sampling, and surveying</p>	<ul style="list-style-type: none"> • Observe MEC/anomaly avoidance procedures in accordance with EP-75-1-2 • Boat shall be equipped with Coast Guard Approved Type III Personal Flotation Devices with attached whistles for each passenger/worker onboard. • Boat shall be equipped with at least one Coast Guard Approved Type IV Personal Flotation Device, first aid kit large enough for the crew, charts, compass, GPS, cell phone or radio, survival kit, anchor, and paddles. • For off-shore operations the boat shall be equipped with marine band radios, radars, bow hook, spotting mirrors, flare gun, and flares. • A qualified boat operator will be in charge of boat operations • The boat engine shall be placed in neutral prior to splashing divers (as conditions permit). • The boat engine shall be turned off (if conditions permit) when recovering divers. • 	

BOAT USE ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

L

Risk Assessment Code (RAC):

Project: Congaree River Remediation Project Job: **Boat Use**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Slips, trips, and falls	<ul style="list-style-type: none"> • Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible. • Inspect areas daily and findings and recorded on daily inspection reports. • Sturdy all leather work boots with traction sole and safety toe. 	14.C
	Biological hazards	<ul style="list-style-type: none"> • Use repellents and proper clothing for protection against insects including ticks and mosquitoes. • Check the area for poisonous plants, insects, snakes, spiders, and scorpions. • Avoid animal droppings they may contain the Hanta Virus. • Avoid holes and rocks that are potential animal habitats. • If contact with insects, animals, animal droppings, or poisonous plants then wash area immediately. • Wear protective clothing, including long pants and sturdy boots for protection against snakes and spiders. • Site-specific training and daily tailgate briefings. 	06.D.01 06.D.01 06.D.01 06.D.01 06.D.01 06.D.01 06.D.01 06.D.02 06.D.02 06.D.01

BOAT USE ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project

Job: **Boat Use**

Risk Assessment Code (RAC):

L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Cold stress	<ul style="list-style-type: none"> • Wear cold weather clothing and provide shelter as needed based on site conditions. • Conduct temperature monitoring when temperatures fall below 45°F. • Site-specific training and daily tailgate briefing . 	06.J.10 06.J.11
	Heat stress	<ul style="list-style-type: none"> • Make drinking water available to all workers and encourage workers to drink small amounts of water frequently. • Adjust work/rest regimens during hot weather. • Use sun screen. • Avoid consuming caffeine. • Site-specific training and daily tailgate briefings. 	06.I.03 06.I.04
	Extreme weather	<ul style="list-style-type: none"> • When there are warnings or indications of severe weather, monitor conditions and take precautions to protect personnel. • Monitor conditions and will call a safety stand down in the event of inclement weather. 	06.J.01
	Fire	<ul style="list-style-type: none"> • Provide Coast Guard Approved portable fire extinguishers onboard. • Inspect fire extinguishers monthly. 	09.E 09.E

BOAT USE ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project

Job: **Boat Use**

Risk Assessment Code (RAC):

L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Noise	<ul style="list-style-type: none"> Wear hearing protection when operating or working near the mower. Site-specific training and daily tailgate briefing. 	05.C.01

DIVE OPERATIONS ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project

Job: **Dive Operations**

Risk Assessment Code (RAC):

M

Prepared By: Brian Woods Reviewed By: James Daffron

Minimum Protective Clothing and Equipment: Dry Suit/ Wet Suit, Tether, Reserve air. Dive flags, Dive boat, Hand tools, Back Board, Breathing gas supply, Buoys, Dive	
---	--

		PROBABILITY				
		Frequent	Likely	Occasional	Seldom	Unlikely
S	Catastrophic	E	E	H	H	M
E	Critical	E	H	H	M	L
V	Marginal	H	M	M	L	L
E	Negligible	M	L	L	L	L
R						
I						
T						
Y						

E = Extremely High Risk
 H = High Risk
 M = Moderate Risk
 L = Low Risk

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
MEC Dive Operations for Anomaly Investigation and Removal	Radiation Hazards: Sun	Use sunblock as appropriate. Avoid extended periods of direct exposure to sun.	06.J.13
	Chemical Hazards: Marine Battery- Lead Acid	Keep containers tightly closed when not in use. If battery case is broken, avoid contact with internal components. Do not handle near heat, sparks, or open flames. Protect containers from physical damage to avoid leaks and spills. Place cardboard between layers of batteries to avoid damage and short circuits. Do not allow conductive material to touch battery terminals. Use protective acid resistant gloves and eye protection if coming in contact with battery acid	05.A 05.B

DIVE OPERATIONS ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project

Job: **Dive Operations**

Risk Assessment Code (RAC):

M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
		from leaks or spills.	
	<p>Biological Hazards: Stinging and biting Insects Animals and Reptiles</p>	Use appropriate insect repellents. Training to avoid poisonous insects and avoid contact. A poster indicating various types of biological hazards will be displayed in the site trailer. Training on symptoms of rabies and avoidance of animals.	06.D.01 06.D.02
	<p>Physical Hazards: Slips, trips, and falls while walking on uneven walking surfaces; weather hazards, such as snow and ice; and poor visibility</p>	Care will be exercised during off-loading and loading of boats to reduce slip, trip or fall hazards associated with the landing or docking area. Work areas will be kept organized; ice, snow, and mud will be cleared to reduce hazards. Work will be completed in adequate natural light or sufficient artificial illumination will be maintained. Site personnel will use the “buddy system” at all times.	14.C
	Underwater Hazards from stepping in holes or on sharp objects	Be observant while in the water and move cautiously.	14.C
	Manual lifting	Use proper lifting techniques—keep back straight, lift with legs, avoid twisting back, use mechanical equipment, or get help from others whenever possible. Heavy loads will be carried with assistance. Verify the path of travel is clear prior to the lift.	14.A.01 14.A.04 05.A

DIVE OPERATIONS ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project

Job: **Dive Operations**

Risk Assessment Code (RAC):

M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Hands or fingers caught between objects; abrasions and lacerations	Personnel will be made aware of the hazard and asked to coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for rough or sharp edges and appropriate precautions will be taken to avoid contact with rough or sharp edges. Personnel will wear work gloves and avoid placing hands between objects.	05.A
	Hand tools, manual	Tools will be inspected prior to use. Damaged tools will be tagged out of service until repair can be performed by a qualified person. Tools will be used properly and for their intended purpose.	13.A.02
	Inclement weather, heat and cold stress	When there are warnings or indications of severe weather, monitor conditions and take precautions to protect personnel. UXOSO will monitor conditions and will call a safety stand down in the event of inclement weather. Electrolyte/fluids replacement will be available to workers as needed. Work/rest periods will be established according to ACGIH and NIOSH guidelines. Personnel will be monitored. Dive gear will include appropriate thermal protection.	06.J.01
	Fire	Fire prevention will be a priority through awareness. A 1A:10BC extinguisher will be required to be on the boat during boating and diving activities.	09.E
	MEC Hazards	On-site MEC training will be conducted. UXO personnel will be EODS graduates. Perform MEC intrusive investigation using approved methods and techniques. EM-385-1-97 will be followed for performing MEC work.	

DIVE OPERATIONS ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project

Job: **Dive Operations**

Risk Assessment Code (RAC):

M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Drowning Hazards	Two way communications system will be employed. Review dive procedures in the Safe Practices Manual. Standby diver will be dressed and ready when a diver is in the water. U.S. Navy No-Decompression tables will be used. All dive gear will be inspected and serviceable. Check lists will be used to insure all procedures are followed.	30.A 30.B
Post Diving	Decompression Stress resulting from Flying After Diving	Divers will not fly within 12 hours after diving or within 24 hours after multiple dives.	30.A.11

Explosive Ordnance Technologies Inc.

Diving Safe Practices Manual

Underwater MEC Investigation/Removal
Using SCUBA



Diving Safe Practices Manual

Underwater MEC Investigation/Removal Using SCUBA

Prepared Date
April 15, 2014

Reviewer Acknowledgment

EOTI Safety Manager

Signature

Date

EOTI Dive Safety Reviewer

Signature

Date

Prepared By

Signature

Date

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Acronyms and Abbreviations

ACDE	Association of Commercial Diving Educators
AED	Automatic Emergency Defibrillator
AHA	activity hazard analysis
ANSI	American National Standards Institute
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
DDC	Designated Dive Coordinator
DDESB	Department of Defense Explosives Safety Board
DoD	Department of Defense
DOT	Department of Transportation
DQCR	Daily Quality Control Report
EM	Engineering Manual
EOD	Explosive Ordnance Disposal
EOTI	Explosive Ordnance Technologies, Inc.
fpm	feet per minute
fsw	feet of salt water
GPS	global positioning system
HAZWOPER	Hazardous Waste Operation and Emergency Response
MD	munitions debris
MEC	munitions and explosives of concern
MPPEH	material potentially presenting an explosive hazard
No.	number
OE	Ordnance and Explosives
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
QC	quality control
SCUBA	self-contained underwater breathing apparatus
SSHP	Site Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
U.S.	United States
URS	URS Group, Inc.
USACE	United States Army Corps of Engineers
UXO	unexploded ordnance

UXOQCS
UXOSO

UXO Quality Control Specialist
UXO Safety Officer

1. INTRODUCTION

This manual establishes the Dive Operations guidelines for Explosive Ordnance Technologies, Inc. (EOTI) personnel engaged in munitions response diving operations. This manual combines and conforms to requirements outlined in Occupational Safety and Health Administration (OSHA) regulations, the United States (U.S.) Navy Diving Manual (Volume I) and the U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual Engineering Manual (EM) 385-1-1. The requirements of OSHA, Department of Labor directive titled, 29 Code of Federal Regulations (CFR) 1910 Subpart T, Commercial Diving Operations has been integrated into this manual. OSHA and EM 385-1-1 established safety and health criteria for personnel to include medical requirements, recommended physical examination, operational procedures, equipment procedures and record keeping requirements which are incorporated herein. Where documents are conflicting in policy, the most stringent regulations take precedence. A site-specific Diving Operation Plan is established for each project.

Safety is the primary consideration in planning and executing all jobs. The underwater investigation and removal of munitions and explosives of concern (MEC) adds a degree of complexity and additional hazards, not present in land based operations. All personnel engaged in these operations are screened carefully for the required training, experience, and physical capabilities required to perform underwater MEC work. Each individual is responsible for personal safety and for the safety of coworkers. Each individual must know their physical limits and technical capability and must immediately notify the Dive Supervisor if unable to safely complete assigned tasks. Site-specific dive plans and safety plans will be developed for each project.

This Safe Practices Manual will be available to Government representatives and all dive team members at all times at all diving locations.

2. DIVE SAFETY PROCEDURES (1910.422)

The success of any diving operation is a direct result of careful and complete planning. The procedures and checklist presented below are intended to help ensure careful planning and safe execution of dive operations. The Dive Supervisor shall comply with the following requirements during diving operations:

- A means capable of supporting the diver will be provided for water entry and exit when conducting dive operations from a boat. The means provided for exiting the water will extend below the water's surface; a means will be provided to assist an injured diver from the water to the dive boat; see Attachment A (Emergency Management Plan) for guidance.
- An operational two-way voice communication system will be used for communication between each diver and a member of the dive team at the dive location. Line-pull signals meet this requirement for SCUBA-diving mode.
- If line-pull signals are used in SCUBA mode, only Navy approved line-pull and hand signals will be used. (See Attachment B);
- Have operational two-way communications (handheld portable radios and cell phones) available at the dive location to obtain emergency assistance;
- Dive profiles will be kept at the dive location for each diver (See Attachment C).
- Explosives shall not be detonated while a diver is in the water;
- The Dive Supervisor will be on the site for all diving operations.
- The Dive Supervisor will devise a means for emergency diver recall. It must be a distinct, sure method and every diver must be made aware of the system being used.
- A standby diver will be utilized on all diving operations. Gear must be ready for immediate donning (i.e., harnesses adjusted, regulators attached, and air on etc.).
- Personnel involved in diving operations shall not hesitate to ditch, abandon, or destroy gear or equipment if, at any time, such action would, in the divers mind, be the proper course of action for his own safety or the safety of others;
- U.S. Navy Standard Air Decompression Tables will be used and available at the dive locations;
- Repetitive and no-decompression tables will be at the dive location; and
- Use a timekeeping device for recording the diving times of all SCUBA diving operations. The Dive Supervisor will ensure that a diver does not exceed the approved bottom time on any dive.
- Plan the dive, dive the plan.

2.1 PRE-DIVE PROCEDURES (1910.421)

The Dive Supervisor shall comply with the following requirements prior to each diving operation.

2.1.1 Emergency Aid

An Emergency Management Plan (Attachment A) shall be completed prior to diving operations and kept at the dive location that includes the telephone or call numbers of the following:

- Location of an operational recompression chamber;
- Location of accessible hospitals;
- Available means of emergency transportation; and
- The nearest U. S. Coast Guard Rescue Coordination Center.

2.1.2 Dive Operation Planning and Assessment

The planning of a dive operation shall include an assessment of the safety and health aspects of the following:

- Diving mode;
- Surface and underwater conditions and hazards;
- Breathing air supply (including reserves);
- Thermal protection;
- Diving equipment and systems;
- Dive team assignment, training in diving equipment/procedures and physical fitness of dive team members (including any impairment known to the employer);
- Dangerous marine life;
- Repetitive dive designation or residual air status of dive team members;
- Decompression and treatment procedures (including altitude corrections) as necessary; and
- Emergency procedures.

2.1.3 Pre-dive Brief

The Dive Supervisor shall brief the dive team members on the following prior to diving:

- Mission and location which will include drawings and/or photographs pertinent to the mission
- Safety procedures for the diving mode;
- Equipment and materials to be used or installed as part of the mission;
- Maximum working depth with estimated bottom times and water temperature;
- Names and duties of personnel on the team;
- Discussion of pertinent activity hazard analyses (AHAs) or new AHAs
- Any unusual hazards or environmental conditions likely to affect the safety of the diving operation;
- Any modifications to the Dive Plan necessitated by the specific diving activities (NOTE: If for any reason the Dive Plan is altered in the mission, depth, personnel, or equipment, the USACE Designated Dive Supervisor (DDC) will be contacted in order to review and accept the alteration prior to actual operation. This review may be conducted electronically and confirmed in writing after completion of the dive operation); and

- Emergency procedures

Prior to making individual dive team member assignments, the Dive Supervisor will inquire into the dive team member's current state of physical fitness, and indicate to the dive team members the procedure for reporting physical problems or adverse physiological effects during and after the dive.

2.2 TERMINATION OF DIVE

The working interval of a dive shall be terminated when:

- A diver requests termination;
- A diver fails to respond correctly to communications or signals from a dive team member;
- Communications are lost and cannot be quickly re-established between the diver and a dive team member at the dive location, and between the Dive Supervisor and the boat operator; or
- A diver begins to use diver-carried reserve breathing gas;
- Emergency recall device is activated; or

2.3 POST-DIVE PROCEDURES

The Dive Supervisor shall comply with the following requirements after each diving operation.

- Check the physical condition of each diver;
- Instruct each diver to report any physical problems or adverse physiological effects including symptoms of decompression sickness;
- Advise each diver of the location of a recompression chamber which is ready for use;
- Alert each diver to the potential hazards of flying after diving (12 hours before flying after any dive and 24 hours following multiple days of repetitive dives);
- Each diver shall remain at the dive location or in close proximity to the Dive Supervisor for at least 30 minutes after completing dive; and
- Ensure that no diver has a bottom time longer than authorized for each dive.

2.4 RECORD OF DIVE

The following information shall be recorded (use Attachment C) and maintained for each diving operation.

- Names of dive team members including Dive Supervisor;
- Date, time and location of dive (s);
- Diving mode used;
- General nature of work performed;

- Surface and underwater conditions (visibility, water temperature and current);
- Maximum depth and bottom time for each diver; and
- Attachment C will be filled out for each dive operation by Dive Supervisor and filed in the permanent project files.

For each dive in which decompression sickness/pulmonary barotraumas are suspected or symptoms are evident, the following additional information will be recorded and maintained:

- Description of decompression sickness symptoms (including depth and time of onset);
- Description and results of treatment;
- Name, address and phone number of attending physician

A decompression procedure assessment shall be conducted by the Dive Supervisor to include the following.

- Investigate and evaluate each incident of decompression sickness based on the recorded information, consideration of the past performance of the decompression table used and individual susceptibility;
- Take appropriate corrective action to reduce the probability of recurrence of decompression sickness;
- Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken, within 45 days of the incident of decompression sickness; and
- Written evaluations will be retained by EOTI for a period of five years and then forwarded to OSHA.

2.5 SCUBA DIVING REQUIREMENTS

2.5.1 Equipment

Each SCUBA team member will be equipped with:

- An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus;
- Buoyancy compensation device or inflatable life jacket capable of maintaining the diver at the surface in a face-up position;
- A submersible cylinder pressure gauge;
- A weight belt or assembly capable of quick release;
- A watch, pressure gauge and knife; and
- SCUBA air cylinders of seamless steel or aluminum which meet Department of Transportation (DOT) 3AA and DOT 3AL specifications with identification symbols stamped into the shoulder of

the tank. Annual inspections and hydrostatic testing will also be stamped into the cylinder as applicable;

- A safety harness with a positive buckling device, attachment point for the safety line, and a lifting point to distribute the pull force of the line over the diver's body while maintaining the body in a heads-up vertical position when unconscious or hurt; and
- A time keeping device will be used by the Dive Supervisor for recording dive times at the dive location and each diver will have a time keeping device to keep track of bottom times.
- Skin suit to protect from cuts and abrasions and thermal protection as required
- Air tanks will be filled from a certified dive shop. Prior to the initial start of dive operations, a copy of the air certification from the dive shop will be obtained and provided to the DDC upon request and maintained on file in the project office.

Each dive team member will be responsible for ensuring that his equipment is inspected prior to each dive using the checklist in Attachment D and report any deficiencies to the Dive Supervisor.

2.5.2 Requirements While Engaged In SCUBA Diving Operations

SCUBA diving shall not be conducted:

- Against currents, exceeding one (1) knot;
- In an enclosed or physically confining spaces unless line-tended;
- In water visibility less than one (1) meter unless line tended with diver/surface two-way voice communications
- When the diver does not have direct access to the surface

2.5.3 Procedures

- Divers will not exceed designated bottom time;
- Will have a layer of skin protection to prevent injury from cuts and scratches and thermal protection if water temperatures are below 75 degrees Fahrenheit.
- A standby diver shall be available while a diver is in the water;
- A diver shall be line-tended from the surface, or accompanied by another diver in the water in continuous visual contact during the diving operation; and
- A diver-carried reserve breathing air supply shall be provided for each diver consisting of:
 - An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus.
 - The valve of the reserve breathing gas supply shall be in the closed position (lever in the up position) prior to the dive.

- All personnel will remain aware of conditions or hazards that might affect diving operations and will inform the Dive Supervisor and/or terminate the dive as necessary;
- Divers will use proper rates of descent/ascent during the dive (75 feet per minute [fpm] descent/30 fpm ascent).
- If communications are lost between a tender and diver and cannot be regained quickly, metal-on-metal audible recall signal will be sounded in the water and line pull signals will be used to recall the diver. If the diver does not surface in a reasonable amount of time after the audible re-call signal and line-pull signals have been initiated, the stand-by diver will be dispatched to the last known location of the diver. If communications are lost between the diver and the tender and cannot be regained quickly, the diver will surface immediately without waiting for the recall signal. The reason for the loss of communications will be investigated and remedied prior to continuation of the dive. The Emergency Plan in Attachment A describes emergency procedures that apply to a situation where there is a lost diver in the water.

2.6 LIVE BOATING

EOTI will operate a safety boat in the area of dive operations. The boat will be positioned to monitor the dive operation and to help maintain a safety exclusion zone around the operation. Personnel on the safety boat will assist in emergency response as requested by the Dive Supervisor. The dive boat will be anchored during dive operations.

2.7 SEARCH METHOD (CIRCLE-LINE AND STATIONARY JACKSTAY)

The purpose of a munitions response dive is to locate and identify underwater MEC. The search shall be conducted using a circle-line search method described in the following paragraph; the diver will be equipped with an all metals detector and hand tools as necessary. The area to be searched will be located using the Global Positioning System (GPS) to locate the points provided by an aero-detection mapping operation.

The circle-line search method will be used to locate underwater MEC when the search area is small. A single clump attached to a buoy line will be lowered to the bottom. A second line with knots tied every four- or five-feet apart of a specified length will be attached to the clump. The diver will then use this second line to circle around the clump at increasing or decreasing radii while searching. After one complete circle, the diver moves out or in one knot as required. This search method can be utilized to reacquire single targets previously electronically positioned (see Figure 2.1).

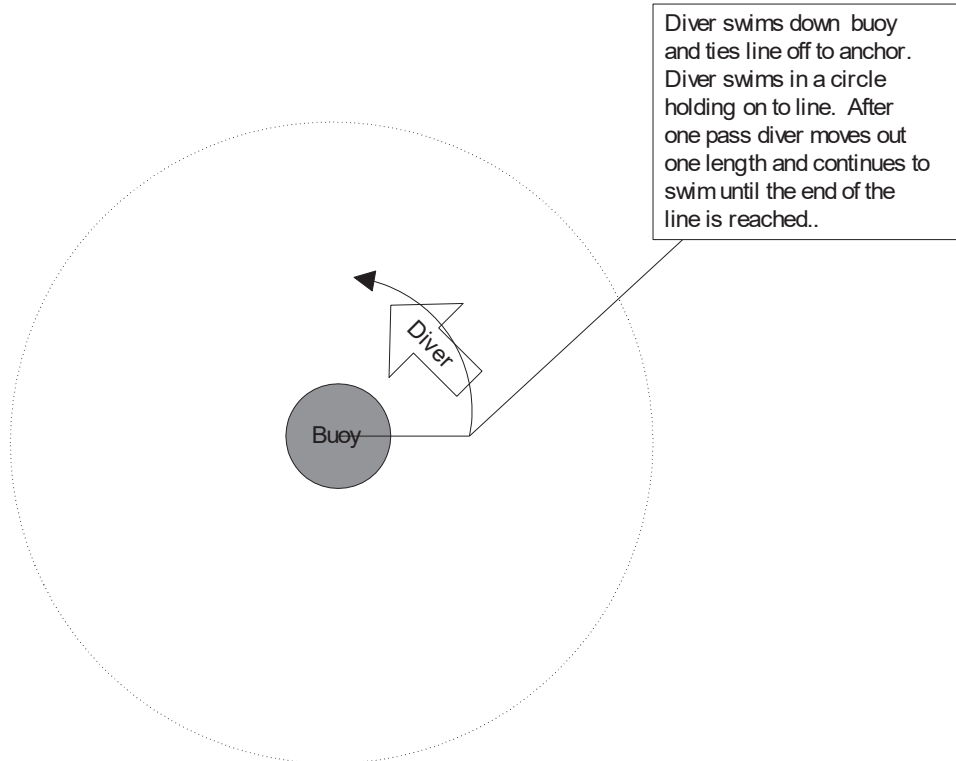


Figure 2.1 Circle Line Search Method

The Stationary Jackstay search method will be used to locate underwater MEC in the areas where specific anomaly locations are unknown. A diver will use a line as a guide as he sweeps a lane that is approximately five feet wide. At the end of the line he will turn around and swim the opposite direction, clearing a five feet wide lane on the other side of the line. The line will then be repositioned and the process is repeated until the entire area is cleared. Figure 2.2 shows how the Stationary Jackstay method is employed.

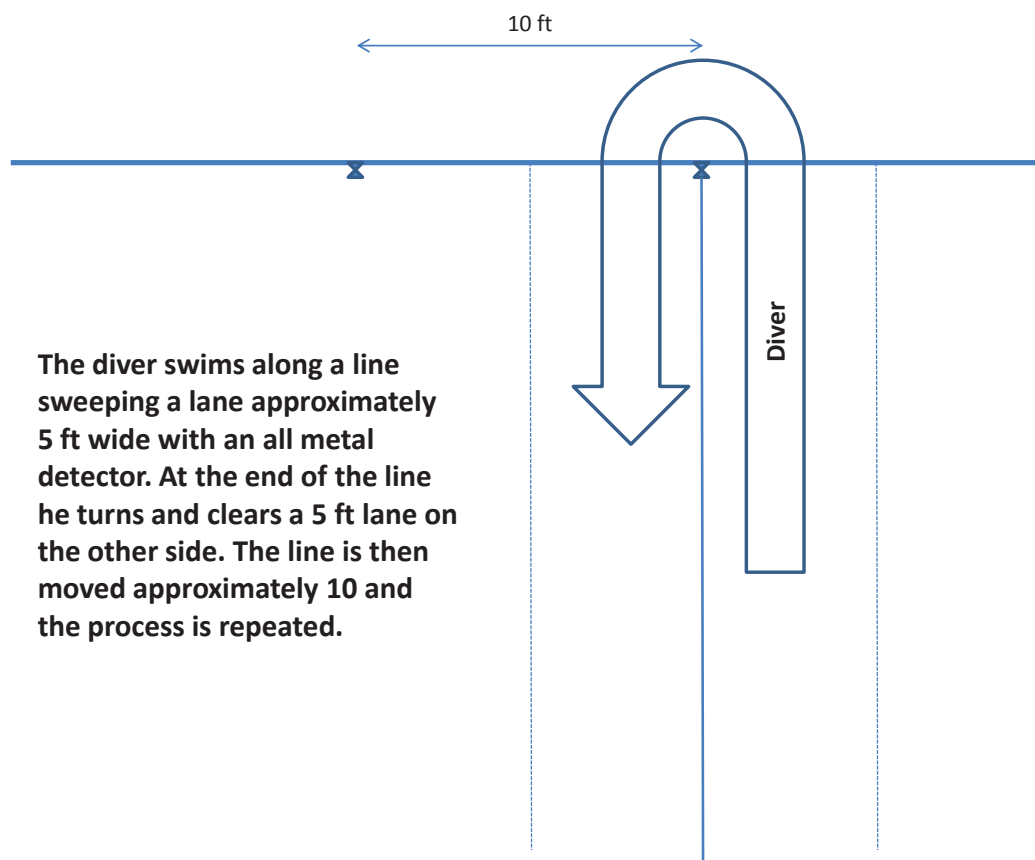


Figure 2.2 Stationary Jackstay Search Method

NOTE: If an item is identified as potential MEC, an attempt will be made to verify if the item is acceptable or unacceptable to move. If the item is acceptable to move the item will be removed to a safe location. If the item is unacceptable to move, it will be marked with a means to identify its location and left in place and the Senior Unexploded Ordnance Supervisor (SUXOS) will be notified immediately in order to coordinate with the Project Manager, Unexploded Ordnance Safety Officer (UXOSO), USACE Ordnance and Explosives (OE) Safety Specialist and/or others as appropriate to determine final disposition.

2.8 DIVE OPERATION CHECKLISTS

2.8.1 The General Planning Checklist

The *General Planning Checklist* (Attachment E) is used by the Dive Supervisor when planning dive operation and should be reviewed and updated prior to each dive.

2.8.2 The Dive Project Supervisor Checklist

The *Dive Project Supervisor Checklist* (Attachment F) is used by the Dive Supervisor to document basic data and to document pre-dive checks. It is completed prior to each dive.

2.8.3 The Project Dive Plan Checklist

The *Project Dive Plan Checklist* (Attachment G) is used by the Dive Supervisor to record basic information from the Dive Plan and to document specific team assignments and dive-specific information. It is completed prior to each dive.

2.8.4 The Dive Supervisor Pre-dive

The *Dive Supervisor Pre-dive Checklist* (Attachment H) is used by the Dive Supervisor to individual diver's readiness. It is completed prior to each dive.

2.8.5 The Dive Boat Operation

The *Dive Boat Operation Checklist* (Attachment I) is used by the Dive Supervisor or Boat Operator to inspect the dive boat. It is completed daily prior to operation of the boat.

3. TEAM MEMBERS

The Project Manager and Project UXO Dive Supervisor are responsible for ensuring all dive team members and boat support personnel, read, understand, and follow all the procedures outlined in this manual. All dive team personnel are responsible for ensuring that they read and follow the procedures outlined in this manual as it pertains to their individual work assignments. If discrepancies are found with procedural steps or any safety issues in this manual they will immediately be brought to the attention of the Project UXO Dive Supervisor and Project Manager for clarification and or corrective action.

(Note: If for any reason the Dive Plan is altered in mission, depth, personnel, or equipment, the USACE DDC will be contacted in order to review and accept the alteration prior to continuing the operation. This review may be conducted electronically and confirmed in writing after completion of the dive operation.)

3.1 QUALIFICATIONS OF DIVERS ENGAGED IN MEC OPERATIONS

Each dive team member will be certified as appropriate for the type of diving to be conducted through formalized military training and will have the experience or training necessary to perform these assigned tasks. In addition, each dive team member shall have the experience and training in the following:

- Have documentation showing that the dive team members have successfully completed training to the appropriate level (e.g. SSA diver's certification, surface supplied mixed-gas diver certificate). Such training shall:
 - Be military school, Federal school, or an Association of Commercial Diving Educators (ACDE) accredited school, or
 - Meet the requirements contained in American National Standards Institute (ANSI)/ACDE-01.
- Have at least one (1) year commercial experience in the applicable position;
- Have completed at least four (4) working dives using the diving techniques and equipment to be used;
- Must demonstrate that at least one (1) of the four (4) qualification dives was performed in the last 6 months prior to the contract award date;
- A graduate of U.S. Naval School Explosive Ordnance Disposal, if engaged in munitions response diving operations;
- Trained in the use of tools, operation, and maintenance of equipment and systems relevant to assigned tasks;
- Trained in the techniques of the assigned diving mode;
- Trained in diving operations and emergency procedures;
- Trained in tasks to be accomplished (to include purpose and function);

- Trained in cardiopulmonary resuscitation (CPR) using emergency oxygen, Automatic Emergency Defibrillator (AED) and first aid as defined by OSHA; and
- All dive team members who are exposed to or control the exposure of others to hyperbaric conditions shall be trained in diving-related physics and physiology.
- 40-hour Hazardous Waste Operations (HAZWOPER) training with an 8-hour annual refresher training as required.

3.2 ASSIGNMENTS

Each dive team member shall be assigned tasks in accordance with the employee's experience or training, except that limited additional tasks may be assigned to a person undergoing job orientation; provided that these tasks are performed under the direct supervision of an experienced dive team member.

EOTI will not require a dive team member to be exposed to hyperbaric conditions against the employee's will, except when necessary to complete decompression or treatment procedures.

The Dive Supervisor will not permit a dive team member to dive or be otherwise exposed to hyperbaric conditions for the duration of any temporary physical impairment or condition, which is known to the Dive Supervisor and is likely to affect adversely the safety or health of a dive team member.

The minimum manning level for dive teams shall be in accordance with Appendix O of EM 385-1-1.

3.3 RESPONSIBILITIES

3.3.1 Dive Supervisor

The Dive Supervisor will review this Safe Dive Practices Manual with the dive team prior to conducting any diving operations. This manual shall be made available at the dive location to each dive team member. The Safe Practices Manual includes:

- Safety Procedures and checklists for diving operations;
- Assignments and responsibilities of the dive team members; and
- Equipment procedures and checklists; and
- Emergency procedures for fire, equipment failure, adverse environmental conditions, and medical illness and injury.

The EOTI Project Manager will designate the Dive Supervisor in writing. The Dive Supervisor is responsible for ensuring complete compliance with the provisions of this manual, the Site Safety and Health Plan (SSHP), and the Project Work Plan. He is responsible for field equipment calibration, oversight of diving operations, field documentation, submittal of Daily Quality Control Reports (DQCRs), and assisting in the preparation of progress reports. The Dive Supervisor shall be at the dive location in charge of all aspects of the diving operation affecting the safety and health of the dive team members. The Dive Supervisor shall have the experience and training in the conduct of the assigned diving operation. The Dive Supervisor will be responsible for all diving operations described herein. The Dive Supervisor will:

- Ensure all dive team members possess current certification and are qualified for the type of diving operation;
- Ensure that the dive team is briefed on the appropriate ordnance safety precautions for ordnance that may potentially be present;
- Ensure safety and emergency equipment is in working order at the dive site;
- Brief the dive team prior to each dive on:
 - Dive objectives;
 - Unusual hazards or environmental conditions likely to affect the diving operation; and
 - Any modifications to the Dive Plan or Emergency Management Plan made necessary by conditions or the specific diving operation.
- Suspend diving operations if in his opinion, conditions are unsafe;
- Draft a site-specific Project Dive Plan and an Emergency Management Plan in accordance with Attachments G and A respectively prior to each diving operation;
- Determine the equipment requirements for all diving operations and ensure that adequate means are taken to make such equipment available at the scene;
- Plan the diving operation considering the job requirements, equipment and personnel available, and condition of the diving operation area utilizing the General Planning Checklist (Attachment E);
- Ensure that the Project Dive Supervisor Checklist, Project Dive Plan and Pre-Dive Checklist (Attachments F, G, H) are completed and adhered to for all diving operations including training;
- Act as timekeeper and maintain a Project Dive Log (Attachment C) at the diving location which will become part of the project official records;
- Obtain a copy of the certificate of analysis showing the breathing air meets the minimum acceptable criteria listed in section 30.F.05c of EM 385-1-1;
- Ensure that all AHA's are available and on site. The AHA will contain hazards associated with each phase of the work and includes hazards associated with flying before and after diving; and
- Maintain direct communications between the dive site, project office, and the EOTI Corporate Office.
- Implementing quality control (QC) for technical data provided by the field staff including field measurement data
- Adhering to work schedules
- Implementing and documenting corrective action procedures and provisions of communication between team and upper management

3.3.2 Diving UXO Specialist (Diver)

The Diver will be a trained and experienced diver, as well as trained in (UXO). The Diver responsibilities and experience will include:

- Required knowledge and experience to perform assigned tasks;
- Keep topside personnel informed of conditions on the bottom and progress of the task(s);
- Obey all signals from the surface and repeat all commands given from topside personnel;
- Acting as a tender for other divers;
- Notifying the Dive Supervisor of any symptoms that may be construed as diving sickness or a mechanical injury;
- Maintaining a personnel dive log which will include:
 - Inform Dive Supervisor or alternate if taking any medications;
 - Full name;
 - Date, time, and location of the dive;
 - Maximum depth and bottom time;
 - Surface interval between dives;
 - Breathing medium and type of equipment used;
 - Group classification at the beginning and the end of each interval and repetitive dive worksheet;
 - Underwater and surface conditions;
 - Depth(s) and duration(s) of any decompression stops (there will be no decompression dives and will only be required in emergency situations);and
 - Date and time of last previous dive.
 - Name of Dive Supervisor(s) during dive.
- Maintaining personal dive equipment (Attachment D);
- Identify and stop any operation that, in their opinion is unsafe

3.3.3 Standby Diver

A standby diver is a fully qualified diver and will be on station whenever a diver(s) is in the water to serve as immediate emergency assistance to the primary diver(s). A standby dive will deploy only after the dive supervisor has assessed the situation and instructed him/her to do so. The Standby Diver receives the same

briefings and instructions as the working Diver, monitors the progress of the dive, and is fully prepared to respond if called upon for assistance. The SCUBA Standby Diver shall be equipped with a second regulator, referred to as an octopus.

The standby diver will:

- Be fully equipped to dive and readily available the entire time the diver is in the water;
- Don all specific gear (suits, harnesses, and equipment) up to mask they will wear/use and be checked by the Dive Supervisor;
- Test all gear for proper operation before the primary diver leaves the surface;
- The Standby Diver may then remove the mask and fins and have them ready to don immediately for quick deployment. For safety reasons at the discretion of the Dive Supervisor, the Standby Diver may remove the tank.
- Be dressed appropriately for the water and air temperature.

3.3.4 Tender

For each dive, a Diver will be designated as tender. The tender will:

- Assist the primary diver and the standby diver in donning, doffing, and checking gear;
- Be a diver prepared to dive each day;
- Maintain communications with the diver;
- Keep the Dive Supervisor informed of communications from and to the Diver;
- Tend the tether line for the diver;
- Monitor the diver's progress and status;
- Remain undistracted so he can monitor the surface for danger from boat traffic and any other hazards

If it becomes necessary for the standby diver to enter the water to assist the diver, the Dive Supervisor will immediately assume the role of tender for the standby diver.

3.3.5 Dive Team Support

The dive team is supported by a UXOSO/Quality Control Specialist (QCS) who is trained as a diver. When used, a safety boat will be positioned to safely observe dive operations and to direct other boat traffic away from the operation. The boat operator will be trained and proficient in the operation of the safety boat. He will position the boat as directed by the UXOSO/QCS to support the operation and will be aware of other boats operating in the area and other potential hazards or risk to the operation. The UXOSO/QCS will:

- Maintain communication with the Dive Supervisor;
- Monitor the operation with respect to worker safety and health and quality control;
- Monitor and maintain copies of certificates of training and medical surveillance;
- Verify certifications and conduct periodic audits of personnel qualifications;
- Conduct quality and safety inspection;
- Provide input to after action reviews of the operation;
- Assist in maintaining proper exclusion zones;

- Inspect munitions debris (MD) and material potentially presenting an explosive hazard (MPPEH) recovered;
- Ensure all project safety and quality requirements are met and documented and reports and potential nonconformance to the EOTI corporate quality or safety manager.

The UXOSO/QCS reports to the Corporate Quality Manager for quality related issues and to the Corporate Safety Manager for safety related issues. He also coordinates site activities with the Dive Supervisor and ensures that quality and safety requirements are met and documented.

4. EQUIPMENT

EOTI's policy on diving equipment is to use quality and state-of-the-art equipment to ensure the safety and well-being of the divers. Equipment used in diving operations, particularly those items which are classified as life-support equipment, must be properly maintained and kept in good working order.

4.1 EQUIPMENT INSPECTION

Prior to any dive, all equipment must be carefully inspected for signs of deterioration, damage, or corrosion and must be tested for proper operation. Pre-dive preparation procedures must be standardized, not altered for convenience, and must be the personal concern of each diver. All divers must always check their own equipment. An inspection of all dive gear and associated equipment will be conducted before each use, using Attachment D as a guide. Any equipment not in good working order will be removed from use.

4.2 DIVE FLAGS

In accordance with ER 385-1-86, an appropriate dive flag at least one meter in height, visible in all directions, and will be displayed at the dive location during dive operations. In accordance with 29 CFR 1910.421(h), the signal will be a rigid replica of the international code Alpha Flag.



A traditional red and white "Diver Down" flag will also be displayed in addition to the code Alpha Flag.

4.3 SCUBA EQUIPMENT

Each SCUBA team member will be equipped with:

- An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus;
- Buoyancy compensation device or inflatable life jacket capable of maintaining the diver at the surface in a face-up position;
- A submersible cylinder pressure gauge;
- A weight belt or assembly capable of quick release;
- A watch, pressure gauge and knife; and
- SCUBA air cylinders of seamless steel or aluminum which meet DOT 3AA and DOT 3AL specifications with identification symbols stamped into the shoulder of the tank. Annual inspections and hydrostatic testing will also be stamped into the cylinder as applicable;
- A safety harness with a positive buckling device, attachment point for the safety line, and a lifting point to distribute the pull force of the line over the diver's body while maintaining the body in a heads-up vertical position when unconscious or hurt; and
- A time keeping device will be used by the Dive Supervisor for recording dive times at the dive location and each diver will have a time keeping device to keep track of bottom times.
- Skin suit to protect from cuts and abrasions and thermal protection as required

- Air tanks will be filled from a certified dive shop. Prior to the initial start of dive operations, a copy of the air certification from the dive shop will be obtained and provided to the DDC upon request and maintained on file in the project office.

Each dive team member will be responsible for ensuring that his equipment is inspected prior to each dive using the checklist in Attachment D and report any deficiencies to the Dive Supervisor.

4.4 FIRST AID SUPPLIES

The following first aid supplies will be available on the dive boat:

- First aid kit appropriate for the diving operation;
- American Red Cross standard first aid handbook or equivalent;
- Emergency oxygen with transparent mask will be available at the dive location; and
- A Stokes litter or backboard.
- AED

5. EMERGENCY PROCEDURES

In every diving operation, the possibility of an accident occurring must be considered. The need for a prompt, decisive plan of action in an emergency is essential for the safety of all diving personnel. The Dive Supervisor will implement the following procedures for the respective situations described below.

5.1 FIRE

Fire extinguishers will be maintained ready at the dive site location. Only attempt to put out small fires as necessary of prevent injury or loss of life. Contact first responders immediately upon discovery. Also see Site Safety and Health Plan submitted as part of the Work Plan.

5.2 EQUIPMENT FAILURE

In the event of an equipment failure of a critical component of the dive operations, all dive operations will be discontinued until the equipment is replaced or repaired and the Dive Supervisor has given authorization for dive operations to continue.

5.3 ADVERSE WEATHER

All diving operations will be suspended if lightning is located within 10 nautical miles of the dive site. During high winds greater than 30 miles per hour, boating and platform operations will be suspended. Also see Site Safety and Health Plan submitted as part of the Work Plan.

5.4 MEDICAL ILLNESS OR INJURY

See Attachment A, *First Aid for Diving Related Injuries*, to this plan as well as the Site Safety and Health Plan submitted as part of the Work Plan. Contact first responders immediately. Render first aid as necessary until an emergency medical team arrives.

5.5 EMERGENCY PROCEDURES DURING DIVE OPERATIONS

5.5.1 Entrapped or Fouled Diver

- Diver will notify dive partner, if appropriate, otherwise will notify Dive Supervisor through line pull signals;
- If only one diver is in the water, then the standby diver will assist the fouled diver under the direction of the Dive Supervisor;
- Diver and dive boat personnel must remain calm; and
- Take additional cylinders of air to the fouled diver, if needed.

5.5.2 Loss of Vital Support Equipment

In the event of an equipment failure of a critical component of the dive operations, all dive operations will be discontinued until the equipment is replaced or repaired and the Dive Supervisor has given authorization for dive operations to continue.

5.5.3 Loss of Gas Supply

- Signal dive partner and abort dive;

- Buddy breath/activate reserve; and
- Exhale to the surface.

NOTE: No diving will proceed until the equipment is replaced/repared (with functional checks performed) and the Dive Supervisor has given the OK to proceed with the operation.

5.5.4 Loss of Communication

If communications are lost between a tender and diver and cannot be regained quickly, an audible recall signal will be sounded. If the diver does not surface in a reasonable amount of time after the audible re-call signal has been initiated the stand-by diver will be dispatched to the last known location of the diver. If communications are lost between the diver and the tender and cannot be regained quickly, the diver will surface immediately. The reason for the loss of communications will be investigated and remedied prior to continuation of the dive.

5.5.5 Lost Diver Plan

- Initiate diver recall and wait one (1) minute for response;
- Mark the last known position of the lost diver with a buoy to establish a reference point where searches can start;
- Deploy the standby diver (Dive Supervisor direction) to swim after bubbles or to conduct a circle line search starting at the lost diver buoy;
- Notify ship/boats in the area to look out for the lost diver;
- Request emergency medical help and report situation to the Project Office and EOTI Corporate Office; and
- Ensure stricken divers recovered get immediate, effective treatment.

5.5.6 Injured Diver Plan

If a diver is injured and unable to enter the boat under his/her own power, the remaining team aboard the boat/platform (Dive Supervisor, Tender/assistant, etc.) will be used to assist or place the injured diver into/on the boat/platform or may hold onto the diver and use the boat/platform to get to the shoreline. Contact first responders immediately and render emergency first aid as necessary.

5.5.7 Actions upon Discovery of Fire

Recall the diver. Fire extinguishers will be maintained ready at the dive site location. Only attempt to put out small fires as necessary of prevent injury or loss of life. Contact first responders immediately upon discovery. Also see Site Safety and Health Plan submitted as part of the Work Plan.

5.5.8 Diver Blow-up/Over Rapid Ascent to Surface

Depths of dives typical of MEC projects performed by EOTI are unlikely to produce a requirement for decompression during ascent. If a diver is believed to have ascended too rapidly, the Dive Supervisor will evaluate the situation to confirm that no decompression stop was required. Dive tables will be consulted.

The diver will be observed on the surface for one hour. If symptoms of decompression sickness are observed or suspected, the diver will be treated for decompression sickness as described above.

5.5.9 Diver Loss of Consciousness

Slowly pull the tending line to the surface to recover the diver. If the tending line is fouled deploy the standby diver. Request emergency medical help and report situation to the Project Office and EOTI Corporate Office; and ensure the stricken diver gets immediate, effective treatment.

5.5.10 Injury or Illness of Surface Crew Member

If a severe injury or illness occurs while a diver is in the water, the diver will be recalled immediately to the surface. Diver will either enter the boat/platform to help render assistance or head to the shore and provide assistance as necessary.

5.5.11 Explosive Detonation with Diver (s) in the Water

- Attempt to establish communications with the diver via tending line;
- If communications are established with the diver immediately recall diver to the surface;
- If no communications are reestablished slowly pull the tending line to the surface to recover the diver. If the tending line is fouled deploy the standby diver;
- If the tending line has parted, mark the last location of the diver and begin a surface search of the area. If no contact is made, deploy the standby diver in the last known diver location and begin a systematic search of the area.

5.5.12 Decompression Sickness (“The Bends”) or Arterial Gas Embolism (air embolism)

- Recall all divers from the water;
- Arrange immediate transport of stricken diver(s) to chamber;
- Notify the Project Office and EOTI Corporate Office of circumstances;
- Perform neurological exam and record on (Attachment J); and
- Treat for shock.

6. Internal Safety Inspection

A Site Specific Accident Prevention Plan is prepared for all projects. A qualified Site Safety and Health Officer (SSHO) is assigned to each project. The SSHO reports directly to the Corporate Safety Officer and is responsible for ensuring compliance with all site safety requirements. When the project involves potential underwater MEC the SSHO will be a Navy-trained diver and UXO technician who has the qualifications of a UXOSO. The UXOSO will be on site any time work is performed. The UXOSO provides initial training to all assigned personnel and visitors to ensure that they are familiar with the hazards and controls associated with the site and specific tasks that they may perform. The UXOSO performs daily safety inspection to ensure compliance with safety requirements and to identify unsafe conditions or acts that may present a hazard to workers or visitors. The UXOSO facilitates daily tailgate safety meetings and after action reviews in order to review potential hazards and the effectiveness of controls with all site personnel. The UXOSO makes on the spot corrections as required and works with the site supervisor to address potentially unsafe conditions or actions. He reports potential nonconformance issues to the Corporate Safety Officer and conducts or supports investigation of accidents or near misses.

7. Safety Compliance

EOTI dive operations are conducted in conformance with requirements outlined in OSHA regulations, the U.S. Navy Diving Manual (Volume I) and the USACE Safety and Health Requirements Manual EM 385-1-1. The requirements of OSHA, Department of Labor directive titled, 29 CFR 1910 Subpart T, Commercial Diving Operations has been integrated into this manual and a complete copy is included in Attachment K. U.S. Navy No- Decompression Dive Tables are included in Section 7. OSHA and EM 385-1-1 established safety and health criteria for personnel to include medical requirements, recommended physical examinations, operational procedures, equipment procedures and record keeping requirements which are incorporated herein. Where regulatory and guidance documents conflict, the most stringent requirement takes precedence.

It is EOTI's policy that all employees engaged in commercial dive operations, review the requirements of this safe practices manual (including 29 CFR 1910 Subpart T), as well as site specific dive and safety plans. Site-specific requirements and hazards are reviewed during the initial on-site training and throughout the project during daily safety meetings. The UXOSO ensures compliance with all safety requirements. Failure to comply is unacceptable.

8. Applicable Navy Tables

8.1 No-Decompression Limits and Repetitive Group Designation for No-Decompression Air Dives

No-Decompression Limits and Repetitive Group Designators for No-Decompression Air Dives.

Depth (fsw)	No-Stop Limit	Repetitive Group Designation																
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Z	
10	Unlimited	57	101	158	245	426	*											
15	Unlimited	36	60	88	121	163	217	297	449	*								
20	Unlimited	26	43	61	82	106	133	165	205	256	330	461	*					
25	595	20	33	47	62	78	97	117	140	166	198	236	285	354	469	595		
30	371	17	27	38	50	62	76	91	107	125	145	167	193	223	260	307	371	
35	232	14	23	32	42	52	63	74	87	100	115	131	148	168	190	215	232	
40	163	12	20	27	36	44	53	63	73	84	95	108	121	135	151	163		
45	125	11	17	24	31	39	46	55	63	72	82	92	102	114	125			
50	92	9	15	21	28	34	41	48	56	63	71	80	89	92				
55	74	8	14	19	25	31	37	43	50	56	63	71	74					
60	60	7	12	17	22	28	33	39	45	51	57	60						
70	48	6	10	14	19	23	28	32	37	42	47	48						
80	39	5	9	12	16	20	24	28	32	36	39							
90	30	4	7	11	14	17	21	24	28	30								
100	25	4	6	9	12	15	18	21	25									
110	20	3	6	8	11	14	16	19	20									
120	15	3	5	7	10	12	15											
130	10	2	4	6	9	10												
140	10	2	4	6	8	10												
150	5	2	3	5														
160	5		3	5														
170	5			4	5													
180	5			4	5													
190	5			3	5													

* Highest repetitive group that can be achieved at this depth regardless of bottom time.

8.2 Residual Nitrogen Timetables for Repetitive Air Dives

Locate the diver's repetitive group designation from his previous dive along the diagonal line above the table. Read horizontally to the interval in which the diver's surface interval lies.

Next, read vertically downward to the new repetitive group designation. Continue downward in this same column to the row that represents the depth of the repetitive dive. The time given at the intersection is residual nitrogen time, in minutes, to be applied to the repetitive dive.

* Dives following surface intervals longer than this are not repetitive dives. Use actual bottom times in the Air Decompression Tables to compute decompression for such dives.

Dive Depth	Repetitive Group at Beginning of Surface Interval															
	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
10	**	**	**	**	**	**	**	**	**	**	**	427	246	159	101	58
15	**	**	**	**	**	**	**	**	450	298	218	164	122	89	61	37
20	**	**	**	**	**	462	331	257	206	166	134	106	83	62	44	27
25	†	†	470	354	286	237	198	167	141	118	98	79	63	48	34	21
30	372	308	261	224	194	168	146	126	108	92	77	63	51	39	28	18
35	245	216	191	169	149	132	116	101	88	75	64	53	43	33	24	15
40	188	169	152	136	122	109	97	85	74	64	55	45	37	29	21	13
45	154	140	127	115	104	93	83	73	64	56	48	40	32	25	18	12
50	131	120	109	99	90	81	73	65	57	49	42	35	29	23	17	11
55	114	105	96	88	80	72	65	58	51	44	38	32	26	20	15	10
60	101	93	86	79	72	65	58	52	46	40	35	29	24	19	14	9
70	83	77	71	65	59	54	49	44	39	34	29	25	20	16	12	8
80	70	65	60	55	51	46	42	38	33	29	25	22	18	14	10	7
90	61	57	52	48	44	41	37	33	29	26	22	19	16	12	9	6
100	54	50	47	43	40	36	33	30	26	23	20	17	14	11	8	5
110	48	45	42	39	36	33	30	27	24	21	18	16	13	10	8	5
120	44	41	38	35	32	30	27	24	22	19	17	14	12	9	7	5
130	40	37	35	32	30	27	25	22	20	18	15	13	11	9	6	4
140	37	34	32	30	27	25	23	21	19	16	14	12	10	8	6	4
150	34	32	30	28	26	23	21	19	17	15	13	11	9	8	6	4
160	32	30	28	26	24	22	20	18	16	14	13	11	9	7	5	4
170	30	28	26	24	22	21	19	17	15	14	12	10	8	7	5	3
180	28	26	25	23	21	19	18	16	14	13	11	10	8	6	5	3
190	26	25	23	22	20	18	17	15	14	12	11	9	8	6	5	3

Residual Nitrogen Times (Minutes)

** Residual Nitrogen Time cannot be determined using this table (see paragraph 9-9.1 subparagraph 8 for instructions).

† Read vertically downward to the 30 fsw repetitive dive depth. Use the corresponding residual nitrogen times to compute the equivalent single dive time. Decompress using the 30 fsw air decompression table.

8.3 Standard Air Decompression

Air Decompression Table.
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O ₂ stop								Total Ascent Time (M:S)	Chamber O ₂ Periods	Repet Group
			100	90	80	70	60	50	40	30			
30 FSW													
371	1:00	AIR								0	1:00	0	Z
		AIR/O ₂								0	1:00		
380	0:20	AIR								5	6:00	0.5	Z
		AIR/O ₂								1	2:00		
In-Water Air/O ₂ Decompression or SurDO ₂ Recommended -----													
420	0:20	AIR								22	23:00	0.5	Z
		AIR/O ₂								5	6:00		
480	0:20	AIR								42	43:00	0.5	
		AIR/O ₂								9	10:00		
540	0:20	AIR								71	72:00	1	
		AIR/O ₂								14	15:00		
Exceptional Exposure: In-Water Air Decompression ----- In-Water Air/O ₂ Decompression or SurDO ₂ Required -----													
600	0:20	AIR								92	93:00	1	
		AIR/O ₂								19	20:00		
660	0:20	AIR								120	121:00	1	
		AIR/O ₂								22	23:00		
720	0:20	AIR								158	159:00	1	
		AIR/O ₂								27	28:00		
35 FSW													
232	1:10	AIR								0	1:10	0	Z
		AIR/O ₂								0	1:10		
240	0:30	AIR								4	5:10	0.5	Z
		AIR/O ₂								2	3:10		
In-Water Air/O ₂ Decompression or SurDO ₂ Recommended -----													
270	0:30	AIR								28	29:10	0.5	Z
		AIR/O ₂								7	8:10		
300	0:30	AIR								53	54:10	0.5	Z
		AIR/O ₂								13	14:10		
330	0:30	AIR								71	72:10	1	Z
		AIR/O ₂								18	19:10		
360	0:30	AIR								88	89:10	1	
		AIR/O ₂								22	23:10		
Exceptional Exposure: In-Water Air Decompression ----- In-Water Air/O ₂ Decompression or SurDO ₂ Required -----													
420	0:30	AIR								134	135:10	1.5	
		AIR/O ₂								29	30:10		
480	0:30	AIR								173	174:10	1.5	
		AIR/O ₂								38	44:10		
540	0:30	AIR								228	229:10	2	
		AIR/O ₂								45	51:10		
600	0:30	AIR								277	278:10	2	
		AIR/O ₂								53	59:10		
660	0:30	AIR								314	315:10	2.5	
		AIR/O ₂								63	69:10		
720	0:30	AIR								342	343:10	3	
		AIR/O ₂								71	82:10		

9. Repetitive Dive Worksheets

The Diving Profile Log is a chronological record of all dives conducted during a project. It contains information related to the specific dive operation conducted each day and to specific divers specific divers involved. A sample form is included in Attachment C.

Information recorded on the log includes:

- Date of dive
- Location of the dive
- Environmental conditions affecting the dive
- Equipment used
- Purpose of the dive
- Identification of divers and standby divers
- Times left and reached surface, bottom time
- Depth
- Decompression time
- Air and water temperature
- Signatures of Diving Supervisor

10. Fitness for Duty

10.1 DIVE PHYSICAL FREQUENCY

All divers must have a certificate signed by a licensed physician, stating that they have been medically examined within the last 12 months and have been determined fit and approved to dive. The dive medical examination will be repeated every 12 months with verifications submitted to the DDC as appropriate.

10.2 PHYSICAL EXAMINATIONS

Initial and Periodic Re-examinations – All ages, require the following:

Medical History Complete

Physical Examination

Chest X-ray

Spirometry

Urinalysis

Vision

Other testing as required

10.3 DIVE PHYSICAL CONSIDERATIONS

The physician conducting the examination should consider the following disorders, which may restrict or limit occupational exposure to hyperbaric conditions depending on severity, presence of residual effects, response to therapy, number of occurrences, diving mode, or degree and duration of isolation.

- History of seizure disorder other than early febrile convulsions.
- Malignancies (active) unless treated and without recurrence for 5 yrs.
- Chronic inability to equalize sinus and/or middle ear pressure.
- Cystic or cavitory disease of the lungs.
- Impaired organ function caused by alcohol or drug use.
- Conditions requiring continuous medication for control (e.g., antihistamines, steroids, barbiturates, mood-altering drugs, or insulin).
- Meniere's disease.
- Hemoglobinopathies.
- Obstructive or restrictive lung disease.
- Vestibular end organ destruction.
- Pneumothorax.
- Cardiac abnormalities (e.g., pathological heart block, valvular disease, intraventricular conduction defects other than isolated right bundle branch block, angina pectoris, arrhythmia, coronary artery disease).
- Juxta-articular osteonecrosis.

11. Administration and Recordkeeping

11.1 DIVING RECORD KEEPING REQUIREMENTS

The Dive Supervisor will provide to the SUXOS all project diving records for the project to be incorporated into the project files; these records will be kept in the project site office. Diving Related Injury or Illness.

The Dive Supervisor and the UXOSO/QCS will record and report any diving-related occupational injury and illness which requires any dive team member to be hospitalized for 24 hours or more, specifying the circumstances of the incident and the extent of the injury or illness on applicable EOTI Incident Report Forms. All injuries and illnesses will be immediately reported to the UXOSO and Project Manager.

11.2 AVAILABILITY OF RECORDS

Records and documents required by 29 CFR 1910 Subpart T shall be provided upon request to the:

- Assistant Secretary of Labor for Occupational Safety and Health (OSH);
- Director, National Institute for OSH; and
- Employee or his designated representative.

11.3 DIVING RECORD RETENTION PERIODS

Records and documents required by 29 CFR 1910 Subpart T shall be retained by EOTI for the following periods.

- Dive team member medical records – five (5) years;
- Safe Practices Manual - current document only;
- Depth-time profile - until completion of the recording of dive, or until completion of decompression procedure assessment where there has been an incident of decompression sickness;
- Recording of dive – one (1) year, except five (5) years when there has been an incident of decompression sickness;
- Decompression procedure assessment evaluations – five (5) years;
- Equipment inspections and testing records - current entry or tag, or until equipment is withdrawn from service;
- Records of hospitalization – five (5) years;
- After the expiration of the retention period of any record required for five (5) years, EOTI will forward such records to the National Institute for Occupational Safety and Health, Department of Health and Human Services.

12. References

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Department of Defense Explosives Safety Board (DDESB). 2004. Technical Paper (TP) 18. Minimum qualifications for Unexploded Ordnance (UXO) Technicians and Personnel. 20 December.

Department of Defense (DoD) Ammunition and Explosives Safety Standards. 2012. DoD Ammunition and Explosives Safety Standards DOD Manual 6055.09-M

Department of Defense (DoD). 2008. DoD Instruction (DoDI) 4140.62, Material Potentially Presenting an Explosive Hazard. November.

DDESB. 2012. TP 16. Methodologies for Calculation Primary Fragment Characteristics.

Revision 4. August United States Army Corps of Engineers (USACE) 2006. Safety and Health Requirements Manual EM 385-1-97 (with Erratas)

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United States Army Corps of Engineers (USACE) 2010. USACE Dive Program. ER 385-1-86. September.

United States Navy (USN). 2008. USN Diving Manual. Revision 6. April.

Department of the Army Memorandum, Subject: Munitions Response Actions – Minimum Separation Distances (Relative to Impulse Water Pressure) from Underwater Detonations, 16 Sep 13

13. Glossary of Diving Terms

ACFM	Actual cubic feet per minute.
Alternate Project Dive Supervisor	Alternate designated, in writing, by the Project Manager to act on behalf of the Project Dive Supervisor.
ASME Code or equivalent	ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code, Section VIII, or an equivalent code which the employer can demonstrate to be equally effective.
ATA	Atmosphere absolute.
Bottom time	The total elapsed time measured in minutes from the time the diver leaves the surface in descent to the time that the diver begins ascent.
Bursting pressure	The pressure at which a pressure containment device would fail structurally.
Circle line search	Descending line leading to a clump with a second line attached used by divers to rapidly search small areas.
Cylinder	A pressure vessel for the storage of gases.
Decompression sickness	A condition with a variety of symptoms which may result from gas of bubbles in the tissues of divers after pressure reduction.
Decompression table	A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure.
Dive location	A surface or vessel from which a diving operation is conducted.
Dive team	For all diving operations, the dive team will consist of a minimum of four people, including a Dive Supervisor, who are assigned to diving duty in writing by EOTI. The dive team members will be required to be graduates of an approved course of instruction.
Dive-location reserve breathing gas	A supply system of air or mixed-gas (as appropriate) at the dive location which is independent of the primary supply system and sufficient to support divers during the planned decompression.
Diver	An employee working in water using underwater apparatus which supplies compressed breathing gas at the ambient pressure.
Diver Orientation	Diver orientation will be scheduled by the Project Dive Supervisor in order to familiarize or train diver personnel on new or unfamiliar technical functions to be performed by the dive team.
Diving Mode	A type of diving requiring specific equipment, procedures and techniques

	(SCUBA, surface-supplied air).
Dive Supervisor	The person in charge of diving operations. May be the Project UXO Dive Supervisor or an Alternate Dive Supervisor.
Diving Time/Water Time	Time spent in or underwater while engaged in a diving operation. Diving time will start at the time the diver enters the water and ends when the diver exits the water and returns to the pier, dive boat, or diving platform.
Diving Training	Training prescribed by the Project Dive Supervisor in order to maintain diver proficiency.
Diver	A graduate of U.S. Naval School Explosive Ordnance Disposal engaged in munitions response diving operations.
FSW	Feet of seawater (or equivalent static pressure head).
Hyperbaric condition	Pressure conditions in excess of (1 ATA) surface pressure.
Live boating	The practice of supporting a SCUBA, surface-supplied air, mixed-gas diver, from a vessel that is underway.
No-decompression limits	The depth-time limits of the "no-decompression limits and repetitive diving group designation table for no-decompression air dives", U. S. Navy Diving Manual or equivalent limits which the employer can demonstrate to be equally effective.
Observer/Assistant	A team member able to assist them in the water
Post-Dive preparation time	Time spent in the breakdown, cleaning, preservation, and maintenance of diving equipment upon completion of a diving operation.
Pre-Dive preparation time	Time spent by diver personnel preparing diving equipment for a diving operation.
Dive Supervisor	This person is responsible for the safe and efficient operation of all diving functions at the location to which he is assigned. The Dive Supervisor must be knowledgeable of diving operations in general and all specific diving assignments involved. He is assigned in writing by EOTI.
psi(g)	Pounds per square inch (as measured using a gauge).
Recompression chamber	A pressure vessel for human occupancy such as a surface recompression chamber, closed bell, or deep diving system used to decompress divers and to treat decompression sickness.

SCUBA	A diving mode independent of surface air supply in which the diver uses open circuit Self-Contained Underwater Breathing Apparatus.
Standby diver	A diver at the dive location available to assist a diver in the water.
Stationary Jackstay grid search	Four clumps with buoy/buoy lines and four bottom lines connecting the four clumps used by divers to systematically and thoroughly search large areas.
SSA	A diving mode in which a diver uses Surface Supplied Air.
Underwater stage	A suspended underwater work platform, which supports a diver in the water.
Volume tank	A pressure vessel connected to the outlet of a compressor and used as air reservoir.
Walking Jackstay grid search	Two clumps with descending lines and a line of a specified length connecting the clumps used by divers to systematically and thoroughly search large areas.
Working pressure	The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

Attachments

- A – Emergency Management Plan
- B - Line Pull and Hand Signals
- C – Diving Profile Log
- D – Personal Dive Equipment Checklist
- E – General Planning Checklist
- F – Project Dive Supervisor Checklist
- G – Project Dive Plan
- H – Dive Supervisor Pre-dive Checklist
- I – Checklist for Dive Boat Operations
- J – Neurological Examination Checklist
- K – 29 CFR 1910 Subpart T

Attachment A – Emergency Management Plan

A.1. FIRST AID FOR INJURIES REQUIRING IMMEDIATE TRANSPORT TO A CHAMBER FACILITY

A.1.1 Air Embolism

Recognition - Usually occurs during or immediately after surfacing

Symptoms (one or more of the following)

Disorientation or Fatigue

Skin Itch

Chest Pain

Numbness, Tingling, Paralysis or Weakness

Dizziness, Vertigo, or Ringing in the Ears

Blurred Vision

Personality Change

Signs (one or more of the following)

Bloody froth from nose or mouth

Paralysis or Weakness

Unconsciousness

Convulsions

Shortness of Breath or Cessation of Breathing

Apparent Death

Note: Symptoms and signs usually appear within 15 minutes to 12 hours after surfacing; in severe cases, symptoms may appear immediately or even before the dive is completed. Delayed occurrence of symptoms is rare but can occur, especially if air travel follows diving. The quicker treatment begins, the better the chances of a full recovery.

Early Management

- CPR, if required
 - Open airway, prevent aspiration, and incubate if trained person available
 - Give O²; remove only to open airway or if convulsion ensue
 - If conscious, give nonalcoholic liquids
 - Place in horizontal, neutral position
 - Restrain convulsing person loosely and resume O² as soon as airway is open
 - Protect from excessive cold, heat, water, or fumes
- Arrange emergency transport, send divers profile with the diver, and send all diving equipment for examination or have it examined locally.

A.1.2 Decompression Sickness

Recognition - Symptoms usually appear 15 minutes to 12 hours after surfacing

Symptoms (one or more of the following)

- Tired Feeling
- Itching
- Pain, arms, legs or trunk
- Dizziness
- Numbness, tingling or paralysis
- Chest compression or shortness of breath
- Anything unusual after the dive

Signs (one or more of the following)

- Blotchy Rash
- Paralysis or weakness anywhere in the body
- Coughing Spasms
- Staggering or instability
- Unconsciousness

Personality change

Early Management

Stabilize patient the same way as for Air Embolism

Arrange for emergency transport, send divers profile with the diver, and send all diving equipment for examination or have it examined locally

A.2.0 FIRST AID FOR INJURIES REQUIRING TRANSPORT TO A HOSPITAL FACILITY

A.2.1 Pneumothorax

Symptoms (one or more of the following)

Pains in the chest

Shortness of breath

Signs (one or more of the following)

- Shallow Rapid Breathing
- Cyanosis (blue skin, lips, fingernails)
- Possible crackling under the skin of the neck
- Possible mediastinal shift (heart sounds not in the usual place)

Emergency Actions:

Call for help and immediate transport

A.2.2 Mediastinal Emphysema (Lung over pressure accident)

Recognition - Always associated with pneumothorax

Symptoms (one or more of the following)

Pain in the chest (beneath the breastbone)

Faintness

Shortness of breath

Signs (one or more of the following)

Obvious difficulty breathing

Brassy change in voice

Emergency Actions:

Transport to medical facility for evaluation

A.2.3 Drowning-Near Drowning

Recognition

Unconsciousness

Lack of respiration

Cyanosis (blue skin, lips, fingernails)

Management

Try to identify the time the victim was last seen breathing

Assess ABC's airway, breathing and circulation

Removal of gear

Transport to the boat or shore

Immediate call for help and transport to facility

Start CPR

A.2.4 Oxygen Toxicity (with convulsions)

Signs (one or more of the following)

Decreased or loss of consciousness; followed by

Convulsions

Symptoms (one or more of the following)

Nausea

Dizziness

Ringling in the ears

Abnormal Vision

Confusion

Prevention

Avoidance of gases with high O² concentrations (as in Nitrox at inappropriate depth)

Avoid CO² retention that can precipitate O² convulsions at any depth

If convulsions occur at depth, be prepared to treat near drowning and/or air embolism

TREATMENT - Call for help and immediate transport

A.2.5 Severe Trauma or Large Predator Injury (Head Injury, Limb Injury due to falls, Equipment Crush, Prop Injuries)

- call for help and immediate transport
- open airway
- treat for shock on site and stabilize before evacuation
- face up neutral position
- direct pressure over bleeding wounds
- CPR if no pulse or respiration
- keep warm
- be mindful of the possibility of neck injury
- splint limb injuries
- call for help and immediate transport

A.2.6 Suspected Heart Attack or Stroke

- Call for help and immediate transport
- Treat for shock
- CPR if no pulse or respiration
- Keep warm
- Call for help and immediate transport

A.2.7 Severe Allergic Reaction

- Remove any remnant of allergen (i.e., jellyfish tentacles, foreign material)
- Wash out wounds of injury with alcohol, vinegar, or water
- Call for help and immediate transport

- Treat for shock
- CPR if no pulse or respiration
- Keep warm
- Pain Relief, if available
- Transport to medical facility for evaluation

A.2.8 Stinging Fishes (Stingrays, Scorpion fish)

- Immobilize
- Remove spine and debride (scrub the wound)
- Irrigate wound
- Soak in hot water (thermolabile toxin) 50° C, for 30-90 minutes
- Call for help and immediate transport
- Treat for shock, hydrate

A.2.9 Hypothermia

- Keep core temperature above 95° F
- Keep airway open
- Immobilize
- Wrap in blankets, preferably next to another person
- Basic life support, CPR, if needed
- Warm liquids, if alert, unless very cold - then avoid due to possibility of ventricular tachycardia (rapid, useless fluttering of the heart)
- Call for help and immediate transport

A.2.10 Hyperthermia (Heat Exhaustion due to excessive fluid loss)

- Remove from source of heat
- Lower temperature (cool compresses at arterial points and head)

- Keep calm
- Keep airway open
- Call for help and immediate transport if unstable

A.2.11 Heat Stroke

- Remove all clothing
- Cover with cool wet sheet
- Place in air-conditioned area
- Cold packs to neck, scalp, groin and armpits
- If convulsions occur ensure victim does not cause further harm to themselves
- Call for help and immediate transport

A.3.0 AID FOR INJURIES THAT CAN BE TREATED ON BOARD

A.3.1 Nitrogen Narcosis

Signs (one or more of the following)

Inappropriate behavior at depth

Ignoring hand signals and instructions

Stupor or coma

Symptoms (one or more of the following)

Inflexible thinking and attitude

Decrease or loss of judgment

False sense of security

Lack of concern for safety

Inability to think through problems

Panic

Near unconsciousness or loss of consciousness at depth

Treatment

- Ascend until free of symptoms
- Surface with controlled ascent
- Transport to medical facility for evaluation

A.3.2 Carbon Dioxide Poisoning

Symptoms (one or more of the following)

- Rapid breathing
- Feeling of suffocation or shortness of breath
- Headache, nausea, dizziness
- Rapid heartbeat
- Confusion and unclear thinking

Signs (one or more of the following)

- Slowed responses
- Muscle irritability (twitching)
- Loss of consciousness

Treatment

- Remove the cause (over-exertion, equipment failure, rebreathers, etc.)
- Stop and rest during early symptoms to avoid loss of consciousness
- Surface; Transport to medical facility for evaluation

A.3.3 Ear Disorders

Middle Ear Barotrauma

- Keep quiet and calm
- Without DCS or rupture of the round or oval windows, give Benadryl 25 mg
- Transport to medical facility for evaluation
- Discontinue diving until cleared by EMT

Inner Ear Barotrauma

Recognize round or oval window damage (loss balance, ataxia, tinnitus, deafness)

Keep head up and affected ear elevated

Discourage straining

Transport to medical facility for evaluation

EMT evaluation, no more diving until cleared by EMT

A.3.4 Sea Sickness

The best medications have been found to be Meclizine, Bonine, Dramamine and Trans-derm Scope.

Keep your eyes on the horizon

Stay on deck

Keep yourself well hydrated with non-alcoholic beverages

Try antacid tablets or lemon drops

If diving, try to be the first diver in water.

Attachment B - Line Pull and Hand Signals

LINE PULL SIGNALS - Line Pull Signals will be distinct pulls on the line which are strong enough to be felt by the diver but not strong enough to pull the diver away from the work. Acknowledgment consists of replying with the same signal. If a signal is not acknowledged, the signal will be re-sent. Continued absence of confirmation will be assumed to mean one of three things:

The line is fouled.

Too much slack in the line.

Diver in trouble.

If communication is lost, the Project Dive Supervisor will take immediate steps to identify the problem.

Line Pull Signals - From Tender to Diver:

1 Pull "Are you All right?"

When diver is descending, one pull means, "STOP".

2 Pulls "Going down"

During ascent, 2 Pulls means, "You have come up too far, go back down until we stop you"

3 Pulls "Standby to come up"

4 Pulls "Come up"

2-1 Pulls "I understand" or "Answer the telephone"

3-2 Pulls "Ventilate"

4-3 Pulls "Circulate"

Line Pull Signals - From Diver to Tender:

1 Pull "I am All right"

When diver is descending, one pull means, "STOP" or "I am on the bottom"

2 Pulls "Lower" or "Give me slack"

3 Pulls "Take up my slack"

4 Pulls "Haul me up"

2-1 Pulls "I understand" or "Answer the telephone"

3-2 Pulls "More Air"

4-3 Pulls "Less Air"

Special Line Pull Signals from the Diver:

1-2-3 Pulls "Send me a square mark"

5 Pulls "Send me a line"

2-1-2 Pulls "Send me a slate"

Line Pull Searching Signals - Without Circling Line

7 Pulls "Go on/off searching signals"

1 Pull "Stop, search where you are"

2 Pulls "Face the line and move away from the weight"

3 Pulls "Face the weight and go right"

4 Pulls "Face the weight and go left"

Emergency Line Pull Signals from the Diver:

2-2-2 Pulls "I am fouled and need the assistance of another diver"

3-3-3 Pulls "I am fouled but can clear myself"

4-4-4 Pulls "Haul me up immediately"

All Emergency Signals will be answered as given, EXCEPT 4-4-4.

Attachment C – Diving Profile Log

EOTI DIVING PROFILING LOG

Date of Last Previous Dive:

Time of Last Previous Dive:

Date	Geographic Location						Air Temp(°F)		
Equipment Used	Dress						Wave Height (ft)		
Breathing Medium	Platform						Water Temp (°F)		
Breathing Medium Source						Current (kts)			
Depth of Dive (fsw)			Bottom Type				Bottom Visibility (ft)		
Diver	LS	RB	LB	RS	TBT	TDT	TTD	Sched Used	
Purpose of Dive, Tools Used, etc.						Repet Group			
						Surface Interval			
						New Repet Group			
						RNT			
Dive Comments									
Signature (Dive Supervisor)									

Attachment D – Personal Dive Equipment Checklist

_____ Air Cylinders	Inspect air cylinders exteriors and valves for rust, cracks, dents, and any evidence of weakness. Remove valve cover and inspect O-ring.
_____ Cylinder pressure	Gauge the cylinder and record pressure reading: _____ psig.
_____ Harness straps	Check for signs of rot and excessive wear. Adjust straps and backpack for individual use, and test quick release mechanisms. Check backpack for cracks and other unsafe conditions.
_____ Hoses	Check the hose(s) for cracks and punctures. Test the connections of each hose at the regulator and mouthpiece assembly by tugging on the hose. Check the clamps for corrosion and damage, replace as necessary.
_____ Regulator	Attach regulator to the cylinder manifold and ensure it is seated correctly. Open cylinder valve slowly all the way and back off one-quarter turn. Check that there are no leaks by listening for the sound of escaping air. Check that the regulator breathes properly by breathing the regulator for thirty seconds. If any leaks are noted or regulator does not breathe properly, inform the Project Dive Supervisor and remove regulator from service.
_____ Emergency air supply	Ensure that it has no damage to the mouth piece, bottle, regulator body, purge valve or regulator. Ensure that the pressure indicator is showing a filled tank or gauge is reading a full tank (3000 psi) or in the safe (green) zone.
_____ Life Preserver or BC	Orally inflate preserver to check for leaks, and then squeeze out air. Inspect the carbon dioxide cartridges to ensure they have not been used and are the proper size for the vest being used and for the depth of the dive. Firing pin(s) will not show wear and will move freely. The firing lanyards and life preserver straps must be free of any signs of deterioration.
_____ Dry Suit	Inspect the exterior of dry suit for holes, rips or tears. Inspect cuffs and neck dam for dry rot, rips, and tears. Ensure zippers are in good working order and no teeth are missing. Test the air fitting connection with an air hose and ensure it locks in place. Inspect air relief valve for damage.
_____ CO ₂ Cartridges	Weigh carbon dioxide cartridges and record weight: _____ . Weight will be within 10% of stamped weight.

If weight is not within tolerance remove from service and notify Dive Supervisor.

_____ Facemask	Check the seal of the mask and the condition of the head strap. Check for cracks in the skirt and faceplate.
_____ Swim Fins	Check straps and inspect blades for signs for cracking.
_____ Dive Knife	Test the edge of the knife for sharpness, and ensure the knife is fastened securely in the scabbard. Verify the knife can be removed from the scabbard.
_____ Weight Belt	Check the condition of the weight belt and that the proper number of weights are secure and in place. Verify that the quick-release buckle is functioning properly.
_____ Wristwatch	Ensure wristwatch is wound and set to the correct time. Inspect the pins and strap of the watch for wear.
_____ Depth Gauge	Inspect pins and straps. If possible, check compass with another compass. Make comparative checks on depth gauges to ensure depth gauges read zero fsw on the surface.
_____ Miscellaneous Equipment	Inspect any other equipment which will be used on the dive as well as any spare that may be needed during the dive including spare regulators, cylinders and gauges. Check all protective clothing, lines, tools, flares, and other optional gear.
_____ Dive Lights	Checked to ensure they work
_____ Metal Detector	Surface check to ensure it powers up
_____ Standby Diver	Inspect line to make sure it is proper length and no deterioration
_____ Observer/Assistant	Check line for proper length and no deterioration
_____ Observer/Assistant	Properly stowed on board Throw bag or Ring Buoy

Attachment E – General Planning Checklist

E.1.0 STEPS IN PLANNING DIVING OPERATIONS

E.1.1. Analyze the Mission for Safety

Advanced planning is the greatest single safety precaution that can be taken. The following points must be considered individually and in depth:

- Objective definition;
- Environmental conditions;
- Emergency assistance (Recompression chamber and medical assistance);
- Route familiarization for all personnel; and
- Relevant instructions.

E.1.2 Pinpoint potential hazards

Atmospheric

- _____ Extreme exposure of personnel to elements
- _____ Adverse exposure of equipment and supplies to elements
- _____ Delays or disruption caused by weather

Surface

- _____ Sea sickness
- _____ Water entry and exit
- _____ Handling of heavy equipment in rough water
- _____ Maintaining location in winds and currents
- _____ Flotsam, kelp, petroleum disrupting operations
- _____ Delays or disruption caused by water state

Underwater and Bottom

- Depth exceeds diving limits or limits of available equipment
- Exposure to cold temperatures
- Bottom obstructions
- Dangerous bottom conditions (mud, drop-offs, sewer outfalls, etc.)
- Visibility reduced or obstructed by suspension of bottom sediment

“On-site” Hazards

- Unusual site conditions
- High powered, active sonar
- Other conflicting water or shore operations
- Radiation contamination
- Pollution

Mission Hazards

- Decompression sickness/Pulmonary Barotraumas
- Communications problems
- Drowning
- Other trauma (injuries)
- Equipment malfunctions

Other Hazards

- Entrapment
- Entanglement
- Pollution, toxic
- Explosives or other ordnance

- _____ Shifting or “working” of object
- _____ Handing branches or limbs

E.1.3 Minimize Hazards and Plan for Emergencies.

E.1.3.1 Diving Personnel

- _____ Assemble a complete and properly qualified Diving Team
- _____ Assign each task to the most trained and experienced personnel
- _____ Verify that each member of the Diving Team is properly trained and qualified for the equipment and depths involved
- _____ Determine that each diver is physically fit to dive, paying attention to:
 - _____ General condition
 - _____ Last record of medical exam
 - _____ Ears and sinuses
 - _____ Severe cold or flu
 - _____ Use of stimulants or intoxicants
 - _____ Fatigue
 - _____ Last Repetitive Dive
 - _____ Time since last air travel
- _____ Determine each person’s emotional fitness to dive (as far as possible):
 - _____ Motivation (willingness)
 - _____ Stability

E.1.3.2 Diving Equipment

- _____ Verify that the type of diving gear chosen (and diving technique) is adequate for the mission and particular task meeting OSHA and USACE requirements
- _____ Verify that the type of equipment and diving technique is appropriate for the depth involved
- _____ Verify that all equipment has been tested and approved

- _____ Determine that all necessary support equipment and tools are readily available and are the best for accomplishing the job efficiently and safely
- _____ Determine that all related support equipment such as winches, boats, cranes, floats, etc., are operable, safe, and under the control of trained personnel
- _____ Check that all diving equipment has been properly maintained with appropriate records, and is in full operating condition

E.1.3.3 Provide for Emergency Equipment

- _____ Obtain suitable communications equipment with sufficient capability to reach “outside help”. Check all communications for proper functioning
- _____ Verify that a recompression chamber is ready for use, or notify the nearest location having one that its use may be required within a given time frame
- _____ Verify that a First Aid Kit is near at hand, and is completely stocked.
- _____ If a resuscitator will be used, check the apparatus for function
- _____ If conducting boat operations, check that all fire-fighting equipment is readily available and in full operating condition
- _____ Verify that Emergency transportation is either standing by, or on immediate call
- _____ Verify AED is on Site and personnel are trained in its use

E.1.3.4 Establish Emergency Procedures

- _____ Know how to obtain medical assistance immediately
- _____ Assign specific tasks to the Diving Team and support personnel for different emergencies
- _____ Develop and post the emergency assistance checklist and ensure that all personnel are familiar with its location and use
- _____ Verify that a copy of the latest U. S. Navy Standard Air Decompression, repetitive and no-decompression tables are available at the dive location
- _____ Be sure that all divers, boat crews, and other support personnel understand all diver hand signals
- _____ Verify that all personnel are familiar with emergency recall signals and procedures

- _____ Pre-determine distress signals and call-signs with all members of the diving team, boat crews, and other activities
- _____ Be sure that all divers have removed anything from their mouths which might choke them during a dive (gum, dentures, tobacco)
- _____ Thoroughly drill and train all personnel in Emergency Procedures, with particular attention to cross training. Drills will include:
 - Fire, for boat operations
 - First Aid
 - Decompression Sickness
 - Embolism
 - Restoration of Breathing
 - Drowning
 - Entrapment
 - Lost Diver
 - Unconscious Diver Recovery

E.1.4 Establish Safe Diving Operational Procedures

- _____ Determine that all other means of accomplishing the mission have been considered before deciding to use divers.
- _____ Be sure that contingency planning has been conducted.
- _____ Carefully state the goals of each mission, and develop a flexible plan of operations.
- _____ Completely brief the Diving Team and support personnel.
- _____ Designate a properly qualified Dive Supervisor to be in charge of the mission.
- _____ Designate a timekeeper and verify that he understands his duties and responsibilities.
- _____ Determine the exact depth at the job-site through the use of an electronic depth finder, lead line or fathometer.
- _____ Verify the existence of an adequate supply of compressed air available for all planned diving operations plus an adequate reserve for emergencies.

- _____ Be sure that operations or action on the part of the Diving Team, support personnel, boat crews, technicians, winch/crane operators, etc., do not start without the knowledge and direct command of the Project Dive Supervisor.
- _____ All efforts must be made through proper planning, briefings, training, organization and other preparations to minimize “bottom-time”. Remember in all cases, water depth and the condition of the diver (especially fatigue) rather than amount of work to be done will govern the diver’s bottom time.
- _____ Decompression tables will be on hand, be up-to-date, and be used in all planning and scheduling of diving operations.
- _____ Instruct all divers and support personnel not to cut any lines until that action is approved by the Dive Supervisor.
- _____ Be sure that the ship, boat, or diving craft is properly manned and in position to permit the safest and most efficient operation (except in the case of emergency).
- _____ Ensure that, when conducting SCUBA operations, the boat can be quickly cast off and moved to a diver in distress.
- _____ Ensure that each diver checks his own equipment in addition to checks made by tenders, technicians, or other support personnel.
- _____ Designate a standby diver for all SCUBA operations; and check that the standby diver is equipped and ready to enter the water if needed.
- _____ All efforts will be made to prevent divers from being fouled on the bottom. If work is to be conducted inside a wreck or similar underwater structure, designate a team of divers to accomplish the task. One diver will enter the water; the other will tend his lines from the point of entry.
- _____ When using explosives, take appropriate measures to ensure that no charge will be fired while divers are in the water.
- _____ Brief all divers on the planned decompression schedules for each particular dive. Check provisions made for decompressing diver.
- _____ Verify that the ship, boat, or diving craft is displaying the proper signals, flags, or lights to indicate diving operations are in progress.
- _____ Ensure that proper protection against harmful marine life has been provided.
- _____ When using the air compressor to fill air cylinders check that the intake hose is not near the exhaust of the compressor.
- _____ Thoroughly brief the boat crew using the Diving Boat Operations Checklist.

_____ Verify that proper safety and operational equipment is aboard small diving boats or craft.

E.1.5 Notify Proper Parties that Dive Operations are Ready to Commence

_____ Local officials, military or civilian

_____ Cognizant Navy Organizations

_____ U. S. Coast Guard (if present).

If deemed necessary by the Dive Supervisor, notify emergency facilities having recompression chambers, as well as sources of emergency transportation that Diving Operations are under way and their assistance may be needed.

Attachment F – Project Dive Supervisor Checklist

F.1. Dive Supervisor: _____

F.2. Dive Location: _____

F.3. Dive Operation Scheduled: _____

F.4. Time Scheduled for Dive: _____

F.5. Chamber Location:

Primary: _____

Secondary: _____

Phone Number: _____

F.6. Route to Chamber/Hospital: _____

F.7. U. S. Coast Guard Rescue Coordination Center: _____

F.8. Pre Operational Checks:

_____ All equipment Pre-Dive maintenance accomplished

_____ Boat set-up

_____ Recompression Chamber notified

_____ Weather conditions checked

_____ Scuba bottles with gauge signifying pressure reading is no less than 90% of the capacity

_____ Personal dive gear inventoried

_____ Required equipment loaded

_____ Radio check with command center

_____ Standby Diver Line loaded

F.9. Dive Supervisor checks:

- _____ Dive flag posted
- _____ Verify water depth
- _____ Conduct dive brief
- _____ Divers properly dressed
- _____ Fill in rough dive log
- _____ Emergency Equipment is checked, loaded and/or readily available

Attachment G – Project Dive Plan

(Note: If for any reason the Dive Plan is altered in mission, depth, personnel, or equipment, the DDC will be contacted in order to review and accept the alteration prior to continuing the operation. This review may be conducted electronically and confirmed in writing after completion of the dive operation)

Name of Dive Supervisor: _____ Date/Time: _____

Locations of Operation: _____ Durations of Operation: _____

G.1. Dive team Assignments: -----

A. Dive team # _____ Dive Mission # _____

Name of Primary	Physical condition
Name of Secondary	Physical condition
Name of Standby	Physical condition
Observer/Assistant:	Remarks:

B. Support Personnel:

Communications:	First Aid/CPR certified person on site
Boat Operator:	Tender

G.2. Emergency Data: (See Emergency Management Plan in Appendix F)

A. DUTY CHAMBER: _____ PHONE: _____

B. AIR TRANSPORT: _____ PHONE: _____

C. ROUTE TO CHAMBER: _____

G.3. Diver Physical Fitness (Aches/Pains/Numbness/Medications):

G.4. TASK:

A. PURPOSE OF THE DIVE: _____

B. NATURE OF THE WORK TO BE PERFORMED: _____

C. DIVING MODE (ie. SSA, SCUBA,) _____

D. MAXIMUM DEPTH PER DIVE: No dive will be no more than 100 feet

E. BOTTOM TYPE : _____ (no dive will exceed 45 minutes in length)

F. TABLE & SCHEDULE (All dive will be no-decompression dives): _____

G. WEATHER/RIVER STATE (visibility, water temperature, etc.):

H. TYPE OF PLATFORM TO BE USED (boat, platform, shore): _____

I. TOOLS AND MATERIALS INVOLVED: _____

Note:

- 1. All dives will be no-decompression dives and the following rates of ascent and descent will be observed: 30 FPM Ascent/75-FPM Descent.**
- 2. Direct communications will be made available at all times between the dive site and the URS project office, the EOTI corporate office, the contracting officer, and the USACE project manager via hand-held two-way communication and or cell phone.**

Attachment H – Dive Supervisor Pre-dive Checklist

_____ DIVERS (AND STAND-BY) ARE PHYSICALLY/MENTALLY FIT TO ENTER THE WATER?

_____ ANY DIVES WITHIN THE LAST 12 HOURS?

_____ ALL DIVERS HAVE MINIMUM EQUIPMENT (FINS, MASK, LIFE PRESERVER, WEIGHT BELT, KNIFE, SCUBA CYLINDER, DEPTH GAUGE, WATCH, REGULATOR, DIVE LIGHT)

_____ CYLINDERS HAVE BEEN GAUGED.

DV1: _____ PSI **DV2:** _____ PSI **STBY:** _____ PSI

_____ ALL QUICK-RELEASE BUCKLES AND FASTENINGS CAN BE REACHED BY BOTH HANDS AND ARE RIGGED FOR PROPER RELEASE.

_____ WEIGHT BELT IS OUTSIDE OF ALL OTHER EQUIPMENT, BELTS, AND STRAPS?

_____ LIFE PRESERVER IS NOT CONSTRAINED, FREE TO EXPAND. CO2 CARTRIDGES ARE PROPERLY INSTALLED AND ALL AIR HAS BEEN REMOVED FROM VEST.

_____ KNIFE POSITIONED SO IT CANNOT BE JETTISONED.

_____ CYLINDER VALVE IS FULLY OPENED AND THEN BACKED OFF ¼ TURN. (DIVER PERFORM)

_____ CYCLE RESERVE MECHANISM AND ENSURE LEVER IS IN THE UP POSITION. (DIVER PERFORM)

_____ DIVER BREATHE FOR 30 SECONDS. ANY IMPURITIES?

_____ CONDUCT FINAL BRIEF.

_____ PROPER DIVING SIGNALS ARE BEING DISPLAYED.

_____ DIVER ENTER THE WATER WHEN READY AND CONDUCTS SURFACE CHECKS.

Attachment I – Checklist for Dive Boat Operations

All personnel involved in the operation of dive boats, launches, barges, floats, and other types of secondary small craft will be briefed and must understand the following safety precautions.

- I.1. Inspect the specified boat or craft and determine its suitability for the intended mission and operating environment; ensure that:
 - _____ Boat (craft) is sound, and seaworthy.
 - _____ Engine is running well and fully tested.
 - _____ Required safety and running equipment is onboard and in workable condition.
 - _____ Proper gear for diving operation is onboard and operational.
 - _____ The assigned boat crew is fully qualified to operate that particular craft.
- I.2. Know the details of the Emergency Assistance Checklist. Make sure it is completely filled out for small craft operations, with a legible copy placed onboard.
- I.3. Inspect all communications gear, radios, underwater communications, power sources, walkie-talkies, cell phones, and ensure that they have been fully tested and are operational.
- I.4. Determine that all non-powered communication equipment (flags, sounds signals, flares, air horn, etc.) are onboard, are complete and are operational.
- I.5. Know all pre-determined signals, proper call signs, etc.
- I.6. Know routine and emergency signals (for divers).
- I.7. Determine that adequate and safe mooring equipment is onboard and personnel are familiar with proper mooring techniques.
- I.8. Know who is in charge of the boat and responsible for giving orders to “Stop” and “Start”. Orders to commence boat operations that affect divers are given only by the Dive Supervisor.
- I.9. Before getting underway, check with the Dive Supervisor for:
 - _____ An “all aboard” head count
 - _____ Approval that all diving equipment lines, safety equipment, etc. are onboard.
- I.10. Plans for various Boat Handling Procedures during Dive Operations include:
 - _____ Dropping off of divers (On small boat drop off both sides)
 - _____ Picking up divers s

- _____ Towing divers, if applicable
- _____ Getting underway in an emergency have anchors lines attached to buoys
- _____ Handling of divers lines during descent, ascent, hanging-off, raising or lowering tools and gear drop-off/pick-up.
- _____ Setting/retrieving of buoy markers.
- _____ Moving or towing of platforms, rafts, rubber boats, search sleds, etc.

I.11. Ensure that stowage of diving supplies and gear does not block access to:

- | | |
|----------------------------|------------------------|
| _____ Fire Extinguishers | _____ Boat hook |
| _____ Life Preservers | _____ Heaving line |
| _____ Ground tackle | _____ Emergency Lights |
| _____ Engine spaces | _____ Flares |
| _____ Communication gear | _____ First Aid Kit |
| _____ Bilge pump or switch | _____ Diving platform |

I.12. Know these general safety precautions that apply to Boat Operations:

- _____ Place all intakes for the diving air compressor upwind of engine or auxiliary power plant exhausts
- _____ Ensure safety of the boat
- _____ Handling gasoline, or other dangerous material
- _____ Shoring and handling of heavy equipment
- _____ Securing gear for heavy weather
- _____ Cutting or other operations involving fire

When divers are in the water:

- (1) Do not change moor if attached to divers
- (2) Do not set anchors
- (3) Do not drop heavy items overboard
- (4) NEVER START ENGINES WHEN DIVERS OR SNORKLERS ARE ALONGSIDE OR DIRECTLY UNDER BOAT

I.13. The Dive Supervisor will ensure that the below listed equipment is ready and available for each Diving Operation:

- | | |
|--|---|
| <input type="checkbox"/> Boat Tool Box (if required) | <input type="checkbox"/> Descent Line & Clumps |
| <input type="checkbox"/> Binoculars | <input type="checkbox"/> Cell Phones/Radio Frequency |
| <input type="checkbox"/> SCUBA Bottles | <input type="checkbox"/> Litter (Stokes) |
| <input type="checkbox"/> Standby Bottle | <input type="checkbox"/> U/W Dive Lights (as required) |
| <input type="checkbox"/> Water Jug | <input type="checkbox"/> Ladder |
| <input type="checkbox"/> First Aid Kit | <input type="checkbox"/> Outboard Motor Oil (if required) |
| <input type="checkbox"/> Communications Line | <input type="checkbox"/> Underwater Metal Detector |
| <input type="checkbox"/> Tools required for job | <input type="checkbox"/> Gas Cans (if required) |
| <input type="checkbox"/> Paddles | <input type="checkbox"/> Circle Line/with Snap hooks |
| <input type="checkbox"/> Marker Buoys & Lines | <input type="checkbox"/> Anchors & lines |
| <input type="checkbox"/> Stand By Diver Tending Line | |
| <input type="checkbox"/> Diver Tending Line | <input type="checkbox"/> Observer/Assistant Throw Line |
| <input type="checkbox"/> Lost Diver Buoy, Line and Clump | <input type="checkbox"/> Search Buoys |
| <input type="checkbox"/> Observer/Assistant Throw Bag or Ring Buoy | |

I.14. The Dive Supervisor will ensure that the information contained below is recorded in the Diving Log:

Time Departed Shore/Pier (if applicable) _____

Time Commenced Dive _____

Time Completed Dive _____

Time Returned Shore/Pier (if applicable) _____

Notify URS Field Office upon completion of daily operation.

Attachment J – Neurological Examination Checklist

NEUROLOGICAL EXAMINATION CHECKLIST
(Sheet 1 of 2)

Patient's Name: _____ Date/Time: _____

Describe pain/numbness: _____

HISTORY

Type of dive last performed: _____ Depth: _____ How long: _____

Number of dives in last 24 hours: _____

Was symptom noticed before, during or after the dive? _____

If during, was it while descending, on the bottom or ascending? _____

Has symptom increased or decreased since it was first noticed? _____

Have any other symptoms occurred since the first one was noticed? _____

Describe: _____

Has patient ever had a similar symptom before? _____ When: _____

Has patient ever had decompression sickness or an air embolism before? _____ When: _____

MENTAL STATUS/STATE OF CONSCIOUSNESS

<p>COORDINATION</p> <p style="padding-left: 40px;">Walk: _____</p> <p style="padding-left: 40px;">Heel-to-Toe: _____</p> <p style="padding-left: 40px;">Romberg: _____</p> <p style="padding-left: 40px;">Finger-to-Nose: _____</p> <p style="padding-left: 40px;">Heel Shin Slide: _____</p> <p style="padding-left: 40px;">Rapid Movement: _____</p> <p>CRANIAL NERVES</p> <p style="padding-left: 40px;">Sense of Smell (I): _____</p> <p style="padding-left: 40px;">Vision/Visual Fld (II): _____</p> <p style="padding-left: 20px;">Eye Movements, Pupils (III, IV, VI): _____</p> <p style="padding-left: 40px;">Facial Sensation, Chewing (V): _____</p> <p style="padding-left: 40px;">Facial Expression Muscles (VII): _____</p> <p style="padding-left: 40px;">Hearing (VIII): _____</p> <p style="padding-left: 20px;">Upper Mouth, Throat Sensation (IX): _____</p> <p style="padding-left: 40px;">Gag & Voice (X): _____</p> <p style="padding-left: 40px;">Shoulder Shrug (XI): _____</p> <p style="padding-left: 40px;">Tongue (XII): _____</p>	<p>STRENGTH (Grade 0 to 5)</p> <p>Upper Body</p> <table border="0" style="width: 100%;"> <tr><td>Deltoids</td><td>L _____ R _____</td></tr> <tr><td>Latissimus</td><td>L _____ R _____</td></tr> <tr><td>Biceps</td><td>L _____ R _____</td></tr> <tr><td>Triceps</td><td>L _____ R _____</td></tr> <tr><td>Forearms</td><td>L _____ R _____</td></tr> <tr><td>Hands</td><td>L _____ R _____</td></tr> </table> <p>Lower Body</p> <p>Hips</p> <table border="0" style="width: 100%;"> <tr><td>Flexion</td><td>L _____ R _____</td></tr> <tr><td>Extension</td><td>L _____ R _____</td></tr> <tr><td>Abduction</td><td>L _____ R _____</td></tr> <tr><td>Adduction</td><td>L _____ R _____</td></tr> </table> <p>Knees</p> <table border="0" style="width: 100%;"> <tr><td>Flexion</td><td>L _____ R _____</td></tr> <tr><td>Extension</td><td>L _____ R _____</td></tr> </table>	Deltoids	L _____ R _____	Latissimus	L _____ R _____	Biceps	L _____ R _____	Triceps	L _____ R _____	Forearms	L _____ R _____	Hands	L _____ R _____	Flexion	L _____ R _____	Extension	L _____ R _____	Abduction	L _____ R _____	Adduction	L _____ R _____	Flexion	L _____ R _____	Extension	L _____ R _____
Deltoids	L _____ R _____																								
Latissimus	L _____ R _____																								
Biceps	L _____ R _____																								
Triceps	L _____ R _____																								
Forearms	L _____ R _____																								
Hands	L _____ R _____																								
Flexion	L _____ R _____																								
Extension	L _____ R _____																								
Abduction	L _____ R _____																								
Adduction	L _____ R _____																								
Flexion	L _____ R _____																								
Extension	L _____ R _____																								

NEUROLOGICAL EXAMINATION CHECKLIST

(Sheet 2 of 2)

REFLEXES

(Grade: Normal, Hypoactive, Hyperactive, Absent)

Biceps L _____ R _____
 Triceps L _____ R _____
 Knees L _____ R _____
 Ankles L _____ R _____

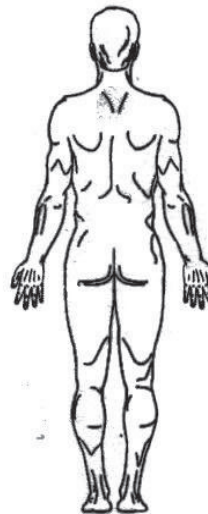
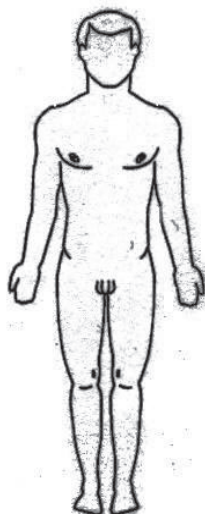
Ankles
 Dorsiflexion L _____ R _____
 Plantarflexion L _____ R _____

 Toes L _____ R _____

Sensory Examination for Skin Sensation

(Use diagram to record location of sensory abnormalities — numbness, tingling, etc.)

LOCATION



Indicate results as follows:

- |||| Painful Area
- ==== Decreased Sensation

COMMENTS

Examination Performed by: _____

Attachment K – 29 CFR 1910 Subpart T

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NFPA 70E-2000 *Standard for Electrical Safety Requirements for Employee Workplaces.* (See also NFPA 70E-2004.)

NFPA 77-2000 *Recommended Practice on Static Electricity.*

NFPA 80-1999 *Standard for Fire Doors and Fire Windows.*

NFPA 88A-2002 *Standard for Parking Structures.*

NFPA 91-2004 *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids.*

NFPA 101-2006 *Life Safety Code.*

NFPA 496-2003 *Standard for Purged and Pressurized Enclosures for Electrical Equipment.*

NFPA 497-2004 *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.*

NFPA 505-2006 *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operation.*

NFPA 820-2003 *Standard for Fire Protection in Wastewater Treatment and Collection Facilities.*

NMAB 353-1-1979 *Matrix of Combustion-Relevant Properties and Classification of Gases, Vapors, and Selected Solids.*

NMAB 353-2-1979 *Test Equipment for Use in Determining Classifications of Combustible Dusts.*

NMAB 353-3-1980 *Classification of Combustible Dust in Accordance with the National Electrical Code.*

[72 FR 7221, Feb., 14, 2007]

Subpart T—Commercial Diving Operations

AUTHORITY: Sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, and 657); Sec. 107, Contract Work Hours and Safety Standards Act (the Construction Safety Act) (40 U.S.C. 333); Sec. 41, Longshore and Harbor Workers' Compensation Act (33 U.S.C. 941); Secretary of Labor's Order No. 8-76 (41 FR 25059), 9-83 (48 FR 35736), 1-90 (55 FR 9033), 3-2000 (65 FR 50017), or 5-2002 (67 FR 65008) as applicable; 29 CFR part 1911.

SOURCE: 42 FR 37668, July 22, 1977, unless otherwise noted.

GENERAL

§ 1910.401 Scope and application.

(a) *Scope.* (1) This subpart (standard) applies to every place of employment within the waters of the United States, or within any State, the District of Columbia, the Commonwealth of Puerto

Rico, the Virgin Islands, American Samoa, Guam, the Trust Territory of the Pacific Islands, Wake Island, Johnston Island, the Canal Zone, or within the Outer Continental Shelf lands as defined in the Outer Continental Shelf Lands Act (67 Stat. 462, 43 U.S.C. 1331), where diving and related support operations are performed.

(2) This standard applies to diving and related support operations conducted in connection with all types of work and employments, including general industry, construction, ship repairing, shipbuilding, shipbreaking and longshoring. However, this standard does not apply to any diving operation:

(i) Performed solely for instructional purposes, using open-circuit, compressed-air SCUBA and conducted within the no-decompression limits;

(ii) Performed solely for search, rescue, or related public safety purposes by or under the control of a governmental agency; or

(iii) Governed by 45 CFR part 46 (Protection of Human Subjects, U.S. Department of Health and Human Services) or equivalent rules or regulations established by another federal agency, which regulate research, development, or related purposes involving human subjects.

(iv) Defined as scientific diving and which is under the direction and control of a diving program containing at least the following elements:

(A) Diving safety manual which includes at a minimum: Procedures covering all diving operations specific to the program; procedures for emergency care, including recompression and evacuation; and criteria for diver training and certification.

(B) Diving control (safety) board, with the majority of its members being active divers, which shall at a minimum have the authority to: Approve and monitor diving projects; review and revise the diving safety manual; assure compliance with the manual; certify the depths to which a diver has been trained; take disciplinary action for unsafe practices; and, assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for SCUBA diving.

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(3) *Alternative requirements for recreational diving instructors and diving guides.* Employers of recreational diving instructors and diving guides are not required to comply with the decompression-chamber requirements specified by paragraphs (b)(2) and (c)(3)(iii) of §1910.423 and paragraph (b)(1) of §1910.426 when they meet all of the following conditions:

(i) The instructor or guide is engaging solely in recreational diving instruction or dive-guiding operations;

(ii) The instructor or guide is diving within the no-decompression limits in these operations;

(iii) The instructor or guide is using a nitrox breathing-gas mixture consisting of a high percentage of oxygen (more than 22% by volume) mixed with nitrogen;

(iv) The instructor or guide is using an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus (SCUBA); and

(v) The employer of the instructor or guide is complying with all requirements of Appendix C of this subpart.

(b) *Application in emergencies.* An employer may deviate from the requirements of this standard to the extent necessary to prevent or minimize a situation which is likely to cause death, serious physical harm, or major environmental damage, provided that the employer:

(1) Notifies the Area Director, Occupational Safety and Health Administration within 48 hours of the onset of the emergency situation indicating the nature of the emergency and extent of the deviation from the prescribed regulations; and

(2) Upon request from the Area Director, submits such information in writing.

(c) *Employer obligation.* The employer shall be responsible for compliance with:

(1) All provisions of this standard of general applicability; and

(2) All requirements pertaining to specific diving modes to the extent diving operations in such modes are conducted.

[42 FR 37668, July 22, 1977, as amended at 47 FR 53365, Nov. 26, 1982; 58 FR 35310, June 30, 1993; 69 FR 7363, Feb. 17, 2004]

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§ 1910.402 Definitions.

As used in this standard, the listed terms are defined as follows:

Acfm: Actual cubic feet per minute.

ASME Code or equivalent: ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code, Section VIII, or an equivalent code which the employer can demonstrate to be equally effective.

ATA: Atmosphere absolute.

Bell: An enclosed compartment, pressurized (closed bell) or unpressurized (open bell), which allows the diver to be transported to and from the underwater work area and which may be used as a temporary refuge during diving operations.

Bottom time: The total elapsed time measured in minutes from the time when the diver leaves the surface in descent to the time that the diver begins ascent.

Bursting pressure: The pressure at which a pressure containment device would fail structurally.

Cylinder: A pressure vessel for the storage of gases.

Decompression chamber: A pressure vessel for human occupancy such as a surface decompression chamber, closed bell, or deep diving system used to decompress divers and to treat decompression sickness.

Decompression sickness: A condition with a variety of symptoms which may result from gas or bubbles in the tissues of divers after pressure reduction.

Decompression table: A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.

Dive-guiding operations means leading groups of sports divers, who use an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus, to local undersea diving locations for recreational purposes.

Dive location: A surface or vessel from which a diving operation is conducted.

Dive-location reserve breathing gas: A supply system of air or mixed-gas (as appropriate) at the dive location which is independent of the primary supply system and sufficient to support divers during the planned decompression.

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Dive team: Divers and support employees involved in a diving operation, including the designated person-in-charge.

Diver: An employee working in water using underwater apparatus which supplies compressed breathing gas at the ambient pressure.

Diver-carried reserve breathing gas: A diver-carried supply of air or mixed gas (as appropriate) sufficient under standard operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by a standby diver.

Diving mode: A type of diving requiring specific equipment, procedures and techniques (SCUBA, surface-supplied air, or mixed gas).

Fsw: Feet of seawater (or equivalent static pressure head).

Heavy gear: Diver-worn deep-sea dress including helmet, breastplate, dry suit, and weighted shoes.

Hyperbaric conditions: Pressure conditions in excess of surface pressure.

Inwater stage: A suspended underwater platform which supports a diver in the water.

Liveboating: The practice of supporting a surfaced-supplied air or mixed gas diver from a vessel which is underway.

Mixed-gas diving: A diving mode in which the diver is supplied in the water with a breathing gas other than air.

No-decompression limits: The depth-time limits of the "no-decompression limits and repetitive dive group designation table for no-decompression air dives", U.S. Navy Diving Manual or equivalent limits which the employer can demonstrate to be equally effective.

Psi(g): Pounds per square inch (gauge).

Recreational diving instruction means training diving students in the use of recreational diving procedures and the safe operation of diving equipment, including an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus, during dives.

Scientific diving means diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific re-

search tasks. Scientific diving does not include performing any tasks usually associated with commercial diving such as: Placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives.

SCUBA diving: A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.

Standby diver: A diver at the dive location available to assist a diver in the water.

Surface-supplied air diving: A diving mode in which the diver in the water is supplied from the dive location with compressed air for breathing.

Treatment table: A depth-time and breathing gas profile designed to treat decompression sickness.

Umbilical: The composite hose bundle between a dive location and a diver or bell, or between a diver and a bell, which supplies the diver or bell with breathing gas, communications, power, or heat as appropriate to the diving mode or conditions, and includes a safety line between the diver and the dive location.

Volume tank: A pressure vessel connected to the outlet of a compressor and used as an air reservoir.

Working pressure: The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

[42 FR 37668, July 22, 1977, as amended at 47 FR 53365, Nov. 26, 1982; 69 FR 7363, Feb. 17, 2004]

PERSONNEL REQUIREMENTS

§ 1910.410 Qualifications of dive team.

(a) *General.* (1) Each dive team member shall have the experience or training necessary to perform assigned tasks in a safe and healthful manner.

(2) Each dive team member shall have experience or training in the following:

(i) The use of tools, equipment and systems relevant to assigned tasks;

(ii) Techniques of the assigned diving mode; and

(iii) Diving operations and emergency procedures.

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(3) All dive team members shall be trained in cardiopulmonary resuscitation and first aid (American Red Cross standard course or equivalent).

(4) Dive team members who are exposed to or control the exposure of others to hyperbaric conditions shall be trained in diving-related physics and physiology.

(b) *Assignments.* (1) Each dive team member shall be assigned tasks in accordance with the employee's experience or training, except that limited additional tasks may be assigned to an employee undergoing training provided that these tasks are performed under the direct supervision of an experienced dive team member.

(2) The employer shall not require a dive team member to be exposed to hyperbaric conditions against the employee's will, except when necessary to complete decompression or treatment procedures.

(3) The employer shall not permit a dive team member to dive or be otherwise exposed to hyperbaric conditions for the duration of any temporary physical impairment or condition which is known to the employer and is likely to affect adversely the safety or health of a dive team member.

(c) *Designated person-in-charge.* (1) The employer or an employee designated by the employer shall be at the dive location in charge of all aspects of the diving operation affecting the safety and health of dive team members.

(2) The designated person-in-charge shall have experience and training in the conduct of the assigned diving operation.

GENERAL OPERATIONS PROCEDURES

§ 1910.420 Safe practices manual.

(a) *General.* The employer shall develop and maintain a safe practices manual which shall be made available at the dive location to each dive team member.

(b) *Contents.* (1) The safe practices manual shall contain a copy of this standard and the employer's policies for implementing the requirements of this standard.

(2) For each diving mode engaged in, the safe practices manual shall include:

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(i) Safety procedures and checklists for diving operations;

(ii) Assignments and responsibilities of the dive team members;

(iii) Equipment procedures and checklists; and

(iv) Emergency procedures for fire, equipment failure, adverse environmental conditions, and medical illness and injury.

[42 FR 37668, July 22, 1977, as amended at 49 FR 18295, Apr. 30, 1984]

§ 1910.421 Pre-dive procedures.

(a) *General.* The employer shall comply with the following requirements prior to each diving operation, unless otherwise specified.

(b) *Emergency aid.* A list shall be kept at the dive location of the telephone or call numbers of the following:

(1) An operational decompression chamber (if not at the dive location);

(2) Accessible hospitals;

(3) Available physicians;

(4) Available means of transportation; and

(5) The nearest U.S. Coast Guard Rescue Coordination Center.

(c) *First aid supplies.* (1) A first aid kit appropriate for the diving operation and approved by a physician shall be available at the dive location.

(2) When used in a decompression chamber or bell, the first aid kit shall be suitable for use under hyperbaric conditions.

(3) In addition to any other first aid supplies, an American Red Cross standard first aid handbook or equivalent, and a bag-type manual resuscitator with transparent mask and tubing shall be available at the dive location.

(d) *Planning and assessment.* Planning of a diving operation shall include an assessment of the safety and health aspects of the following:

(1) Diving mode;

(2) Surface and underwater conditions and hazards;

(3) Breathing gas supply (including reserves);

(4) Thermal protection;

(5) Diving equipment and systems;

(6) Dive team assignments and physical fitness of dive team members (including any impairment known to the employer);

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(7) Repetitive dive designation or residual inert gas status of dive team members;

(8) Decompression and treatment procedures (including altitude corrections); and

(9) Emergency procedures.

(e) *Hazardous activities.* To minimize hazards to the dive team, diving operations shall be coordinated with other activities in the vicinity which are likely to interfere with the diving operation.

(f) *Employee briefing.* (1) Dive team members shall be briefed on:

(i) The tasks to be undertaken;

(ii) Safety procedures for the diving mode;

(iii) Any unusual hazards or environmental conditions likely to affect the safety of the diving operation; and

(iv) Any modifications to operating procedures necessitated by the specific diving operation.

(2) Prior to making individual dive team member assignments, the employer shall inquire into the dive team member's current state of physical fitness, and indicate to the dive team member the procedure for reporting physical problems or adverse physiological effects during and after the dive.

(g) *Equipment inspection.* The breathing gas supply system including reserve breathing gas supplies, masks, helmets, thermal protection, and bell handling mechanism (when appropriate) shall be inspected prior to each dive.

(h) *Warning signal.* When diving from surfaces other than vessels in areas capable of supporting marine traffic, a rigid replica of the international code flag "A" at least one meter in height shall be displayed at the dive location in a manner which allows all-round visibility, and shall be illuminated during night diving operations.

[42 FR 37668, July 22, 1977, as amended at 47 FR 14706, Apr. 6, 1982; 54 FR 24334, June 7, 1989]

§ 1910.422 Procedures during dive.

(a) *General.* The employer shall comply with the following requirements which are applicable to each diving operation unless otherwise specified.

(b) *Water entry and exit.* (1) A means capable of supporting the diver shall be provided for entering and exiting the water.

(2) The means provided for exiting the water shall extend below the water surface.

(3) A means shall be provided to assist an injured diver from the water or into a bell.

(c) *Communications.* (1) An operational two-way voice communication system shall be used between:

(i) Each surface-supplied air or mixed-gas diver and a dive team member at the dive location or bell (when provided or required); and

(ii) The bell and the dive location.

(2) An operational, two-way communication system shall be available at the dive location to obtain emergency assistance.

(d) *Decompression tables.* Decompression, repetitive, and no-decompression tables (as appropriate) shall be at the dive location.

(e) *Dive profiles.* A depth-time profile, including when appropriate any breathing gas changes, shall be maintained for each diver during the dive including decompression.

(f) *Hand-held power tools and equipment.* (1) Hand-held electrical tools and equipment shall be de-energized before being placed into or retrieved from the water.

(2) Hand-held power tools shall not be supplied with power from the dive location until requested by the diver.

(g) *Welding and burning.* (1) A current supply switch to interrupt the current flow to the welding or burning electrode shall be:

(i) Tended by a dive team member in voice communication with the diver performing the welding or burning; and

(ii) Kept in the open position except when the diver is welding or burning.

(2) The welding machine frame shall be grounded.

(3) Welding and burning cables, electrode holders, and connections shall be capable of carrying the maximum current required by the work, and shall be properly insulated.

(4) Insulated gloves shall be provided to divers performing welding and burning operations.

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(5) Prior to welding or burning on closed compartments, structures or pipes, which contain a flammable vapor or in which a flammable vapor may be generated by the work, they shall be vented, flooded, or purged with a mixture of gases which will not support combustion.

(h) *Explosives.* (1) Employers shall transport, store, and use explosives in accordance with this section and the applicable provisions of §1910.109 and §1926.912 of Title 29 of the Code of Federal Regulations.

(2) Electrical continuity of explosive circuits shall not be tested until the diver is out of the water.

(3) Explosives shall not be detonated while the diver is in the water.

(i) *Termination of dive.* The working interval of a dive shall be terminated when:

(1) A diver requests termination;

(2) A diver fails to respond correctly to communications or signals from a dive team member;

(3) Communications are lost and can not be quickly re-established between the diver and a dive team member at the dive location, and between the designated person-in-charge and the person controlling the vessel in liveboating operations; or

(4) A diver begins to use diver-carried reserve breathing gas or the dive-location reserve breathing gas.

§ 1910.423 Post-dive procedures.

(a) *General.* The employer shall comply with the following requirements which are applicable after each diving operation, unless otherwise specified.

(b) *Precautions.* (1) After the completion of any dive, the employer shall:

(i) Check the physical condition of the diver;

(ii) Instruct the diver to report any physical problems or adverse physiological effects including symptoms of decompression sickness;

(iii) Advise the diver of the location of a decompression chamber which is ready for use; and

(iv) Alert the diver to the potential hazards of flying after diving.

(2) For any dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas as a breathing mixture, the employer shall instruct the

diver to remain awake and in the vicinity of the decompression chamber which is at the dive location for at least one hour after the dive (including decompression or treatment as appropriate).

(c) *Recompression capability.* (1) A decompression chamber capable of recompressing the diver at the surface to a minimum of 165 fsw (6 ATA) shall be available at the dive location for:

(i) Surface-supplied air diving to depths deeper than 100 fsw and shallower than 220 fsw;

(ii) Mixed gas diving shallower than 300 fsw; or

(iii) Diving outside the no-decompression limits shallower than 300 fsw.

(2) A decompression chamber capable of recompressing the diver at the surface to the maximum depth of the dive shall be available at the dive location for dives deeper than 300 fsw.

(3) The decompression chamber shall be:

(i) Dual-lock;

(ii) Multiplace; and

(iii) Located within 5 minutes of the dive location.

(4) The decompression chamber shall be equipped with:

(i) A pressure gauge for each pressurized compartment designed for human occupancy;

(ii) A built-in-breathing-system with a minimum of one mask per occupant;

(iii) A two-way voice communication system between occupants and a dive team member at the dive location;

(iv) A viewport; and

(v) Illumination capability to light the interior.

(5) Treatment tables, treatment gas appropriate to the diving mode, and sufficient gas to conduct treatment shall be available at the dive location.

(6) A dive team member shall be available at the dive location during and for at least one hour after the dive to operate the decompression chamber (when required or provided).

(d) *Record of dive.* (1) The following information shall be recorded and maintained for each diving operation:

(i) Names of dive team members including designated person-in-charge;

(ii) Date, time, and location;

(iii) Diving modes used;

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(iv) General nature of work performed;

(v) Approximate underwater and surface conditions (visibility, water temperature and current); and

(vi) Maximum depth and bottom time for each diver.

(2) For each dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas, the following additional information shall be recorded and maintained:

(i) Depth-time and breathing gas profiles;

(ii) Decompression table designation (including modification); and

(iii) Elapsed time since last pressure exposure if less than 24 hours or repetitive dive designation for each diver.

(3) For each dive in which decompression sickness is suspected or symptoms are evident, the following additional information shall be recorded and maintained:

(i) Description of decompression sickness symptoms (including depth and time of onset); and

(ii) Description and results of treatment.

(e) *Decompression procedure assessment.* The employer shall:

(1) Investigate and evaluate each incident of decompression sickness based on the recorded information, consideration of the past performance of decompression table used, and individual susceptibility;

(2) Take appropriate corrective action to reduce the probability of recurrence of decompression sickness; and

(3) Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken, within 45 days of the incident of decompression sickness.

[42 FR 37668, July 22, 1977, as amended at 49 FR 18295, Apr. 30, 1984]

SPECIFIC OPERATIONS PROCEDURES

§ 1910.424 SCUBA diving.

(a) *General.* Employers engaged in SCUBA diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits.* SCUBA diving shall not be conducted:

(1) At depths deeper than 130 fsw;

(2) At depths deeper than 100 fsw or outside the no-decompression limits unless a decompression chamber is ready for use;

(3) Against currents exceeding one (1) knot unless line-tended; or

(4) In enclosed or physically confining spaces unless line-tended.

(c) *Procedures.* (1) A standby diver shall be available while a diver is in the water.

(2) A diver shall be line-tended from the surface, or accompanied by another diver in the water in continuous visual contact during the diving operations.

(3) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(4) A diver-carried reserve breathing gas supply shall be provided for each diver consisting of:

(i) A manual reserve (J valve); or

(ii) An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus.

(5) The valve of the reserve breathing gas supply shall be in the closed position prior to the dive.

§ 1910.425 Surface-supplied air diving.

(a) *General.* Employers engaged in surface-supplied air diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits.* (1) Surface-supplied air diving shall not be conducted at depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw.

(2) A decompression chamber shall be ready for use at the dive location for any dive outside the no-decompression limits or deeper than 100 fsw.

(3) A bell shall be used for dives with an inwater decompression time greater than 120 minutes, except when heavy gear is worn or diving is conducted in physically confining spaces.

(c) *Procedures.* (1) Each diver shall be continuously tended while in the water.

(2) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(3) Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of

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the planned dive including decompression.

(4) For dives deeper than 100 fsw or outside the no-decompression limits:

(i) A separate dive team member shall tend each diver in the water;

(ii) A standby diver shall be available while a diver is in the water;

(iii) A diver-carried reserve breathing gas supply shall be provided for each diver except when heavy gear is worn; and

(iv) A dive-location reserve breathing gas supply shall be provided.

(5) For heavy-gear diving deeper than 100 fsw or outside the no-decompression limits:

(i) An extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver.

(ii) An inwater stage shall be provided to divers in the water.

(6) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing gas supply shall be provided whenever the diver is prevented by the configuration of the dive area from ascending directly to the surface.

§ 1910.426 Mixed-gas diving.

(a) *General.* Employers engaged in mixed-gas diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits.* Mixed-gas diving shall be conducted only when:

(1) A decompression chamber is ready for use at the dive location; and

(i) A bell is used at depths greater than 220 fsw or when the dive involves inwater decompression time of greater than 120 minutes, except when heavy gear is worn or when diving in physically confining spaces; or

(ii) A closed bell is used at depths greater than 300 fsw, except when diving is conducted in physically confining spaces.

(c) *Procedures.* (1) A separate dive team member shall tend each diver in the water.

(2) A standby diver shall be available while a diver is in the water.

(3) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(4) Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.

(5) Each diving operation shall have a dive-location reserve breathing gas supply.

(6) When heavy gear is worn:

(i) An extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver; and

(ii) An inwater stage shall be provided to divers in the water.

(7) An inwater stage shall be provided for divers without access to a bell for dives deeper than 100 fsw or outside the no-decompression limits.

(8) When a closed bell is used, one dive team member in the bell shall be available and tend the diver in the water.

(9) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing gas supply shall be provided for each diver:

(i) Diving deeper than 100 fsw or outside the no-decompression limits; or

(ii) Prevented by the configuration of the dive area from directly ascending to the surface.

§ 1910.427 Liveboating.

(a) *General.* Employers engaged in diving operations involving liveboating shall comply with the following requirements.

(b) *Limits.* Diving operations involving liveboating shall not be conducted:

(1) With an inwater decompression time of greater than 120 minutes;

(2) Using surface-supplied air at depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw;

(3) Using mixed gas at depths greater than 220 fsw;

(4) In rough seas which significantly impede diver mobility or work function; or

(5) In other than daylight hours.

(c) *Procedures.* (1) The propeller of the vessel shall be stopped before the diver enters or exits the water.

(2) A device shall be used which minimizes the possibility of entanglement

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of the diver's hose in the propeller of the vessel.

(3) Two-way voice communication between the designated person-in-charge and the person controlling the vessel shall be available while the diver is in the water.

(4) A standby diver shall be available while a diver is in the water.

(5) A diver-carried reserve breathing gas supply shall be carried by each diver engaged in liveboating operations.

EQUIPMENT PROCEDURES AND REQUIREMENTS

§ 1910.430 Equipment.

(a) *General.* (1) All employers shall comply with the following requirements, unless otherwise specified.

(2) Each equipment modification, repair, test, calibration or maintenance service shall be recorded by means of a tagging or logging system, and include the date and nature of work performed, and the name or initials of the person performing the work.

(b) *Air compressor system.* (1) Compressors used to supply air to the diver shall be equipped with a volume tank with a check valve on the inlet side, a pressure gauge, a relief valve, and a drain valve.

(2) Air compressor intakes shall be located away from areas containing exhaust or other contaminants.

(3) Respirable air supplied to a diver shall not contain:

(i) A level of carbon monoxide (CO) greater than 20 p/m;

(ii) A level of carbon dioxide (CO₂) greater than 1,000 p/m;

(iii) A level of oil mist greater than 5 milligrams per cubic meter; or

(iv) A noxious or pronounced odor.

(4) The output of air compressor systems shall be tested for air purity every 6 months by means of samples taken at the connection to the distribution system, except that non-oil lubricated compressors need not be tested for oil mist.

(c) *Breathing gas supply hoses.* (1) Breathing gas supply hoses shall:

(i) Have a working pressure at least equal to the working pressure of the total breathing gas system;

(ii) Have a rated bursting pressure at least equal to 4 times the working pressure;

(iii) Be tested at least annually to 1.5 times their working pressure; and

(iv) Have their open ends taped, capped or plugged when not in use.

(2) Breathing gas supply hose connectors shall:

(i) Be made of corrosion-resistant materials;

(ii) Have a working pressure at least equal to the working pressure of the hose to which they are attached; and

(iii) Be resistant to accidental disengagement.

(3) Umbilicals shall:

(i) Be marked in 10-ft. increments to 100 feet beginning at the diver's end, and in 50 ft. increments thereafter;

(ii) Be made of kink-resistant materials; and

(iii) Have a working pressure greater than the pressure equivalent to the maximum depth of the dive (relative to the supply source) plus 100 psi.

(d) *Buoyancy control.* (1) Helmets or masks connected directly to the dry suit or other buoyancy-changing equipment shall be equipped with an exhaust valve.

(2) A dry suit or other buoyancy-changing equipment not directly connected to the helmet or mask shall be equipped with an exhaust valve.

(3) When used for SCUBA diving, a buoyancy compensator shall have an inflation source separate from the breathing gas supply.

(4) An inflatable flotation device capable of maintaining the diver at the surface in a face-up position, having a manually activated inflation source independent of the breathing supply, an oral inflation device, and an exhaust valve shall be used for SCUBA diving.

(e) *Compressed gas cylinders.* Compressed gas cylinders shall:

(1) Be designed, constructed and maintained in accordance with the applicable provisions of 29 CFR 1910.101 and 1910.169 through 1910.171.

(2) Be stored in a ventilated area and protected from excessive heat;

(3) Be secured from falling; and

(4) Have shut-off valves recessed into the cylinder or protected by a cap, except when in use or manifolded, or when used for SCUBA diving.

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(f) *Decompression chambers.* (1) Each decompression chamber manufactured after the effective date of this standard, shall be built and maintained in accordance with the ASME Code or equivalent.

(2) Each decompression chamber manufactured prior to the effective date of this standard shall be maintained in conformity with the code requirements to which it was built, or equivalent.

(3) Each decompression chamber shall be equipped with:

(i) Means to maintain the atmosphere below a level of 25 percent oxygen by volume;

(ii) Mufflers on intake and exhaust lines, which shall be regularly inspected and maintained;

(iii) Suction guards on exhaust line openings; and

(iv) A means for extinguishing fire, and shall be maintained to minimize sources of ignition and combustible material.

(g) *Gauges and timekeeping devices.* (1) Gauges indicating diver depth which can be read at the dive location shall be used for all dives except SCUBA.

(2) Each depth gauge shall be dead-weight tested or calibrated against a master reference gauge every 6 months, and when there is a discrepancy greater than two percent (2 percent) of full scale between any two equivalent gauges.

(3) A cylinder pressure gauge capable of being monitored by the diver during the dive shall be worn by each SCUBA diver.

(4) A timekeeping device shall be available at each dive location.

(h) *Masks and helmets.* (1) Surface-supplied air and mixed-gas masks and helmets shall have:

(i) A non-return valve at the attachment point between helmet or mask and hose which shall close readily and positively; and

(ii) An exhaust valve.

(2) Surface-supplied air masks and helmets shall have a minimum ventilation rate capability of 4.5 acfm at any depth at which they are operated or the capability of maintaining the diver's inspired carbon dioxide partial pressure below 0.02 ATA when the diver

is producing carbon dioxide at the rate of 1.6 standard liters per minute.

(i) *Oxygen safety.* (1) Equipment used with oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be designed for oxygen service.

(2) Components (except umbilicals) exposed to oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be cleaned of flammable materials before use.

(3) Oxygen systems over 125 psig and compressed air systems over 500 psig shall have slow-opening shut-off valves.

(j) *Weights and harnesses.* (1) Except when heavy gear is worn, divers shall be equipped with a weight belt or assembly capable of quick release.

(2) Except when heavy gear is worn or in SCUBA diving, each diver shall wear a safety harness with:

(i) A positive buckling device;

(ii) An attachment point for the umbilical to prevent strain on the mask or helmet; and

(iii) A lifting point to distribute the pull force of the line over the diver's body.

[39 FR 23502, June 27, 1974, as amended at 49 FR 18295, Apr. 30, 1984; 51 FR 33033, Sept. 18, 1986]

RECORDKEEPING

§ 1910.440 Recordkeeping requirements.

(a)(1) [Reserved]

(2) The employer shall record the occurrence of any diving-related injury or illness which requires any dive team member to be hospitalized for 24 hours or more, specifying the circumstances of the incident and the extent of any injuries or illnesses.

(b) *Availability of records.* (1) Upon the request of the Assistant Secretary of Labor for Occupational Safety and Health, or the Director, National Institute for Occupational Safety and Health, Department of Health and Human Services of their designees, the employer shall make available for inspection and copying any record or document required by this standard.

(2) Records and documents required by this standard shall be provided upon

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request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.1020 (a)-(e) and (g)-(i). Safe practices manuals (§1910.420), depth-time profiles (§1910.422), recordings of dives (§1910.423), decompression procedure assessment evaluations (§1910.423), and records of hospitalizations (§1910.440) shall be provided in the same manner as employee exposure records or analyses using exposure or medical records. Equipment inspections and testing records which pertain to employees (§1910.430) shall also be provided upon request to employees and their designated representatives.

(3) Records and documents required by this standard shall be retained by the employer for the following period:

(i) Dive team member medical records (physician's reports) (§1910.411)—5 years;

(ii) Safe practices manual (§1910.420)—current document only;

(iii) Depth-time profile (§1910.422)—until completion of the recording of dive, or until completion of decompression procedure assessment where there has been an incident of decompression sickness;

(iv) Recording of dive (§1910.423)—1 year, except 5 years where there has been an incident of decompression sickness;

(v) Decompression procedure assessment evaluations (§1910.423)—5 years;

(vi) Equipment inspections and testing records (§1910.430)—current entry or tag, or until equipment is withdrawn from service;

(vii) Records of hospitalizations (§1910.440)—5 years.

(4) After the expiration of the retention period of any record required to be kept for five (5) years, the employer shall forward such records to the National Institute for Occupational Safety and Health, Department of Health and Human Services. The employer shall also comply with any additional requirements set forth at 29 CFR 1910.20(h).

(5) In the event the employer ceases to do business:

(i) The successor employer shall receive and retain all dive and employee medical records required by this standard; or

(ii) If there is no successor employer, dive and employee medical records shall be forwarded to the National Institute for Occupational Safety and Health, Department of Health and Human Services.

[42 FR 37668, July 22, 1977, as amended at 45 FR 35281, May 23, 1980; 47 FR 14706, Apr. 6, 1982; 51 FR 34562, Sept. 29, 1986; 61 FR 9242, Mar. 7, 1996; 71 FR 16672, Apr. 3, 2006]

APPENDIX A TO SUBPART T TO PART 1910—EXAMPLES OF CONDITIONS WHICH MAY RESTRICT OR LIMIT EXPOSURE TO HYPERBARIC CONDITIONS

The following disorders may restrict or limit occupational exposure to hyperbaric conditions depending on severity, presence of residual effects, response to therapy, number of occurrences, diving mode, or degree and duration of isolation.

History of seizure disorder other than early febrile convulsions.

Malignancies (active) unless treated and without recurrence for 5 yrs.

Chronic inability to equalize sinus and/or middle ear pressure.

Cystic or cavitory disease of the lungs.

Impaired organ function caused by alcohol or drug use.

Conditions requiring continuous medication for control (e.g., antihistamines, steroids, barbiturates, moodaltering drugs, or insulin).

Meniere's disease.

Hemoglobinopathies.

Obstructive or restrictive lung disease.

Vestibular end organ destruction.

Pneumothorax.

Cardiac abnormalities (e.g., pathological heart block, valvular disease, intraventricular conduction defects other than isolated right bundle branch block, angina pectoris, arrhythmia, coronary artery disease).

Juxta-articular osteonecrosis.

APPENDIX B TO SUBPART T TO PART 1910—GUIDELINES FOR SCIENTIFIC DIVING

This appendix contains guidelines that will be used in conjunction with §1910.401(a)(2)(iv) to determine those scientific diving programs which are exempt from the requirements for commercial diving. The guidelines are as follows:

1. The Diving Control Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operations.

2. The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.

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3. The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.

4. Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and, therefore, are scientists or scientists in training.

[50 FR 1050, Jan. 9, 1985]

APPENDIX C TO SUBPART T TO PART 1910—ALTERNATIVE CONDITIONS UNDER §1910.401(a)(3) FOR RECREATIONAL DIVING INSTRUCTORS AND DIVING GUIDES (MANDATORY)

Paragraph (a)(3) of §1910.401 specifies that an employer of recreational diving instructors and diving guides (hereafter, “divers” or “employees”) who complies with all of the conditions of this appendix need not provide a decompression chamber for these divers as required under §§1910.423(b)(2) or (c)(3) or 1910.426(b)(1).

1. EQUIPMENT REQUIREMENTS FOR REBREATHERS

(a) The employer must ensure that each employee operates the rebreather (*i.e.*, semi-closed-circuit and closed-circuit self-contained underwater breathing apparatuses (hereafter, “SCUBAs”)) according to the rebreather manufacturer’s instructions.

(b) The employer must ensure that each rebreather has a counterlung that supplies a sufficient volume of breathing gas to their divers to sustain the divers’ respiration rates, and contains a baffle system and/or other moisture separating system that keeps moisture from entering the scrubber.

(c) The employer must place a moisture trap in the breathing loop of the rebreather, and ensure that:

(i) The rebreather manufacturer approves both the moisture trap and its location in the breathing loop; and

(ii) Each employee uses the moisture trap according to the rebreather manufacturer’s instructions.

(d) The employer must ensure that each rebreather has a continuously functioning moisture sensor, and that:

(i) The moisture sensor connects to a visual (*e.g.*, digital, graphic, analog) or auditory (*e.g.*, voice, pure tone) alarm that is readily detectable by the diver under the diving conditions in which the diver operates, and warns the diver of moisture in the breathing loop in sufficient time to terminate the dive and return safely to the surface; and

(ii) Each diver uses the moisture sensor according to the rebreather manufacturer’s instructions.

(e) The employer must ensure that each rebreather contains a continuously functioning CO₂ sensor in the breathing loop, and that:

(i) The rebreather manufacturer approves the location of the CO₂ sensor in the breathing loop;

(ii) The CO₂ sensor is integrated with an alarm that operates in a visual (*e.g.*, digital, graphic, analog) or auditory (*e.g.*, voice, pure tone) mode that is readily detectable by each diver under the diving conditions in which the diver operates; and

(iii) The CO₂ alarm remains continuously activated when the inhaled CO₂ level reaches and exceeds 0.005 atmospheres absolute (ATA).

(f) Before each day’s diving operations, and more often when necessary, the employer must calibrate the CO₂ sensor according to the sensor manufacturer’s instructions, and ensure that:

(i) The equipment and procedures used to perform this calibration are accurate to within 10% of a CO₂ concentration of 0.005 ATA or less;

(ii) The equipment and procedures maintain this accuracy as required by the sensor manufacturer’s instructions; and

(iii) The calibration of the CO₂ sensor is accurate to within 10% of a CO₂ concentration of 0.005 ATA or less.

(g) The employer must replace the CO₂ sensor when it fails to meet the accuracy requirements specified in paragraph 1(f)(iii) of this appendix, and ensure that the replacement CO₂ sensor meets the accuracy requirements specified in paragraph 1(f)(iii) of this appendix before placing the rebreather in operation.

(h) As an alternative to using a continuously functioning CO₂ sensor, the employer may use a schedule for replacing CO₂-sorber material provided by the rebreather manufacturer. The employer may use such a schedule only when the rebreather manufacturer has developed it according to the canister-testing protocol specified below in Condition 11, and must use the canister within the temperature range for which the manufacturer conducted its scrubber canister tests following that protocol. Variations above or below the range are acceptable only after the manufacturer adds that lower or higher temperature to the protocol.

(i) When using CO₂-sorber replacement schedules, the employer must ensure that each rebreather uses a manufactured (*i.e.*, commercially pre-packed), disposable scrubber cartridge containing a CO₂-sorber material that:

(i) Is approved by the rebreather manufacturer;

(ii) Removes CO₂ from the diver’s exhaled gas; and

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(iii) Maintains the CO₂ level in the breathable gas (*i.e.*, the gas that a diver inhales directly from the regulator) below a partial pressure of 0.01 ATA.

(j) As an alternative to manufactured, disposable scrubber cartridges, the employer may fill CO₂ scrubber cartridges manually with CO₂-sorbent material when:

(i) The rebreather manufacturer permits manual filling of scrubber cartridges;

(ii) The employer fills the scrubber cartridges according to the rebreather manufacturer's instructions;

(iii) The employer replaces the CO₂-sorbent material using a replacement schedule developed under paragraph 1(h) of this appendix; and

(iv) The employer demonstrates that manual filling meets the requirements specified in paragraph 1(i) of this appendix.

(k) The employer must ensure that each rebreather has an information module that provides:

(i) A visual (*e.g.*, digital, graphic, analog) or auditory (*e.g.*, voice, pure tone) display that effectively warns the diver of solenoid failure (when the rebreather uses solenoids) and other electrical weaknesses or failures (*e.g.*, low battery voltage);

(ii) For a semi-closed circuit rebreather, a visual display for the partial pressure of CO₂, or deviations above and below a preset CO₂ partial pressure of 0.005 ATA; and

(iii) For a closed-circuit rebreather, a visual display for: partial pressures of O₂ and CO₂, or deviations above and below a preset CO₂ partial pressure of 0.005 ATA and a preset O₂ partial pressure of 1.40 ATA or lower; gas temperature in the breathing loop; and water temperature.

(l) Before each day's diving operations, and more often when necessary, the employer must ensure that the electrical power supply and electrical and electronic circuits in each rebreather are operating as required by the rebreather manufacturer's instructions.

2. SPECIAL REQUIREMENTS FOR CLOSED-CIRCUIT REBREATHERS

(a) The employer must ensure that each closed-circuit rebreather uses supply-pressure sensors for the O₂ and diluent (*i.e.*, air or nitrogen) gases and continuously functioning sensors for detecting temperature in the inhalation side of the gas-loop and the ambient water.

(b) The employer must ensure that:

(i) At least two O₂ sensors are located in the inhalation side of the breathing loop; and

(ii) The O₂ sensors are: functioning continuously; temperature compensated; and approved by the rebreather manufacturer.

(c) Before each day's diving operations, and more often when necessary, the employer must calibrate O₂ sensors as required by the sensor manufacturer's instructions. In doing so, the employer must:

(i) Ensure that the equipment and procedures used to perform the calibration are accurate to within 1% of the O₂ fraction by volume;

(ii) Maintain this accuracy as required by the manufacturer of the calibration equipment;

(iii) Ensure that the sensors are accurate to within 1% of the O₂ fraction by volume;

(iv) Replace O₂ sensors when they fail to meet the accuracy requirements specified in paragraph 2(c)(iii) of this appendix; and

(v) Ensure that the replacement O₂ sensors meet the accuracy requirements specified in paragraph 2(c)(iii) of this appendix before placing a rebreather in operation.

(d) The employer must ensure that each closed-circuit rebreather has:

(i) A gas-controller package with electrically operated solenoid O₂-supply valves;

(ii) A pressure-activated regulator with a second-stage diluent-gas addition valve;

(iii) A manually operated gas-supply bypass valve to add O₂ or diluent gas to the breathing loop; and

(iv) Separate O₂ and diluent-gas cylinders to supply the breathing-gas mixture.

3. O₂ CONCENTRATION IN THE BREATHING GAS

The employer must ensure that the fraction of O₂ in the nitrox breathing-gas mixture:

(a) Is greater than the fraction of O₂ in compressed air (*i.e.*, exceeds 22% by volume);

(b) For open-circuit SCUBA, never exceeds a maximum fraction of breathable O₂ of 40% by volume or a maximum O₂ partial pressure of 1.40 ATA, whichever exposes divers to less O₂; and

(c) For a rebreather, never exceeds a maximum O₂ partial pressure of 1.40 ATA.

4. REGULATING O₂ EXPOSURES AND DIVING DEPTH

(a) Regarding O₂ exposure, the employer must:

(i) Ensure that the exposure of each diver to partial pressures of O₂ between 0.60 and 1.40 ATA does not exceed the 24-hour single-exposure time limits specified either by the 2001 National Oceanic and Atmospheric Administration Diving Manual (the "2001 NOAA Diving Manual"), or by the report entitled "Enriched Air Operations and Resource Guide" published in 1995 by the Professional Association of Diving Instructors (known commonly as the "1995 DSAT Oxygen Exposure Table"); and

(ii) Determine a diver's O₂-exposure duration using the diver's maximum O₂ exposure (partial pressure of O₂) during the dive and the total dive time (*i.e.*, from the time the diver leaves the surface until the diver returns to the surface).

(b) Regardless of the diving equipment used, the employer must ensure that no

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a separate supply of emergency breathing gas, and the emergency breathing gas consists of air or the same nitrox breathing-gas mixture used during the dive.

(b) As an alternative to the "bail-out" system specified in paragraph 7(a) of this appendix, the employer may use:

(i) For open-circuit SCUBA, an emergency-egress system as specified in §1910.424(c)(4); or

(ii) For a semi-closed-circuit and closed-circuit rebreather, a system configured so that the second stage of the regulator connects to a reserve supply of emergency breathing gas.

(c) The employer must obtain from the rebreather manufacturer sufficient information to ensure that the bail-out system performs reliably and has sufficient capacity to enable the diver to terminate the dive and return safely to the surface.

8. TREATING DIVING-RELATED MEDICAL EMERGENCIES

(a) Before each day's diving operations, the employer must:

(i) Verify that a hospital, qualified health-care professionals, and the nearest Coast Guard Coordination Center (or an equivalent rescue service operated by a state, county, or municipal agency) are available to treat diving-related medical emergencies;

(ii) Ensure that each dive site has a means to alert these treatment resources in a timely manner when a diving-related medical emergency occurs; and

(iii) Ensure that transportation to a suitable decompression chamber is readily available when no decompression chamber is at the dive site, and that this transportation can deliver the injured diver to the decompression chamber within four (4) hours travel time from the dive site.

(b) The employer must ensure that portable O₂ equipment is available at the dive site to treat injured divers. In doing so, the employer must ensure that:

(i) The equipment delivers medical-grade O₂ that meets the requirements for medical USP oxygen (Type I, Quality Verification Level A) of CGA G-4.3-2000 ("Commodity Specification for Oxygen");

(ii) The equipment delivers this O₂ to a transparent mask that covers the injured diver's nose and mouth; and

(iii) Sufficient O₂ is available for administration to the injured diver from the time the employer recognizes the symptoms of a diving-related medical emergency until the injured diver reaches a decompression chamber for treatment.

(c) Before each day's diving operations, the employer must:

(i) Ensure that at least two attendants, either employees or non-employees, qualified in first-aid and administering O₂ treatment,

are available at the dive site to treat diving-related medical emergencies; and

(ii) Verify their qualifications for this task.

9. DIVING LOGS AND NO-DECOMPRESSION TABLES

(a) Before starting each day's diving operations, the employer must:

(i) Designate an employee or a non-employee to make entries in a diving log; and

(ii) Verify that this designee understands the diving and medical terminology, and proper procedures, for making correct entries in the diving log.

(b) The employer must:

(i) Ensure that the diving log conforms to the requirements specified by paragraph (d) ("Record of dive") of §1910.423; and

(ii) Maintain a record of the dive according to §1910.440 ("Recordkeeping requirements").

(c) The employer must ensure that a hard-copy of the no-decompression tables used for the dives (as specified in paragraph 6(a) of this appendix) is readily available at the dive site, whether or not the divers use dive-decompression computers.

10. DIVER TRAINING

The employer must ensure that each diver receives training that enables the diver to perform work safely and effectively while using open-circuit SCUBAs or rebreathers supplied with nitrox breathing-gas mixtures. Accordingly, each diver must be able to demonstrate the ability to perform critical tasks safely and effectively, including, but not limited to: recognizing the effects of breathing excessive CO₂ and O₂; taking appropriate action after detecting excessive levels of CO₂ and O₂; and properly evaluating, operating, and maintaining their diving equipment under the diving conditions they encounter.

11. TESTING PROTOCOL FOR DETERMINING THE CO₂ LIMITS OF REBREATHING CANISTERS

(a) The employer must ensure that the rebreather manufacturer has used the following procedures for determining that the CO₂-sorber material meets the specifications of the sorber material's manufacturer:

(i) The North Atlantic Treating Organization CO₂ absorbent-activity test;

(ii) The RoTap shaker and nested-sieves test;

(iii) The Navy Experimental Diving Unit ("NEDU")-derived Schlegel test; and

(iv) The NEDU MeshFit software.

(b) The employer must ensure that the rebreather manufacturer has applied the following canister-testing materials, methods, procedures, and statistical analyses:

(i) Use of a nitrox breathing-gas mixture that has an O₂ fraction maintained at 0.28 (equivalent to 1.4 ATA of O₂ at 130 fsw, the

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maximum O₂ concentration permitted at this depth);

(ii) While operating the rebreather at a maximum depth of 130 fsw, use of a breathing machine to continuously ventilate the rebreather with breathing gas that is at 100% humidity and warmed to a temperature of 98.6 degrees F (37 degrees C) in the heating-humidification chamber;

(iii) Measurement of the O₂ concentration of the inhalation breathing gas delivered to the mouthpiece;

(iv) Testing of the canisters using the three ventilation rates listed in Table I below (with the required breathing-machine tidal volumes and frequencies, and CO₂-injection rates, provided for each ventilation rate);

TABLE I—CANISTER TESTING PARAMETERS

Ventilation rates (Lpm, ATPS ¹)	Breathing machine tidal volumes (L)	Breathing machine frequencies (breaths per min.)	CO ₂ injection rates (Lpm, STPD ²)
22.5	1.5	15	0.90
40.0	2.0	20	1.35
62.5	2.5	25	2.25

¹ATPS means ambient temperature and pressure, saturated with water.

²STPD means standard temperature and pressure, dry; the standard temperature is 32 degrees F (0 degrees C).

(v) When using a work rate (*i.e.*, breathing-machine tidal volume and frequency) other than the work rates listed in the table above, addition of the appropriate combinations of ventilation rates and CO₂-injection rates;

(vi) Performance of the CO₂ injection at a constant (steady) and continuous rate during each testing trial;

(vii) Determination of canister duration using a minimum of four (4) water temperatures, including 40, 50, 70, and 90 degrees F (4.4, 10.0, 21.1, and 32.2 degrees C, respectively);

(viii) Monitoring of the breathing-gas temperature at the rebreather mouthpiece (at the “chrome T” connector), and ensuring that this temperature conforms to the temperature of a diver’s exhaled breath at the water temperature and ventilation rate used during the testing trial;¹

(ix) Implementation of at least eight (8) testing trials for each combination of temperature and ventilation-CO₂-injection rates (for example, eight testing trials at 40 de-

grees F using a ventilation rate of 22.5 Lpm at a CO₂-injection rate of 0.90 Lpm);

(x) Allowing the water temperature to vary no more than ± 2.0 degrees F (± 1.0 degree C) *between* each of the eight testing trials, and no more than ± 1.0 degree F (± 0.5 degree C) *within* each testing trial;

(xi) Use of the average temperature for each set of eight testing trials in the statistical analysis of the testing-trial results, with the testing-trial results being the time taken for the inhaled breathing gas to reach 0.005 ATA of CO₂ (*i.e.*, the canister-duration results);

(xii) Analysis of the canister-duration results using the repeated-measures statistics described in NEDU Report 2-99;

(xiii) Specification of the replacement schedule for the CO₂-sorbent materials in terms of the lower prediction line (or limit) of the 95% confidence interval; and

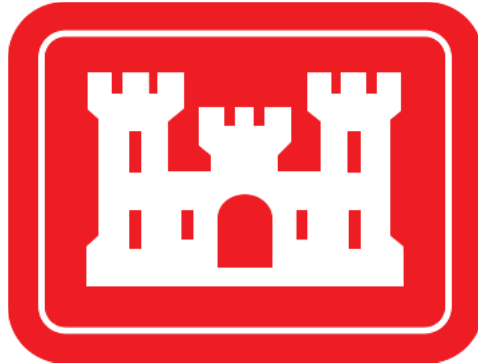
(xiv) Derivation of replacement schedules only by interpolating among, but not by extrapolating beyond, the depth, water temperatures, and exercise levels used during canister testing.

[69 FR 7363, Feb. 17, 2004]

Subparts U–Y [Reserved]

§§ 1910.901–1910.999 [Reserved]

¹NEDU can provide the manufacturer with information on the temperature of a diver’s exhaled breath at various water temperatures and ventilation rates, as well as techniques and procedures used to maintain these temperatures during the testing trials.



EXPLOSIVES SAFETY SUBMISSION
MUNITIONS AND EXPLOSIVES OF CONCERN
REMOVAL ACTION AND CONSTRUCTION
SUPPORT
CONGAREE RIVER PROJECT
COLUMBIA, SOUTH CAROLINA

April 2015

Prepared by
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Acronyms

ATF&E	Bureau of Alcohol, Tobacco, Firearms and Explosives
BEM	Buried Explosion Module
BGS	below ground surface
BIP	blown in place
CD	Cultural Debris
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CM	Conventional Munitions
CRP	Congaree River Project
CWM	Chemical
DDESB	Department of Defense Explosives Safety Board
DHEC	Department of Health and Environmental Control
DMM	Discarded Military Munitions
DoD	Department of Defense
EE/CA	Engineering Evaluation/Cost Assessment
EMM	Earth Moving Machinery
EOD	explosive ordnance disposal
ESS	Explosive Safety Submission
EZ	exclusion zone
IAW	In Accordance With
IDW	industrial derived waste
MDAS	Material Documented as Safe
MEC	Munitions and Explosives of Concern
MGFD	munitions with the greatest fragmentation distance
MGP	Manufactured Gas Plant
MPPEH	Material Potentially Presenting an Explosive Hazard
MRS	Munitions Response Site
MSD	Minimum Separation Distance
NEW	Net Explosive Weight
OE	Ordnance and Explosives
PM	Project Manager
QA	Quality Assurance
QC	quality control
QCM	Quality Control Manager
Q-D	Quantity Distance
RCWM	recovered chemical warfare materiel
SARA	Superfund Amendments and Reauthorization Act
SC	South Carolina
SCDHEC	South Carolina Department of Health and Environmental Control
SCE&G	South Carolina Electric and Gas

SUXOS	Senior Unexploded Ordnance Supervisor
TLM	tar-like materials
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center Huntsville
UXO	Unexploded Ordnance
UXOSO	Unexploded Ordnance Safety Officer
VCC	Voluntary Cleanup Contract

1. Background

1.1. Site location

The CRP area is located on the Congaree River in Columbia, SC. The site, also referred to as the “project area”, begins directly south of the Gervais Street Bridge, extends approximately 200-300 feet into the river from the eastern shoreline and approximately 2,000 feet downriver, towards the Blossom Street Bridge. The MEC intrusive activities will occur on eastern side of Congaree River between Gervais and Blossom Street Bridges, shown on Figure A-1-Site Location. Underwater intrusive activities will also occur within the coffer dam footprint prior to their installation. See Appendix A for footprint of the coffer dam location.

Table 1-1

Area	Total Acreage	Munitions Response Action	Institutional Controls
Water/Land Area	12.65	Surface and Subsurface to Depth of Dam Footprint and Construction Support	Fencing and Signage

This interim response action is being performed under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and is part of the overall Remedial Action Process. Additional removal responses may be dictated in the future during the remainder of the remedial response process, as determined by subsequent action memoranda or other decision documents. If subsequent removal responses are determined to be necessary in the full remedial process, this ESS will be reviewed and amended in accordance with DoD 6055.09-M as necessary to support that response.

1.2. Site Description:

1.2.1. Terrain and Vegetation:

The predominant topographic feature within the project area is the Congaree River itself, which is a broad shallow river with numerous bedrock assemblages that are visible above the water level at normal river flows. The river slope in the vicinity of the project area is approximately 2.10 feet/mile (USACE, 1977). The river depth varies significantly in the project area due to the variability of the bedrock river bottom elevations.

The project area abuts the eastern shoreline, which rises sharply from the water’s edge in most places due to a steep bank that varies in height from approximately 5 to 20 feet depending on location. The ground slopes more gently to the east once the top of the riverbank is reached with an approximate 28 feet increase in land surface elevation over approximately The riverbank is forested in this area with vegetative cover consisting of various trees and tall native grasses and shrubs. The undergrowth is periodically maintained and trimmed in the vicinity of the wooden scenic overlook and river walkway and is much thicker and overgrown further south. The terrain and vegetation are not anticipated to hinder the field activities at the site.

Access to the river is provided by a partially paved access road, which extends from the intersection of Senate and Gist Streets to the river.

1.2.2. Soil Condition:

The landside Congaree River bank soil/sediments are unconsolidated, ranged in particle size from clay to gravels, displayed layering, and were approximately 12 feet to 27 feet thick. Generally, soil/sediment thickness increased in the downriver direction, and is attributed to down cutting of the granite by the Congaree River. The upper most soil/sediments were generally found to range from clays to medium sands. Below this is a gray silt that overlies a sand and gravel layer. The Congaree River and project area can be generalized by shoreline (gray silt) and channel (sands and gravel). It is not anticipated that soils and or tar-like materials (TLM) will impact detection equipment results.

1.3. Site History:

In 1865, during the Civil War, MEC and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman's occupation and subsequent destruction of Columbia.

Archeological investigations, conducted as late as 1980, recovered some MEC or Discarded Military Munitions (DMM) from the area as well as some other potentially historically significant artifacts. Specifically this work was focused in and adjacent to the unnamed tributary that enters the river just south of the Gervais Street Bridge. Several MEC cannonballs were identified during this operation and properly disposed of by trained explosive ordnance disposal (EOD) personnel located at nearby Fort Jackson.

Due to the potential presence of MEC within the project area, an additional reconnaissance and screening of the area in question was conducted as part of the investigative activities. Analysis of the survey data identified concentrations of anomalies with DMM potential in the immediate vicinity of the Senate Street landing and scatters extending into the river. A terrestrial magnetometer investigation of the unnamed tributary below the Gervais Street Bridge was also carried out and that investigation identified eight additional anomalies with a potential association with ordnance.

In June 2010, the occurrence of a TLM within the Congaree River was reported to the South Carolina Department of Health and Environmental Control (SCDHEC). Preliminary sample results conducted on the material by SCDHEC and South Carolina Electric and Gas Company (SCE&G) indicated that the TLM had similar chemical and physical characteristics as coal tar, a by-product of Manufactured Gas Operations, which were common in cities from the late 1800s until the 1950s. Additional research found that the most likely source of the TLM was a former Manufactured Gas Plant (MGP) located northeast of the river at 1409 Huger Street that operated from about 1906 until the mid-1950s prior to the existence of environmental regulations and permitting. Later this was the location of the city bus terminal until 2008.

SCE&G had previously entered into a Voluntary Cleanup Contract (VCC) with DHEC in August

2002 to conduct environmental assessment and cleanup activities at the former Huger Street MGP site. SCE&G has worked proactively and cooperatively with DHEC under its existing VCC to determine the extent of TLM in the Congaree River and to develop a plan for cleanup. Overall, the delineation activities extended from the Gervais Street Bridge downriver approximately 9,050 feet.

An Engineering Evaluation/Cost Assessment (EE/CA) was prepared and a Final was submitted in January 2013. A non-time critical removal action of the impacted river sediments was chosen as the alternative. The TLM-impacted sediment varies in thickness from a few inches to approximately 6 feet thick in some areas. The current total estimate of sediment requiring removal is approximately 40,000 tons. The total project area is estimated to be 23 acres, with 10.5 acres consisting of waters of the United States. Sediment removal from within the water area will occur after coffer dams are installed and water has been removed. Intrusive Dive removal operations of metallic anomalies will be conducted prior to installation of the coffer dams. The landside or upland portion of the project area consists of approximately 12.5 acres of mostly undeveloped land with a cleared utility right-of-way. Much of the area will not be disturbed.

On August 21, 2013, a public release was issued summarizing the project purpose and objectives detailing that this is an environmental clean-up project mandated by SCDHEC intended to remove approximately 40,000 tons of tar-like material (TLM) and impacted sediment from the Congaree River. The removal of the impacted sediment will result in a permanent improvement to the aquatic environment in the project area. Upon completion of the removal activities in the Congaree River, the project area will be allowed to return to its original pre-impacted state.

The removal of MEC from the riverbank, impacted sediments and assisting in the segregation and disposal of impacted sediment remove by APEX covered under this work plan is to protect worker safety and environment.

1.4.Current and Future Land Use:

Current land use for the project area is public and is being used as a public green space including a park and recreation activities of walking, river site-seeing, picnicking and playing. The future land use is expected to be the same or similar unrestricted use.

1.5.Project Area:

The site, also referred to as the “project area”, begins directly south of the Gervais Street Bridge, extends approximately 200-300 feet into the river from the eastern shoreline and approximately 2,000 feet downriver, towards the Blossom Street Bridge. The MEC intrusive activities will occur on eastern side of Congaree River between Gervais and Blossom Street Bridges, shown on Figure A-1-Site. Underwater intrusive activities will also occur within the coffer dam footprint prior to their installation. See Appendix A for footprint of the coffer dam location.

1.5.1. General:

This ESS covers the munitions response actions in support of removal of TLM at within the Congaree River. The area to be swept for of MPPEH consists of approximately 11.80 acres within the Congaree River. A shallow dive operation (covered in a separately submitted Dive

Operation Plan) will be performed to remove any potential MEC within a coffer dam footprint prior to its construction needed to dewater the sediment containing TLM.

MEC items determined acceptable to move will be hand carried out of the water. Any MEC deemed unsafe to move may be dragged out of the stream by essential personnel using rope or cable that is suitable for moving the MEC items remotely. Essential personnel must be separated from the operation 3060 ft, or by the K24 of 29 ft and must be protected by shields or barricades designed to defeat hazardous fragments until the MEC item has been dragged to the location where it will be blown in place.

Once the coffer dams have been constructed and water removed from within a sweep for MPPEH will be performed prior to excavation of TLM material by APEX environmental.

This area will be cleared of all surface MPPEH regardless of size (excluding small arms ammunition .50 caliber and below not visually detectable) and subsurface ferrous metal items (including MPPEH) 10 in “cannonball” or greater, to a depth of 11 times the item diameter up to one meter below ground surface (BGS). It is not anticipated that Conventional Munitions (CM) will be encountered during operations. The Senior Unexploded Ordnance Supervisor (SUXOS) and Unexploded Ordnance Safety Officer (UXOSO) will ensure all personnel are fully trained of the associated hazards and fully aware of the procedures to be followed when MEC operations commence.

1.5.2. History and Characterization Data Analysis:

Site History and previous characterization data is presented above in Site History section 1.2. The munitions response actions for additional areas will be addressed in future amendments to this ESS or separate ESS.

1.5.3. Selected Munitions Response Actions:

In order to support the removal of TLM from the project area a “mag and dig” type removal action of dewatered sediments and land area has been selected to remove the MEC prior to sediment/soil excavation performed by APEX. There will be no underwater removal of sediments prior to dewatering. A shallow wading/dive operation to sweep the area of the coffer dam footprint will be performed prior to coffer dam installation and is covered under a separate dive operations plan. Stand-by construction support will also be performed during sediment/soil excavation by Apex.

1.5.3.1. Land Use Controls

No permanent land use controls are being proposed. Currently there are signs announcing that no swimming allowed in the area of the TLM. Prior to field activities the entire site will be fenced and signs posted to keep public out for safety and protection of civil war era antiquities. Temporary fencing to prevent unauthorized access to the site will be put up and maintained during the entire removal action project.

1.6.Reason for Munitions and Explosives of Concern (MEC):

In 1865, during the Civil War, MEC and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman’s occupation and subsequent destruction of Columbia.

1.7.Type of MEC:

Based on historical information primarily from an Inventory of Stores Captured in Columbia, SC document dated February 17, 1865, MEC items of interest that could potentially be encountered are identified below. The historical list contained a more general nomenclature than that used in the DoD Fragmentation database of today. The list below is taken directly in name from the 1865 document.

- Case shot, fixed, 12 pounder gun
- Fuse-shell, fixed, 12 pounder gun
- Grape, 12 pounder gun
- Canister, fixed, 12 pounder gun
- Shot, fixed, 6 pounder gun
- Case, fixed, 6 pounder gun
- Fuse-shell, fixed, 6 pounder gun
- Canister, fixed, 6 pounder gun
- Shot, fixed, 24 pounder gun
- Shell, fixed, 24 pounder gun
- Canister, fixed, 24 pounder gun
- Shell, fixed, 8 inch
- Shot and shell, not fixed, 8 inch
- Shot and shell, not fixed, 8 inch
- Shot and shell, not fixed, 10 inch

According to historical information for Columbia, SC inventory, a variety of other munitions were identified as having been used or stored at the site. No information found to date associates any other munitions with the project site. Therefore, the 10 in “cannonball” shell has been selected as the munitions with the greatest fragmentation distance (MGFD) for the project.

Table 2-1 Type and Depth of MEC Recovered

MRS Name or Other Identifier	MEC Recovered	MAX Depth of MEC recovered during site investigation	MAX Geophysical Detection Depth BGS
Congaree River Project	Cannonball (reported historically)	No intrusive activities were conducted during the site investigation. Only a geophysical survey was performed to detect anomalies.	10-inch cannonball can be detected at approximately 11X diameter below ground surface this results in 110 inches BGS.

2. Maps

Figure A-1 in appendix A shows a map of the site in relation to the surrounding area. Figure A-3, demonstrates the phased clearance approach in regard to MEC clearance within the river. Figure A-2 is a map that shows the area with the Quantity Distance (Q-D) arcs that will be used during the MEC removal action in the area.

3. Explosive Safety Quantity -Distance

3.1. Munitions with Greatest Fragmentation Distance (MGFD):

The 10 inch cannonball was chosen as the Munitions with the Greatest Fragmentation Distance (MGFD) for the project area is based on the historical documentation and manifests dating to the relocation of the ordnance items from the a nearby ammunition storage area to the river by soldiers. Additionally, previous Archeological investigations recovered MEC from the river area that correlated with the above MGFD munitions type. This MGFD is the same for both intrusive dive and land operations.

See Appendix B for Fragmentation Data Sheets.

See Table 3-1 for Minimum Separation Distances. Quantity-Distance (Q-D) arcs are shown in Appendix A on Figure A-3.

Table 3-1								
Minimum Separation Distances (MSD)								
Area	MEC	MSD (ft) ¹						
		For Unintentional Detonations			For Intentional Detonations			
		Team Separation Distance (K40)	Hazardous Fragment Distance (HFD)		Without Engineering Controls	Using Sandbag Mitigation ²	Using Double sandbag Mitigation ²	Using Water Mitigation ²
Project area	10" Cannonball	48	237		3060	220	Not Permitted	275
Notes:								
All Values in Bold Italics are the MSDs for unintentional detonations that must be used on-site for the Area.								
¹ See Appendix B for calculation sheets documenting MSDs. Note the NEW for the MGFD based on the HFD is the maximum NEW that may be collected at a collection point								
² See Appendix B for required sandbag thickness (HNC-ED-CS-S-98-7) and water containment system (HNC-ED-CS-S-00-3).								
3 MSD for sandbag mitigation per DDESB memo "Revision of DDESB Approval for Use of Sandbags for Mitigation of Fragmentation and Blast Effects Resulting from the Intentional Detonation of Munitions" dated 22 May 2014.								

3.2. MEC Area(s):

The MSD restrictions from MEC areas to non-essential personnel will be applied during all MEC operations. The MSD for the NTCRA Area is presented in Table 3-1. Preliminary site work such as surveying, laying grid lanes and anomaly avoidance do not require the establishment of a MSD for Q-D purposes. Essential personnel are defined as those on-site contractor and DoD

personnel required to participate in the MEC removal, along with those approved and authorized visitors. All other personnel are non-essential personnel. The outer boundaries of the MSD arcs are depicted on the Q-D map in Figure A-3. The team separation distance at this site will be the K40 overpressure distance shown in Table 3-1. Positive control of the exclusion zone (EZ) based on the MSD will be maintained at all times that MEC operations are being conducted. Prior to beginning MEC operations, the contractor will ensure that there are no nonessential personnel within the EZ and the contractor will ensure that, the EZ remains clear of non-essential personnel throughout the MEC operations.

Only UXO-qualified personnel (see DDESB Technical Paper 18 for definitions) will perform MEC Construction Support and Removal Activities. Activities will be accomplished in accordance with the procedures detailed in USACE Engineering Manual (EM) 385-1-97 (including Change 1 and Errata sheets 1 through 6), “Explosives Safety and Health Requirements Manual”. The UXO personnel will clear all soil excavation locations to ensure there is no intentional physical contact with MEC during soil removal/excavation operations.

Any occupied buildings or public roadways in the MSD areas during MEC operations will be evacuated and/or roadways blocked to prevent non-essential personnel from entering during the conduct of MEC operations. In addition, spotters may be used to stop work when non-essential personnel enter the MSD on a roadway during the conduct of MEC operations.

3.3. Demolition Explosives:

3.3.1. Delivery on As-Needed Basis:

Donor explosives will be stored in a on-site type 2 ATF&E explosives magazine. This action is to mitigate the need for an afterhours guard. Should a magazine not be used, explosives will be provided by a local vendor on an as-needed basis. MEC will be marked and guarded until disposal is accomplished.”.

3.3.2. Explosive Storage Magazines:

Due to the fact that on-going explosives needs might be present on the project, an on-site magazine to store commercial explosives will be utilized on this project. Commercial explosives will be stored in the un-barricaded type II ATF&E explosives magazine with an attached lockable cap box. The explosives will be used only for disposal of any MEC items recovered during operations and will be stored IAW DoD 6055.09-M, DA Pam 385-64 and any other local regulations. EOTI will maintain constant control the sited explosive storage magazine. Positioning of the magazine will be IAW DDESB 6055.09-M, EP 1110-1-18 and Section 55.206 of ATRP 5400.7. The closest occupied structure relative to the explosives magazine is 500 ft and nearest public road is 950 ft. The Magazine will be secured by the erection of a temporary fence that will be 8 to 10 ft in height and has one locked entry point. The maximum Net Explosive Weight (NEW) that will be stored will be less than 31 lbs. IAW DoD 6055.09-M Section V3.E3.1.2.1.1.5.1 its has been determined that the . Public Transportation Route Distance (PTRD) for the proposed magazine location has no public road access. The traffic for the area of the magazine is less than 400 car/rail passengers per day, and less than 80 ship passengers per

day. Therefore, no Minimum Fragment Distance (MFD) is required for public traffic route (PTR) distance (DA PAM 385-64 Section 5-5, and DoD 6055.09-M Section C9.4.1.2.1.1.5.3). Inhabited Building Distance exclusion for the magazine is 200 ft, this is based on a NEW of less than 31 lbs IAW DoD 6055.09-M table V3. E3.T2.

These commercial explosives will have assigned DOD hazard division/storage compatibility groups (HD/SCG) and will be stored in accordance with DOD 6055.09-M, DA Pam 385-64 and any local regulations.

3.4.Planned or Established Demolition Areas:

Demolition area planned for this project is to be located within the fenced open area to be located far enough away from road and inhabited buildings as not to include them within 220 ft of the demolition area.

3.5.Footprint Areas:

3.5.1. Blow-in-place:

If a MPPEH is unacceptable-to-move it will be blown in place (BIP) on both land or water removal operations. BIP procedures will be conducted within each grid. All disposal activities will be performed by Technical Paper (TP)-18, "Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel", 20 December 2004 qualified UXO personnel within the MRS. Please see table 3-1 for minimum separation distances for BIP procedures.

If it is determined that an item is acceptable to move then the MPPEH will be consolidated on land and a consolidated demolition shot will be performed IAW TP-18 as stated above.

3.5.2. Collection Points:

Collection points are those areas used to temporarily accumulate MEC pending destruction at the end of the day using consolidated shots. MEC items at collection points must be laid out as shown in "Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites". The maximum net explosive weight (NEW) at a collection point will be limited such that the K40 overpressure distance for the total NEW does not exceed the HFD for the area (see Table 3-1, footnote 1). The SUXOS and UXOSO are the authoritative individuals for this project to determine if items are acceptable to move.

3.5.3. In-Grid Consolidated Shots:

If determined acceptable to move by the SUXOS and UXOSO, consolidating multiple MEC within the MRS is anticipated for this project. US Army Engineering and Support Center, Huntsville (USAESCH) publication "Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites", dated March 2000 will be used and a copy of this report will be available on site. The maximum net explosive weight (NEW) for a consolidated shot will be limited such that the K328 overpressure distance for the total NEW (including donor charges) does not exceed the MFD-H for the intentional detonation."

3.6. Maximum Credible Event (MCE):

This section is not applicable to this project; no explosive soil, CWM, or explosives contaminated facilities are expected.

4. Start Date:

The anticipated start date for field activities is March 2, 2015.

5. MEC Migration:

MEC Migration could be a factor due to strong bottom current within the Congaree River. It is notable that MEC and other munitions items have the potential to migrate to tide actions and river flows. These events can re-distribute items outside of the AOI and much further away from its impact location.

6. Detection Equipment and Response Techniques:

6.1. Removal Depth:

The removal depths for MRS 1 Land / Water subsurface clearance of MEC, MPPEH, and any ferrous metal items as shown in table 1-1.

6.2. Detection Equipment:

The possible detectors for this project include but are not limited to Schonstedt 52-CX and an all metals detector (White's). All of these instruments have similar detection characteristics and can be expected to consistently detect the MEC items shown in Table 1-2 at their expected depths.

6.2.1. Analog Mag and Flag using Flux-Gate Magnetic Gradiometers:

The Flux-Gate Magnetic Gradiometers that will be utilized will be the Schonstedt 52-CX and an all metals detector (White Spectrum XLT).

6.2.2. Analog Mag and Flag using Electromagnetic Induction:

Approved detectors for this project include the AN-PSS 12, White XLT, Fisher, Garrett, and MineLabs Explorer. All of these instruments have similar detection characteristics. However, unlike the other classes of instruments, they may only be used for targets less than 24 inches deep. The CEHNC MM-CX may approve other similar geophysical instruments.

6.3. Sweep Procedures:

Each UXO Technician will demonstrate proficiency with the hand held geophysical device before site activities begin. The site will be divided into grids and search lanes will be used to sweep for MEC. See work plan for more information on sweep procedures.

6.4.Exclusion Zone Control:

Positive control of the exclusion zone (EZ) based on the MSD will be maintained at all times that MEC operations are being conducted. Prior to beginning MEC operations, the EOTI will ensure that there are no nonessential personnel within the EZ and the contractor will ensure that, the EZ remains clear of non-essential personnel throughout the MEC operations. This will include barricading access roads as necessary and displaying appropriate signage indicating explosive operations at barricade points and personnel to facilitate the halting of traffic and pedestrians.

6.5.Intrusive Investigation:

Non-Mechanized MEC removal and identification of anomalies will be performed using the criteria and procedures outlined below. Only TP 18 qualified personnel will perform excavation and investigation of anomalies. To gain access to a subsurface anomaly, excavation will be initiated to the side of the anomaly, and will not be conducted directly over the anomaly until such time as the depth of the anomaly can be ascertained. Earth Moving Machinery (EMM) excavation of the soil overburden may be performed for anomalies for the purpose of removing overburden. However, the EMM will not be used within 12 inches directly over the anomaly. Additional excavation will be conducted with care using small hand tools only. A detailed accounting of all MEC located at each site will be made and maintained by the Senior UXO Supervisor (SUXOS). A log entry will be made for each MEC item indicating the item's identity, its explosive hazards, location (x, y, and z measurements) and final disposition. All munitions debris excavated during this investigation will be removed from the site

6.6.Quality Control and Quality Assurance:

Upon conclusion of the removal activities in each grid within each area, the UXO Quality Control Specialist (UXOQCS) will conduct a surface and subsurface quality control (QC) inspection. Lots that pass the QC inspection will be submitted to the USAESCH for Quality Assurance (QA) inspection per the Quality Assurance Surveillance Plan. Any non-conformance to contractual requirements will be documented and reported in writing to the Senior Unexploded Ordnance Supervisor (SUXOS), Quality Control Manager (QCM), and Project Manager (PM). The SUXOS will be responsible for the field remediation of the non-conformance.

6.7.Equipment Tests:

See section 6.3 Sweep Procedures for information regarding equipment tests.

7. Disposition Techniques:

7.1.Demolition Operations:

If disposal activities are required, they will be performed by personnel qualified in accordance with TP 18 within the MRS. The MSDs for intentional detonations are shown in Table 3-1 and Q-D Arcs are shown on Figure A-3.

7.1.1. Methods of Disposal:

- a. If disposal activities are required, they will be performed by qualified UXO personnel within the MRS. The MSDs for intentional detonations are shown in Table 3-1 and Q-D Arcs are shown on Figure A-4.
- b. MEC will be marked and guarded, if necessary, until disposal is accomplished.
- c. All explosive operations will follow the procedures outlined in TM 60A-1-1-31 and EM 385-1-97, Explosives Safety and Health Requirements Manual, demolition operations will be performed daily or items properly guarded until operations can be conducted.

The magazine location chosen for this effort is located within a fenced open area. It has controlled access. All gates are to be locked at all times when not under supervision. The nearest improved public road is approximately 0.1 miles away. The nearest inhabited building is 0.1 miles away.

7.2. Explosive Storage, Accountability, and Transportation:

EOTI does not anticipate generating any hazardous waste that will require off-site transportation, treatment, storage, or disposal. MEC and/or MPPEH will be destroyed on-site and resulting scrap will be certified as Material Documented as Safe (MDAS) and turned over to a recycler for smelting before it is released to the public. Non-hazardous, CD and municipal waste generated during this project will be transported to a municipal landfill for disposal.

7.3. Engineering Controls:

Sandbags (HNC-ED-CS-S-98-7, HNC Safety Advisory dated 7 November 2011, the DDESB Memorandum “Clarifications Regarding Use of Sandbags for Mitigation of Fragmentation and Blast Effects due to Intentional Detonation of Munitions”, Nov. 29 2010, and DDESB Memorandum “Revision of DDESB Approval for Use of Sandbag Mitigation of Fragmentation and Blast Effects Resulting from the Intentional Detonation of Munitions”, May 22 2014) or Water Mitigation (HNC-ED-CS-S-00-3) may be used to reduce the intentional detonation MSD. Double Sandbag Mitigation is authorized for robust and non-robust items with fragmentation characteristics and a net explosive weight not exceeding that of a 75 mm M48, and a minimum withdrawal distance of 12.5 feet applies. Tamping (single or multiple items) may be used in accordance with DDESB Technical Paper 16 and the Buried Explosion Module (version 6.3.2.). These reports will be on site for all mitigation methods used.

7.4. Scrap Procedures:

7.4.1. Inspection and Certification:

MPPEH procedures will be IAW DoDI 4140.62 and EM1110-1-4009. All Material Potentially Presenting an Explosive Hazard (MPPEH) will be assessed and its explosives safety status determined and documented prior to transfer to a third party for disposal recycling or preservation. Prior to release to the public, MPPEH will be documented by authorized and

technically qualified personnel as Material Documented as Safe (MDAS) after a 100% inspection and an independent 100% re-inspection to determine that it is safe from an explosives safety perspective. A DD Form 1348-1A will be completed for all munitions debris and range-related debris to be transferred for final disposition and certified by the USXQCS & SUXOS.

7.4.2. DD Form 1348-1A:

Upon completion of all removal activities, EOTI will complete a DD Form 1348-1A IAW EM 11110-1-4009 Chapter 14 that will include the following statement regarding to processed MDAS & IDW materials:

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

7.5. Alternative Disposal Techniques:

No off-site destruction of recovered MEC is anticipated for this MEC removal action.

8. Environmental, Ecological or Cultural Consideration:

Dive activities will be conducted around the short nosed sturgeon spawn season which is anticipated in spring part of the year. APEX will under their effort determine when the area is safe to work in prior to giving notice to proceed of EOTI site work. In the event that any environmental, ecological, or cultural considerations arise during project performance, project activities or affected portions of project activities will immediately cease and the Project SUXOS, PM, and Government Representatives will be immediately notified. Project activities will not commence in project affected areas until the contractor is notified by the Government to proceed in a manner determined appropriate by the Government or the contractor in coordination with the Government.

9. Technical Support:

9.1. Military Support:

No chemical warfare materiel (CWM) is suspected at this site. However, if suspected CWM is encountered at the project site, all work will immediately cease. All project personnel will withdraw along identified, cleared paths upwind from the discovery. The senior UXO person on site will designate a two-person team to secure the area and prevent unauthorized access. This team will position themselves as far upwind as possible while still maintaining visual contact and control of the area. The senior UXO person on site following evacuation will immediately notify the EOTI PM who will immediately coordinate with forward Government Project Representatives to contact and facilitate military control and Explosive Ordnance Disposal (EOD) response. The contractor will maintain control of the site until control is relinquished to the military.

Additionally, local law enforcement will be contacted of the discovery. If the item is RCWM of has an unknown liquid filler, the on-site USACE OESS will notify the Chemical Warfare Design Center (CWM-DC) at the USAESCH by calling the 24/7 telephone number at 256-895-1180.

9.2. Contractor:

All on-site UXO Personnel will meet the required training and minimum experience required by DDESB TP 18.

10. Residual Risk Management:

10.1. LUC:

No permanent land use controls are being proposed. Temporary fencing to prevent unauthorized access to the site will be put up and maintained during the entire removal action project.

10.2. Long-Term Management:

Any long-term management is the responsibility of the military or other stakeholders related to the project.

11. UXO Safety Education Program:

EOTI has not been contract to perform any UXO Safety education program outside daily safety briefings that is utilized to make other site personnel aware of hazards presented by Unexploded Ordnance and the proper procedures in notifying EOTI if evidence of UXO is discovered. Others will conduct all other education program material and training/education to public.

12. Stakeholder Involvement:

This project was coordinated with the USAESCH and EA Engineering. All agencies will remain active in the final planning and response stages of the project to include Work Plan review and final approval, progress review and schedule adjustments as required to accommodate construction schedules, EZ establishment and control support as necessary, unplanned environmental, emergency as necessary, and final report review, comment, and acceptance. All agencies concur with the selected response and support actions presented.

13. Contingencies:

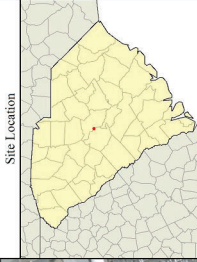
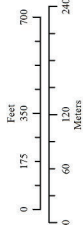
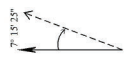
No contingencies planned at this time.

Appendix A
Maps



Legend
 Approximation Extent of Proposed TLM Location

MAD 1983 State Plane South Carolina (feet)
 Data Provided By:
 Apex Companies, LLC



**FIGURE A-1
 SITE LOCATION**

Columbia, SC

Prepared For:
 Apex Companies, LLC

Prepared By:
 Explosive Ordnance
 Technologies, Inc.

DATE: 10/13/2014

DESIGNER: M. Norris

PREPARED BY: J. Daffron

FILE: Map.aesx

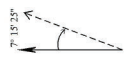
SCALE: 1 inch = 350 feet

PAGE # A-1

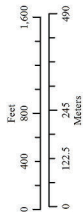


Legend

- Clearance Phase**
- Phase 1 - Year 1
 - Phase 2 - Year 2
 - Approximate Confined Location
 - Sandbag Mitigation MSD 220 ft
 - Hazardous Fragment Distance 237 ft
 - Hazardous Fragment Distance 3060 ft



NAD 1983 State Plane South Carolina (feet)
Data Provided By:
Apex Companies, LLC



Site Location



**FIGURE A-2
INTENTIONAL AND UNINTENTIONAL
DETONATION DISTANCES**

Prepared For:
Apex Companies, LLC

Prepared By:
Explosive Ordnance
Technologies, Inc.

DATE: 12/17/2014

PREPARED BY: J. Duffin

PROJECT: APT0325

SCALE: 1 inch = 800 feet

PAGE # A-2

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, IGP, Swisstopo, and the GIS User Community

Legend

- Explosive Magazine Location
- PTRD-Low 75 Ft (based on 31 Lbs Net Explosive Weight)
- PTRD-Medium 120 Ft (based on 31 Lbs Net Explosive Weight)
- IBD/PTRD-High 200 Ft (based on 31 Lbs Net Explosive Weight)
- Approximate Cofferdam Location

Clearance Phase

- Phase 1 - Year 1
- Phase 2 - Year 2

MAD 1983 Site Plan, South Column (Feet)
Data Provided By:
APEX Companies, LLC

Scale: 0 125 250 375 500 Feet
0 37.5 75 150 Meters

7° 18' 22"

Site Location

**FIGURE A-3
EXPLOSIVE STORAGE MAGAZINE
PROPOSED LOCATION**

Columbia, SC

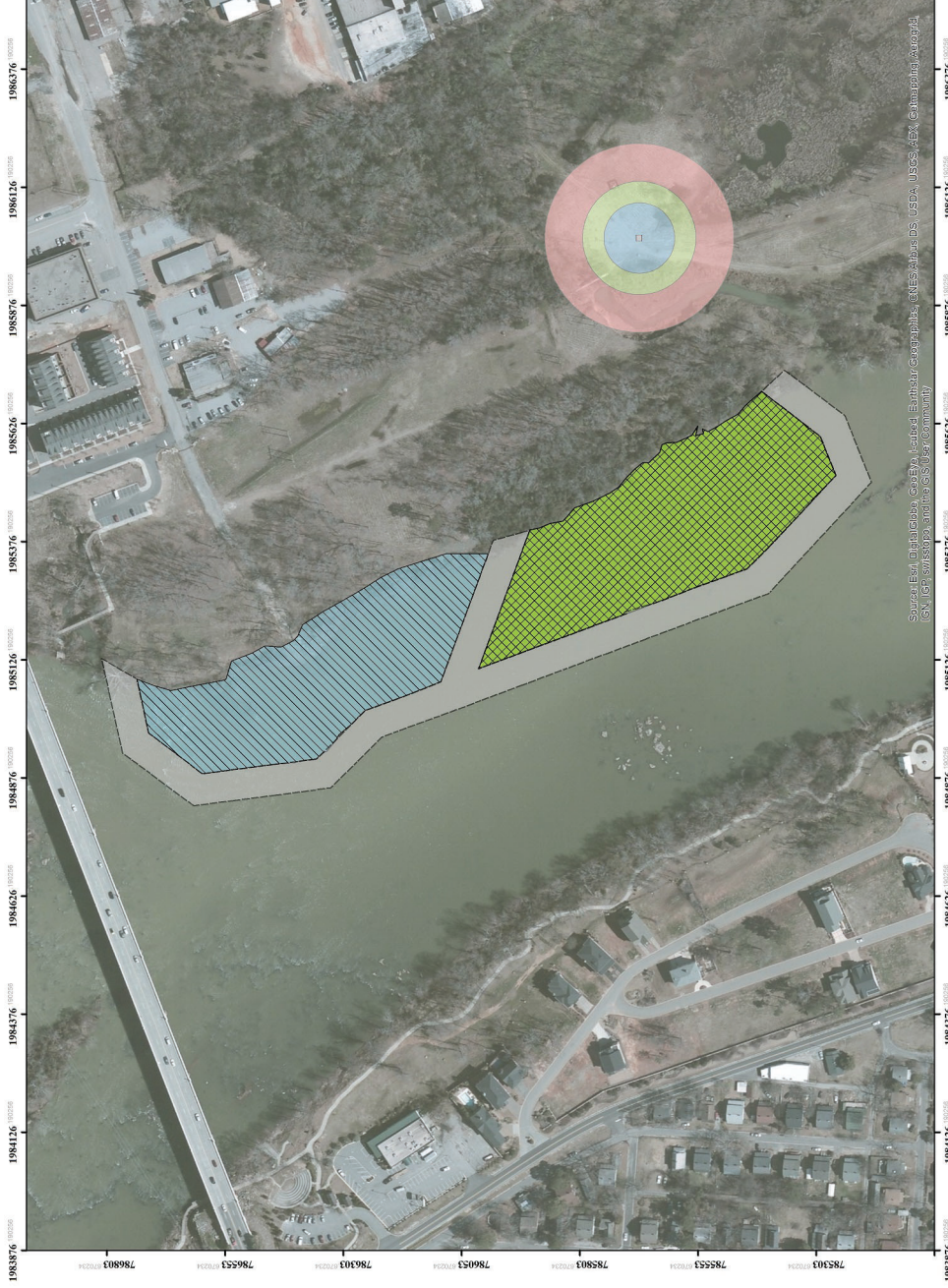
Prepared For:
APEX Companies, LLC

Prepared By:
Explosive Ordnance
Technologies, Inc.

DESIGNER: M.A. Norris
DATE: 04/10/2015

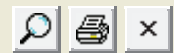
APPROVED BY:
J. Daffron
B. Woods

FILE: A-3.mxd
SCALE: 1 inch = 200 feet



Appendix B
MSD Calculation Sheets

Fragmentation Data Review Form



Database Revision Date 8/21/2014

Category:

Munition:

Case Material:

Fragmentation Method:

Secondary Database Category:

Munition Case Classification:

DODIC:

Date Record Created:

Record Created By:

Last Date Record Updated:

Individual Last Updated Record:

Date Record Retired:

Munition Information and Fragmentation Characteristics

Explosive Type:

Explosive Weight (lb):

Diameter (in):

Cylindrical Case Weight (lb):

Maximum Fragment Weight (Intentional) (lb):

Design Fragment Weight (95% (Unintentional) (lb):

Critical Fragment Velocity (fps):

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):

MFD-H [Maximum Fragment Distance, Horizontal] (ft):

MFD-V [Maximum Fragment Distance, Vertical] (ft):

Overpressure Distances

TNT Equivalent (Pressure):

TNT Equivalent Weight - Pressure (lbs):

Unbarricaded Intraline Distance (3.5 psi), K18 Distance:

Public Traffic Route Distance (2.3 psi); K24 Distance:

Inhabited Building Distance (1.2 psi), K40 Distance:

Intentional MSD (0.0655 psi), K328 Distance:

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):

TNT Equivalent Weight - Impulse (lbs):

Kinetic Energy 10^6 (lb-ft²/s²):

Single Sandbag Mitigation

Required Wall & Roof Thickness (in):

Expected Max. Throw Distance (ft):

Minimum Separation Distance (ft):

Double Sandbag Mitigation

Required Wall & Roof Thickness (in):

Expected Max. Throw Distance (ft):

Minimum Separation Distance (ft):

Water Mitigation

Minimum Separation Distance (ft):

Water Containment System:

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	<input type="text" value="12.80"/>	<input type="text" value="7.40"/>
Mild Steel:	<input type="text" value="2.21"/>	<input type="text" value="1.23"/>
Hard Steel:	<input type="text" value="1.81"/>	<input type="text" value="1.01"/>
Aluminum:	<input type="text" value="4.07"/>	<input type="text" value="2.36"/>
LEXAN:	<input type="text" value="11.35"/>	<input type="text" value="7.93"/>
Plexi-glass:	<input type="text" value="9.75"/>	<input type="text" value="6.06"/>
Bullet Resist Glass:	<input type="text" value="9.20"/>	<input type="text" value="5.43"/>

Item Notes

The TNT equivalency for black powder rounds has been updated from 0.4 to 0.43 to agree with Rev 4 of TP 16. This has resulted in minor changes in values.

ATTACHMENT O

ENGINEERING EVALUATIONS

- O-1 Reinforced Rockfill Cofferdam Conceptual Design**
- O-2 Cofferdam Slope Stability Analysis**
- O-3 West Bank Erosion Potential Evaluation**
- O-4 River Bottom Erosion Potential Evaluation**



July 9, 2020

Mr. Paul Biery
Senior Project Manager
Dominion Energy South Carolina
400 Otarre Parkway
Cayce, SC 29033

RE: Reinforced Rockfill Cofferdam Conceptual Design
SCE&G Fleet Maintenance Site (Congaree River)
Columbia, South Carolina

Dear Mr. Biery,

The State Voluntary Cleanup Program has reviewed the Reinforced Rockfill Cofferdam Conceptual Design received by the Department on June 22nd, 2020. The Department approves of the submittal and the conclusions made in the report.

If you have any questions or comments please contact me at (803) 898-0747 or cassidga@dhec.sc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "Greg Cassidy", is written over a light blue horizontal line.

Greg Cassidy
State Voluntary Cleanup Program
Bureau of Land and Waste Management

cc: File 52561
Lucas Berresford, BLWM
Veronica Barringer, Midlands EA Region
Al Peeples, Midlands EA Region



VIA ELECTRONIC MAIL

May 28, 2020

William Zeli, P.E., Environment Program Manager
Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

**Subject: Reinforced Rockfill Cofferdam Conceptual Design
Congaree River Remediation Project
Columbia, South Carolina**

Dear Mr. Zeli:

This Letter Report presents the results of WSP USA's (WSP) engineering evaluation and conceptual design of reinforced rockfill cofferdam options for the Congaree River Remediation project. Our services for this Project were performed in accordance with our December 31, 2019 proposal submitted to Apex Companies, LLC (Apex) authorized by Work Order #4, Change Order #1, dated December 17, 2019 and our April 28, 2020 proposal submitted to Apex authorized by Work Order #4, Change Order #4, dated April 30, 2020.

PROJECT UNDERSTANDING

In 2010, coal tar was discovered along the bottom of the Congaree River from the Gervais Street bridge to the Blossom Street bridge. Coal tar is a byproduct of a manufactured gas plant that once operated on Huger Street above the river. The manufacturing process left a residue that ultimately leaked into the Congaree River. Apex has prepared preliminary plans to remove the coal tar from the riverbed. The removal process will require the construction of a temporary cofferdam in the river to provide access for the construction equipment to remove the coal tar. Recent discussions held between WSP, Apex, and Dominion related to the revised design of the cofferdams to reflect the current removal plan resulted in a recommendation to evaluate various approaches to reinforcing the rockfill cofferdams in lieu of using cellular sheet pile cofferdams to mitigate the potential for catastrophic failure during flood flows. A catastrophic failure would result in distributing the rockfill within the river which may not be acceptable to the project stakeholders. This letter report presents descriptions for three reinforcement options and an evaluation of liner options for the rockfill cofferdam. Conceptual designs, associated budgetary cost estimates, and an evaluation matrix for the rockfill reinforcement concepts retained for evaluation are presented. Recommendations to proceed with a final design are also provided in this letter.

CONCEPTUAL DESIGN

This section presents a brief description of three cofferdam reinforcement options followed by an evaluation of liner options for the cofferdam. A conceptual design, including design sketch and budgetary cost estimate, are presented for each option retained for further evaluation. This information is used to complete the evaluation matrix. The conceptual designs consist of covering the outboard slope (wet side), crest, and the upper third of the inboard slope (dry side) of the rockfill cofferdam with

WSP USA
Suite 950
11 Stanwix Street
Pittsburgh, PA 15222

Tel.: +1 412 281-9900
Fax: +1 412 281-2056
wsp.com



reinforcement. The purpose of the reinforcement is to provide protection during overtopping, to prevent a catastrophic failure of the rockfill, and to limit deformations during flood loading conditions. Additional extensions of the reinforcement material further down the inboard slope will be subject to evaluation during final design. Engineering sketches of the conceptual designs are provided in Enclosure A.

ARTICULATED CONCRETE BLOCK MATS

This conceptual design consists of placing Articulated Concrete Block (ACB) mats on top of the rockfill throughout the outboard slope, crest, and the upper third of the inboard slope of the cofferdam. ACB mats are typically used for overtopping protection of earthen dams or earth lined spillways. Cable tied ACB mats are fabricated in the shop from pre-cast concrete blocks and steel cables. The height of the block ranges from 4 to 8 inches and the mats are generally 8-foot wide and up to 40-foot long (Contech, 2020). The mats can be transported to the site on a large flat-bed truck. A crane with spreader bar is required for installation. This concept includes potentially reusing the ACB mats at Area 2 after the coal tar has been removed from Area 1. However, this potential cost savings was not considered in the budgetary cost estimates due to uncertainties in the ability to successfully remove the ACB mats from Area 1 and the condition of the reclaimed ACBs. Since ACBs can resist flow velocities in excess of 25 feet per second, rip rap is not required along the outboard side of the cofferdam for erosion control.

ROCK MATTRESSES

This concept consists of placing rock mattresses on top of the rockfill throughout the outboard slope, crest, and the upper third of the inboard slope of the cofferdam. Rock mattresses are thin, flexible rectangular cages made from wire mesh. The mattresses are manufactured at an off-site facility and are delivered to the site where the baskets are formed, tied together, and then filled with appropriate sized crushed stone (rock). The wire cages are placed along the slope, tied together, filled with rock, and the top is placed and tied. Rock mattresses are typically used primarily for scour protection along river banks or embankment stability in channel linings. Typical mattress dimensions are 6 feet wide by 12 feet long. The height of the mattress ranges from 6 to 12 inches. The rock placed inside the mattress is hard, angular, and durable to prevent disintegration during the life of the project. Rock sizes range between 3 and 5 inches for 6 to 9-inch thick mattresses and between 4 and 8 inches for 12-inch thick mattresses. Rock mattresses can resist flow velocities in excess of 19 feet per second for slopes ranging from 2H:1V to 3H:1V. Due to the flow resistance of the rock mattresses, rip rap is not required along the outboard side of the cofferdam for erosion control.

STEEL REBAR MATS

This conceptual design consists of placing rectangular rebar mats on top of the rockfill. Rebar mats are typically used for constructing reinforced rockfill structures which include horizontal rows of rebar attached to the mats along the outside face. Our proposed design concept includes the mats along the outboard and inboard faces of the rockfill cofferdam. The spacing of the rebar is set to retain the rockfill dimensions placed along the face of the cofferdam. The Pit No. 7 Afterbay dam in California includes both internal and external rebar mats and has resisted flow velocities up to 12 feet per second but has experienced considerable material loss along the dam (FEMA, 2014). Therefore, we recommend that rip rap should be placed along the outboard side of the cofferdam for erosion control.

Horizontal reinforcement bars running through the cofferdam are required to increase the structural stability of the cofferdam, which would limit deformations of the rock fill and reduce the risk of a catastrophic failure during flood loading conditions. However, this design requirement presents a number of constructability issues. The horizontal bars would have to run through the liner along the outboard side of the cofferdam which would require watertight penetrations which are not practical. Also, the construction sequence of the cofferdam would require placing the horizontal bars along the rockfill lifts at predefined intervals, resulting in additional construction time compared with the other design concepts under consideration. Placing the horizontal rebar mats in the wet during construction is also challenging and would significantly



increase construction cost. Based on the challenges of maintaining a watertight seal around the frequent liner penetrations for the horizontal reinforcement bars, and the additional construction time associated with this design concept, the steel rebar mat is considered to be the least practical and cost-effective design concept under consideration. Therefore, the steel rebar mat concept is discounted and not considered further in this evaluation.

LINER EVALUATION

Each conceptual design includes a geomembrane liner to minimize seepage through the cofferdam. The most commonly used materials used for geomembrane liners used for providing an impermeable barrier are linear low-density polyethylene (LLDPE), high-density polyethylene (HDPE), and polyvinyl chloride (PVC). Other materials such as Hypalon, reinforced polypropylene and EPDM rubber are also used as geomembranes. However, based on discussions with Apex and Dominion, we have limited our evaluation to HDPE, PVC, and possibly Geosynthetic Clay Liners (GCLs).

GCLs are factory manufactured hydraulic barriers consisting of a layer of bentonite or other very low-permeability material supported by geotextiles and/or geomembranes mechanically held together by needling, stitching, or chemical adhesives. Typical applications for GCLs are for secondary lining systems for municipal or hazardous waste landfills when clay is not readily available. The use of GCL's for permanent dams or cofferdams is not mentioned in the United States Bureau of Reclamation's Design Standard No. 13 (USBR, 2018) and our discussions with geomembrane installers have indicated that GCLs need to be installed in the dry. Since our cofferdams will be installed in the wet, we do not believe that GCLs are suitable for the rockfill cofferdam.

HDPE geomembranes are used extensively in the US, have high UV resistance, and are very resistant to tearing and puncturing. HDPE seams must be thermally welded. However, HDPE is also very stiff so installation can be difficult especially in cold weather or tight corners. Typical applications are for landfill lining systems.

PVC geomembranes are more flexible than HDPE and have good tensile, elongation, and puncture resistance. PVC seams can be attached by solvent welding, adhesives, and heat or dielectric methods. PVC is used extensively in both US and Europe as an impermeable barrier in both embankment and concrete dams.

Based on this evaluation, our recommendation is to include a geomembrane liner (either PVC or HDPE) in the rockfill cofferdam with a minimum thickness of 50 mils. In addition, we will specify a minimum overlap distance of 5 feet or welding adjacent geomembrane panel seams.

ALTERNATIVE EVALUATION

The two remaining alternatives described in the previous section of the letter were ranked based on the key factors listed in *Table 1*. The following factors used in previous evaluations conducted for the site were not included since the different reinforcement concepts do not have any significant differences:

- Practical to found on stream bottom
- Estimated leakage
- No Rise analysis
- Unexploded Ordnance impacts
- Availability of Contractors



Table 1
Cofferdam Alternatives Evaluation Matrix

REINFORCEMENT OPTION	ACB MATS	ROCK MATTRESSES
Overtopping Resistance	High	Medium
Proven Track Record for temporary installations	Yes	No
Estimated Installed Cost	\$16/SF ^(a)	\$12/SF ^(b)
Stability Enhancement	Yes (confirmed by stability analysis)	Possibly
Ease of Installation	Moderate	Less proven since mattresses need to be pre-filled
Ease of Removal	Moderate (recent temporary installation)	Challenging (no recent installations identified)
Installation and Removal Requirement	Common methods: crane with spreader bar required to lift and place/remove mats	Less proven methods: specialized equipment required to install in the wet
Duration of Installation and Removal	Medium	Long
Resistance to Catastrophic Failure	High	High
Compatibility with liner during construction	High (might be able to attach liner to bottom of ACB Mats)	Medium
Rank	1	2

Notes:

- a. Cost information provided by ARMORTEC (2020).
- b. Based on cost information provided by Elite Erosion Supply (2020).



BUDGETARY LEVEL COST ESTIMATES

Budgetary level cost estimates for the rockfill berm cofferdam including fabricating and installing the two reinforcement alternatives are provided in Enclosure B and summarized below. Installation costs are based on engineering judgement and recent correspondence with material suppliers for both ACBs (ARMORTEC) and rock mattresses (Elite Erosion Supply).

- ACB Mats: \$5.3M
- Rock Mattresses: \$4.9M

These budgetary costs for the reinforced rockfill berm include the base rockfill berm cost of \$2.7M as described in WSP's July 17, 2019 letter report (WSP, 2019) and as summarized in the following paragraphs.

“These budgetary cost estimates are consistent for the current removal plan which consists of two separate work areas. The quantities of rock required for the rockfill berm have been calculated based on footprints of the stakeholder-developed MRA and the latest bathymetric data provided by APEX.

A Digital Terrain Model (DEM) of the proposed cofferdams has been developed in ArcGIS software based on a 10-ft wide crest at elevation 124.5 ft NVGD29 and a side slope of 1V:1.3H. The bathymetric DEM has been subtracted from the cofferdam DEM, and the resulting DEM provides the depth of rockfill throughout Area 1 and Area 2. The DEMs are produced at a 1-ft by 1-ft resolution, which is appropriate for a budgetary level cost estimate.

The cost estimates include a 20% contingency amount to reflect the associated uncertainty.

The duration of dewatering is assumed to be 7 months for Area 1, and 2 months for Area 2.”

The estimated duration for installation and removal of the reinforced rockfill berms is approximately 8 weeks for Area 1 and approximately 5 weeks for Area 2.

RECOMMENDATIONS

Based on the results of the evaluation presented in this letter report, we recommend proceeding with preparing a final design using ACB mats to reinforce the rockfill cofferdam.

If you have any questions or need any additional information, please contact John Osterle at 412-535-9823 or john.osterle@wsp.com.

Kind regards,

John P. Osterle, P.E.
Project Manager

JPO:TE:

Enclosure



References

ARMORTEC, February 13, 2020, e-mail correspondence from Barrie King, PE.

Elite Erosion Supply, February 19, 2020, e-mail correspondence from Anamarie Stralla.

FEMA, 2014, "Technical Manual: Overtopping Protection for Dams", FEMA P-1015.

CONTECH Engineered Solutions, 2020, "Articulating Concrete Block (ACB) System Specifications – Tapered Series Armor Flex, www.contech.com.

Maccaferri, 2017, "Reno Mattress, Galmac & PVC Coated, Technical Data Sheet".

U.S. Bureau of Reclamation, 2018, "Design Standard No. 13, Embankment Dams, Chapter 20: Geomembranes".

WSP, July 17, 2019, "Cellular Sheetpile Cofferdam Evaluation", letter report submitted to Apex Companies, LLC.

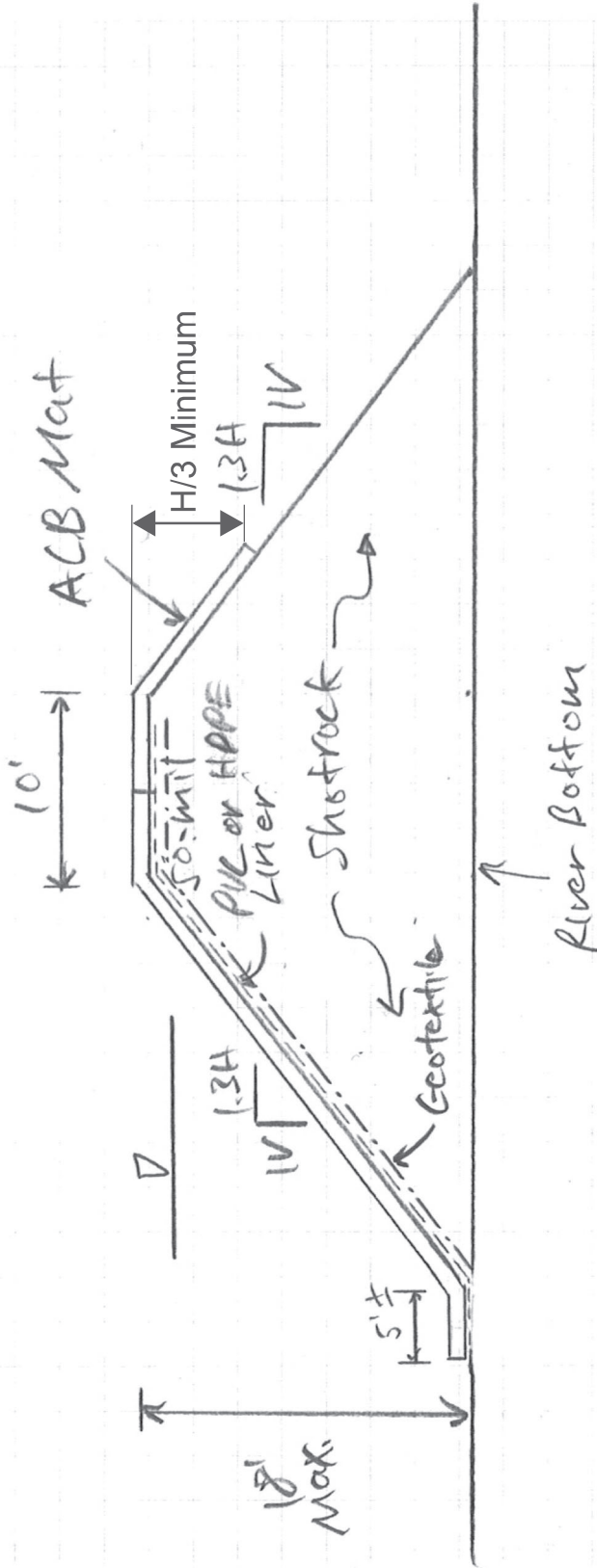


ENCLOSURE A: ENGINEERING SKETCHES



Sheet No. 1 of 2
 Project # 31401700
 Date 5/15/2020
 Date 5/19/2020

Project Congaree River Remediation Computed by JPO
 Subject Reinforced Cofferdam Checked by TE

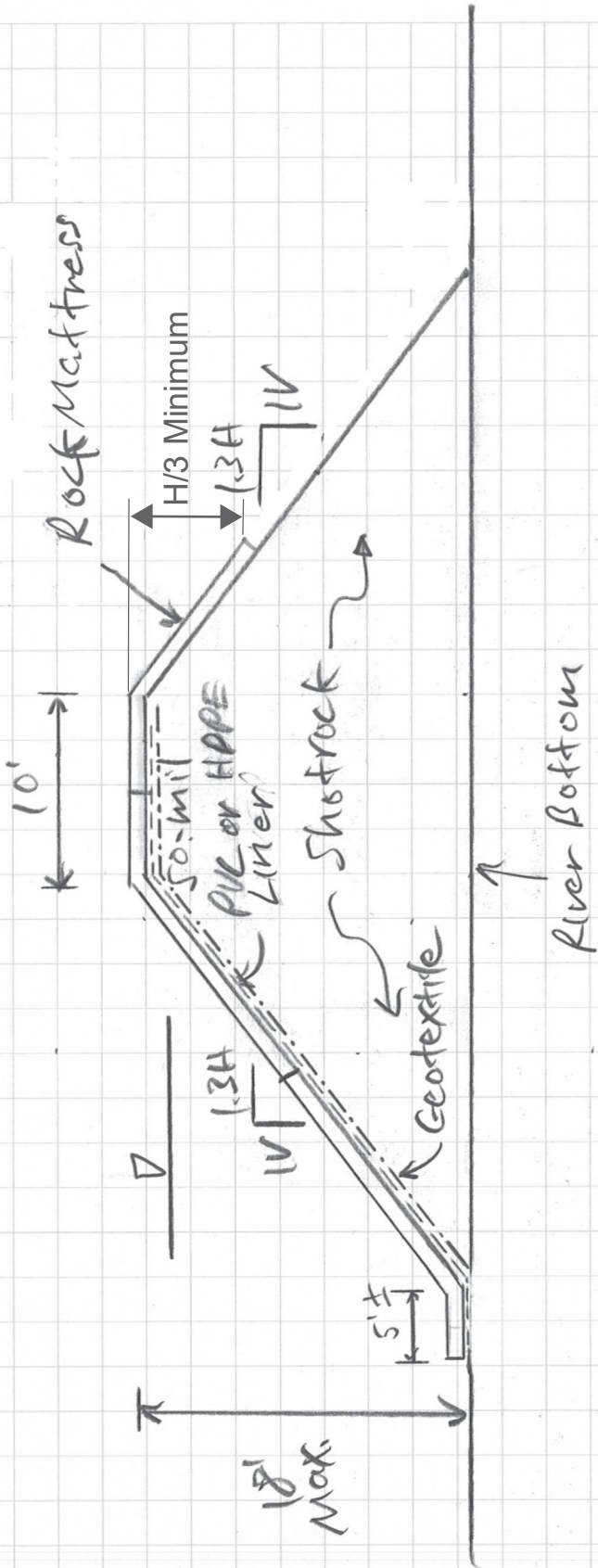


Notes:

1. Provide a structural connection between both ACB mats at the crest of the Cofferdam
2. Place Shoctrack in horizontal layers

Scale

1" = 16'



Notes:

1. Provide a structural connection between both Rock mats at the crest and along slope of cofferdam
2. Place shotrock in horizontal layers

Scale
 1" = 10'



ENCLOSURE B: BUDGETARY LEVEL COST ESTIMATES

**CONGAREE RIVER REMEDIATION - ROCKFILL BERM WITH ACBs**Budgetary Cost Estimate
MAY 2020Orig: JPO 5/15/20
Chk: TE 5/27/20

Item No.	Title	UNIT	QUANTITY	UNIT PRICE	ITEM PRICE
1.0	MOBILIZATION AND DEMOBILIZATION				
1.1	MOBILIZATION AND DEMOBILIZATION (10% of Cost)	LS	1	\$405,000	\$405,000
	SUB TOTAL 1.0				\$405,000
2.0	AREA 1 BERM CONSTRUCTION (1215 FEET)				
2.1	GEOTEXTILE	SY	4,622	\$3.50	\$16,179
2.2	HDPE LINER	SF	41,602	\$2.50	\$104,005
2.3	SHOTROCK OR RIPRAP PLACEMENT	CY	16,380	\$47.00	\$769,860
2.4	DEWATERING	MONTH	7	\$10,000	\$70,000
2.5	ACBs (ARMORFLEX 45)	SF	62,942	\$16.00	\$1,007,072
2.6	ACB REMOVAL	SF	62,942	\$4.00	\$251,768
2.7	ACB DISPOSAL	TON	1,416	\$50.00	\$70,810
2.8	BERM REMOVAL	CY	16,380	\$23.00	\$376,740
2.9	OUTLET STRUCTURE	-	-	-	-
2.9.1	CHECK VALVE	EA	1	\$6,000	\$6,000
2.9.2	HDPE PIPE	FT	80	\$125.00	\$10,000
2.9.3	CATCH BASIN	EA	1	\$2,500	\$2,500
2.9.4	COLLARS AND MISC	EA	1	\$6,000	\$6,000
	SUB TOTAL 2.0				\$2,690,933
3.0	AREA 2 BERM CONSTRUCTION (553 FT)				
3.1	GEOTEXTILE	SY	2,417	\$3.50	\$8,458
3.2	HDPE LINER	SF	21,749	\$2.50	\$54,373
3.3	SHOTROCK OR RIPRAP PLACEMENT	CY	8,600	\$47.00	\$404,200
3.4	DEWATERING	MONTH	2	\$10,000	\$20,000
3.5	ACBs (ARMORFLEX 45)	SF	30,300	\$16.00	\$484,800
3.6	ACB REMOVAL	SF	30,300	\$4.00	\$121,200
3.7	ACB DISPOSAL	TON	682	\$50.00	\$34,088
3.8	BERM REMOVAL	CY	8,600	\$23.00	\$197,800
3.9	OUTLET STRUCTURE	-	-	-	-
3.9.1	CHECK VALVE	EA	1	\$6,000	\$6,000
3.9.2	HDPE PIPE	FT	80	\$125.00	\$10,000
3.9.3	CATCH BASIN	EA	1	\$2,500	\$2,500
3.9.4	COLLARS AND MISC	EA	1	\$6,000	\$6,000
	SUB TOTAL 3.0				\$1,349,418
	CONTINGENCY (20%)				\$889,070
TOTAL BASE BID PRICE					\$5,334,422

**CONGAREE RIVER REMEDIATION - ROCKFILL BERM WITH ROCK MATTRESSES**Budgetary Cost Estimate
MAY 2020Orig: JPO 5/15/20
Chk: TE 5/27/20

Item No.	Title	UNIT	QUANTITY	UNIT PRICE	ITEM PRICE
1.0	MOBILIZATION AND DEMOBILIZATION				
1.1	MOBILIZATION AND DEMOBILIZATION (10% of Cost)	LS	1	\$368,000	\$368,000
	SUB TOTAL 1.0				\$368,000
2.0	AREA 1 BERM CONSTRUCTION (1215 FT)				
2.1	GEOTEXTILE	SY	4,622	\$3.50	\$16,179
2.2	HDPE LINER	SF	41,602	\$2.50	\$104,005
2.3	SHOTROCK OR RIPRAP PLACEMENT	CY	16,380	\$47.00	\$769,860
2.4	DEWATERING	MONTH	7	\$10,000	\$70,000
2.5	ROCK MATTRESS (6" RENO)	SF	62,942	\$12.00	\$755,304
2.6	ROCK MATTRESS REMOVAL	SF	62,942	\$4.00	\$251,768
2.7	ROCK MATTRESS DISPOSAL	TON	1,574	\$50.00	\$78,678
2.8	BERM REMOVAL	CY	16,380	\$23.00	\$376,740
2.9	OUTLET STRUCTURE	-	-	-	-
2.9.1	CHECK VALVE	EA	1	\$6,000	\$6,000
2.9.2	HDPE PIPE	FT	80	\$125.00	\$10,000
2.9.3	CATCH BASIN	EA	1	\$2,500	\$2,500
2.9.4	COLLARS AND MISC	EA	1	\$6,000	\$6,000
	SUB TOTAL 2.0				\$2,447,033
3.0	AREA 2 BERM CONSTRUCTION (553 FT)				
3.1	GEOTEXTILE	SY	2,417	\$3.50	\$8,458
3.2	HDPE LINER	SF	21,749	\$2.50	\$54,373
3.3	SHOTROCK OR RIPRAP PLACEMENT	CY	8,600	\$47.00	\$404,200
3.4	DEWATERING	MONTH	2	\$10,000	\$20,000
3.5	ROCK MATTRESS (6" RENO)	SF	30,300	\$12.00	\$363,600
3.6	ROCK MATTRESS REMOVAL	SF	30,300	\$4.00	\$121,200
3.7	ROCK MATTRESS DISPOSAL	TON	758	\$50.00	\$37,875
3.8	BERM REMOVAL	CY	8,600	\$23.00	\$197,800
3.9	OUTLET STRUCTURE	-	-	-	-
3.9.1	CHECK VALVE	EA	1	\$6,000	\$6,000
3.9.2	HDPE PIPE	FT	80	\$125.00	\$10,000
3.9.3	CATCH BASIN	EA	1	\$2,500	\$2,500
3.9.4	COLLARS AND MISC	EA	1	\$6,000	\$6,000
	SUB TOTAL 3.0				\$1,232,005
	CONTINGENCY (20%)				\$809,408
TOTAL BASE BID PRICE					\$4,856,446



July 9, 2020

Mr. Paul Biery
Senior Project Manager
Dominion Energy South Carolina
400 Otarre Parkway
Cayce, SC 29033

RE: Rockfill Cofferdam Slope Stability Analysis Memo
SCE&G Fleet Maintenance Site (Congaree River)
Columbia, South Carolina

Dear Mr. Biery,

The State Voluntary Cleanup Program has reviewed the Rockfill Cofferdam Slope Stability Analysis Memo received by the Department on July 2nd, 2020. The Department approves of the submittal and the conclusions made in the report.

If you have any questions or comments please contact me at (803) 898-0747 or cassidga@dhec.sc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "Greg Cassidy", is written in a cursive style.

Greg Cassidy
State Voluntary Cleanup Program
Bureau of Land and Waste Management

cc: File 52561
Lucas Berresford, BLWM
Veronica Barringer, Midlands EA Region
Al Peeples, Midlands EA Region



Statement of Purpose

This calculation has been prepared to analyze the stability of the proposed rockfill cofferdams to be constructed in Area 1 and Area 2 of the Congaree River as shown on Figure 1. This analysis is required to evaluate the stability of the critical sections of the cofferdam for flood loading conditions.

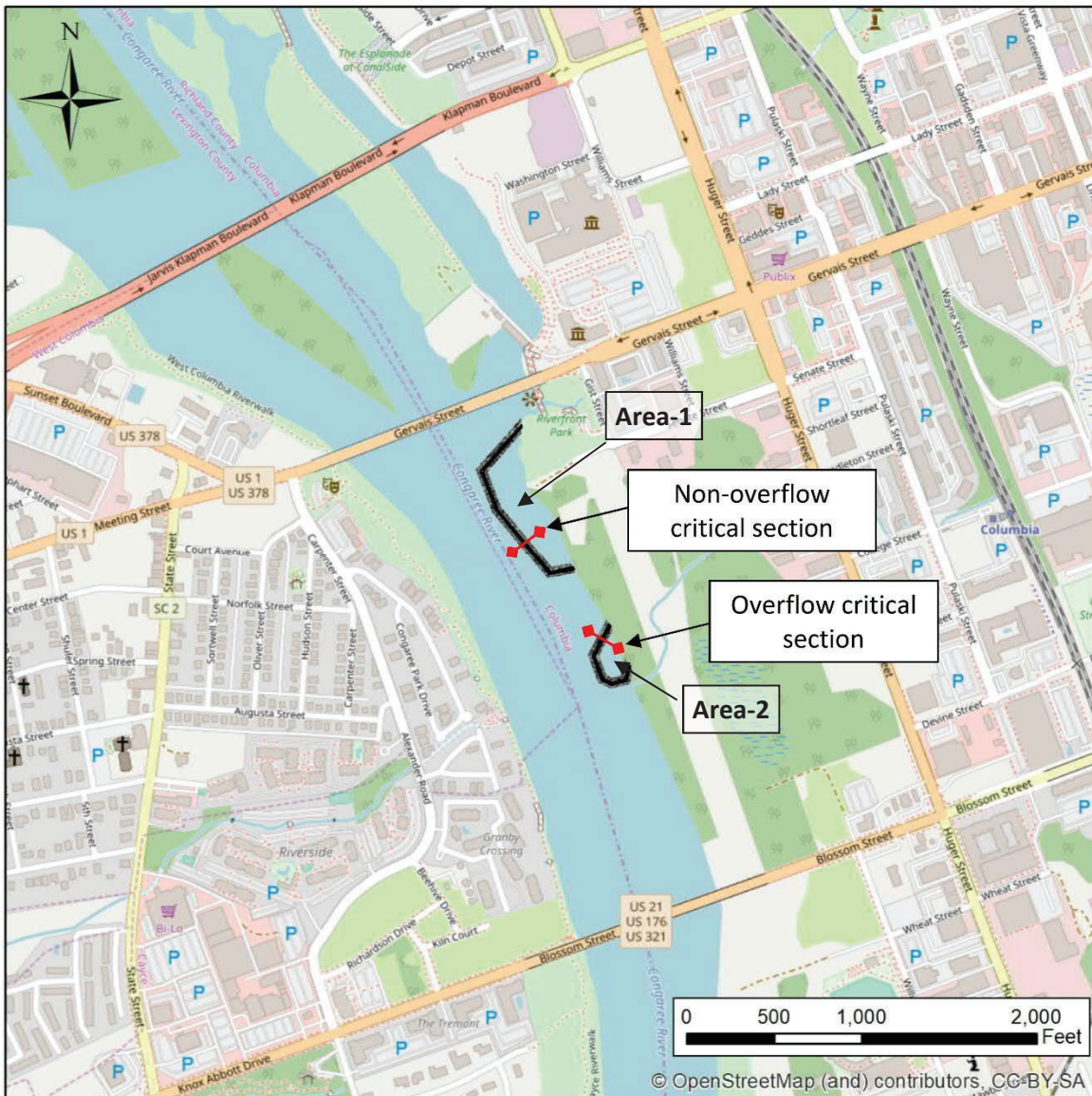


Figure 1: Plan View of Proposed Cofferdams

Approach

The slope stability of the proposed rockfill cofferdam was performed using the SLOPE/W computer program to evaluate the critical failure surfaces. The SLOPE/W software program is part of the GeoStudio software package and is produced by GEO-SLOPE International, Ltd. This program is a two-dimensional, limit equilibrium slope stability program which can model heterogeneous soil types, complex stratigraphic and slip surface geometries,



and variable pore-water pressure conditions using a wide range of soil models. The Spencer method was used to evaluate the slope stability of the proposed cofferdam.

The Spencer method is derived from the method of slices on the basis of limit equilibrium. It requires satisfying the equilibrium of forces and moments acting on individual slices. This method has been shown to be conservative and provide relatively accurate results.

The slope stability analysis was performed for flood loading conditions where the water level is assumed to be at the crest of the overflow structure of the Cofferdam. Section 3.2 of USACE EM-1110-2-1902 (Reference 1) states that stability computations must be performed when the consequences of the failure of a cofferdam, which is a temporary structure, is serious. A failure of the cofferdam during river remediation would introduce safety risks including equipment damage so a slope stability analysis is warranted and is good engineering practice. We have used a minimum required factor of safety of 1.3 (Reference 1, Table 3-1) since the cofferdam is a temporary structure that will only be used during construction activities (i.e., removing the contaminated sediment from the Congaree River). The analysis conditions and associated required minimum factors of safety are presented in Table 1.

Table 1: Load Cases Considered in Slope Stability Analysis

Analysis Condition	Analyzed Slope	Required Factor of Safety
Water Level at EL 123.5 (Crest of Overflow Structure)	Outboard (wet)	1.3
Water Level at EL 123.5 (Crest of Overflow Structure)	Inboard (dry)	1.3

The slip surface for the inboard (dry) and outboard (wet) sides of the cofferdam was considered as a “circular” slip surface by checking the option to optimize the critical slip surface location in SLOPE/W. This type of slip surface is where the moment equilibrium is completely independent of the interslice shear forces. The interslice shear force can be assumed zero and still retain the ability for an acceptable factor of safety. (Reference 1).

An additional case was also considered for areas where significant sediment thickness (greater than 1 foot) is present on the river bottom beneath the cofferdam. A “circular” slip surface on the inboard slope was analyzed for this case with three different excavation scenarios behind the cofferdam.

Assumptions and Justification

1. The minimum depth of failure surfaces of interest are 3 feet from the top of the slope.
2. The material properties for the materials used to construct the proposed cofferdam are based on typical values for rockfill. The material properties are presented in Table 2.
3. The rockfill is assumed to be cohesionless and free draining.
4. Any water leaking through the HDPE liner is assumed to flow through the rockfill into a sump where it will be removed from the work area.

5. Phreatic surface assumed to have an initial height of $H/4$ from the foundation material, where H is the total height of the slope. The phreatic surface is assumed to build up after water flows through leaks in the liner.
6. Typical Cofferdam and Overtopping sections constructed on bedrock. Typical Full Articulated Concrete Block (ACB) Coverage section is constructed on a layer of river sediment. Bathymetric and sediment surveys show the maximum depth of sediment along the inboard toe of slope is 5.5 feet. 1 foot of settlement is assumed during placement of the shot rock, giving a revised sediment thickness of 4.5 feet for this analysis.
7. For the Reinforced Rockfill analysis, the Articulated Concrete Block (ACB) Mats extend to the toe of the cofferdam and onto the river bottom at the inboard/outboard sides for the typical overtopping section and the full ACB coverage section. Our slope stability model for these cases assumes that the mats terminate 2 feet above the bottom of the cofferdam. This prevents overestimating the shear resistance at the base of the cofferdam at the outboard side. In reality, the toe of the slope will move laterally if the driving forces exceed the frictional resistance from the ACB Mat/river bottom interface. This is not an issue for the typical cofferdam section, where the ACB Mats extend from the outboard toe of slope, up the outboard slope, across the crest and terminate one-quarter of the distance down the inboard slope.

Model Geometry

The locations of the critical cofferdam cross-sections are shown on Figure 1. The analysis of the proposed cofferdam was performed for the typical section shown on Figure 2, the typical overtopping section shown on Figure 3, and the full ACB coverage section shown on Figure 4.

The sections all have a 50-mil HDPE liner modeled between the shot rock and the planned 4-inch thick (ACB) on the outboard slope and crest. However, as discussed in the Assumptions and Justification section, the ACB mat was terminated 2 feet from the bottom of the cofferdam in the Slope/W model for the typical sections.

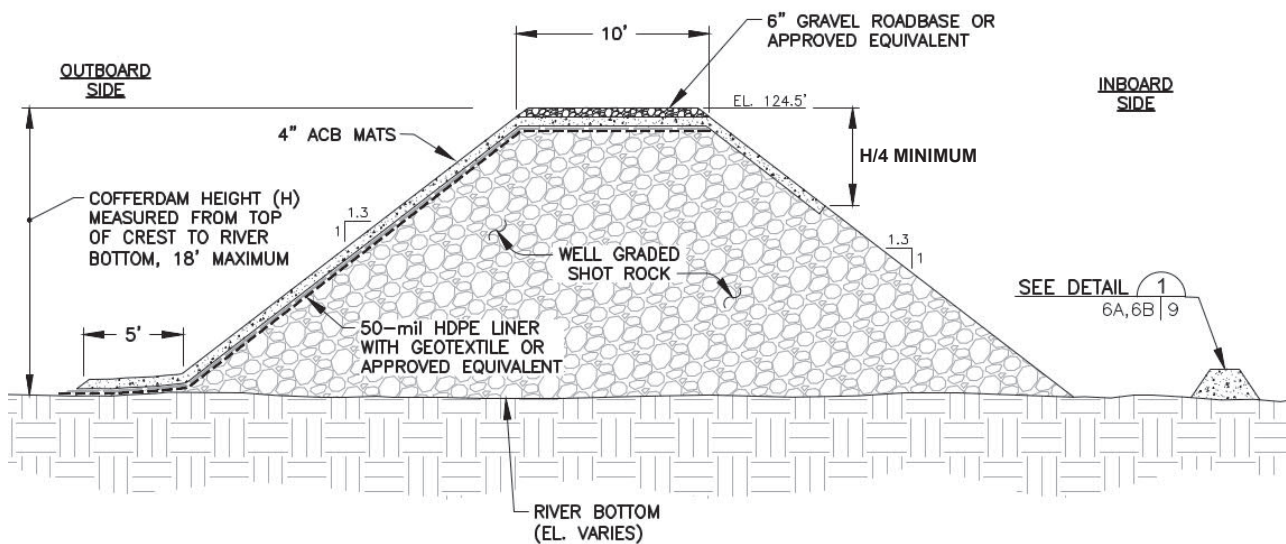


Figure 2: Typical Cofferdam Section

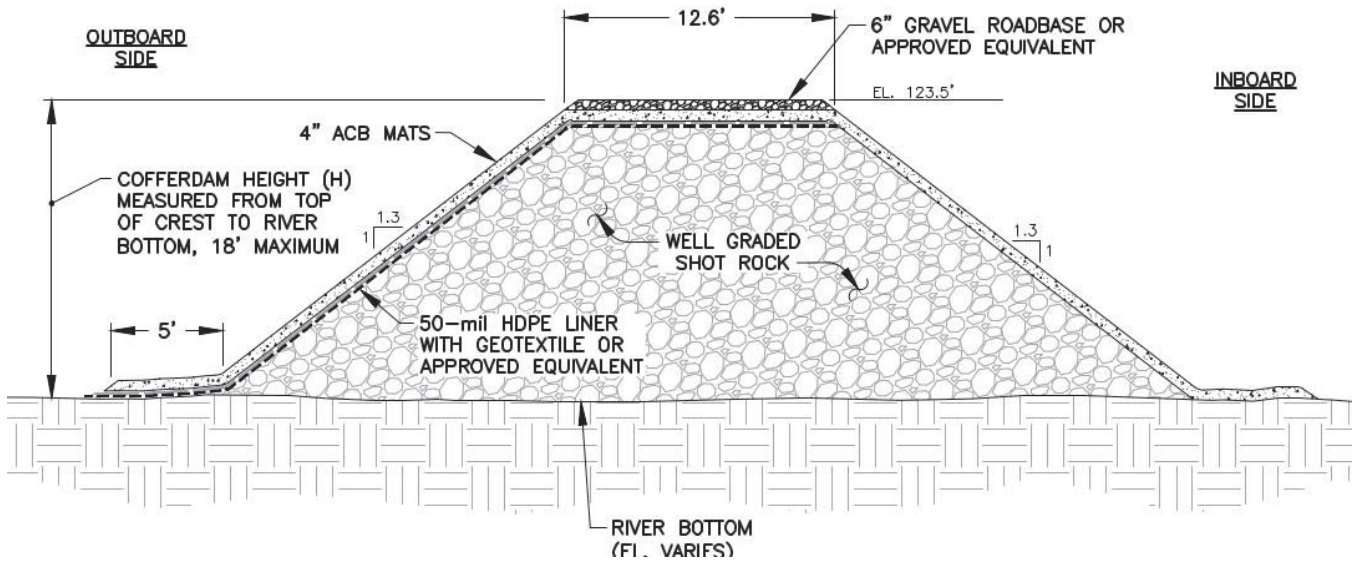


Figure 3: Typical Overflow Section

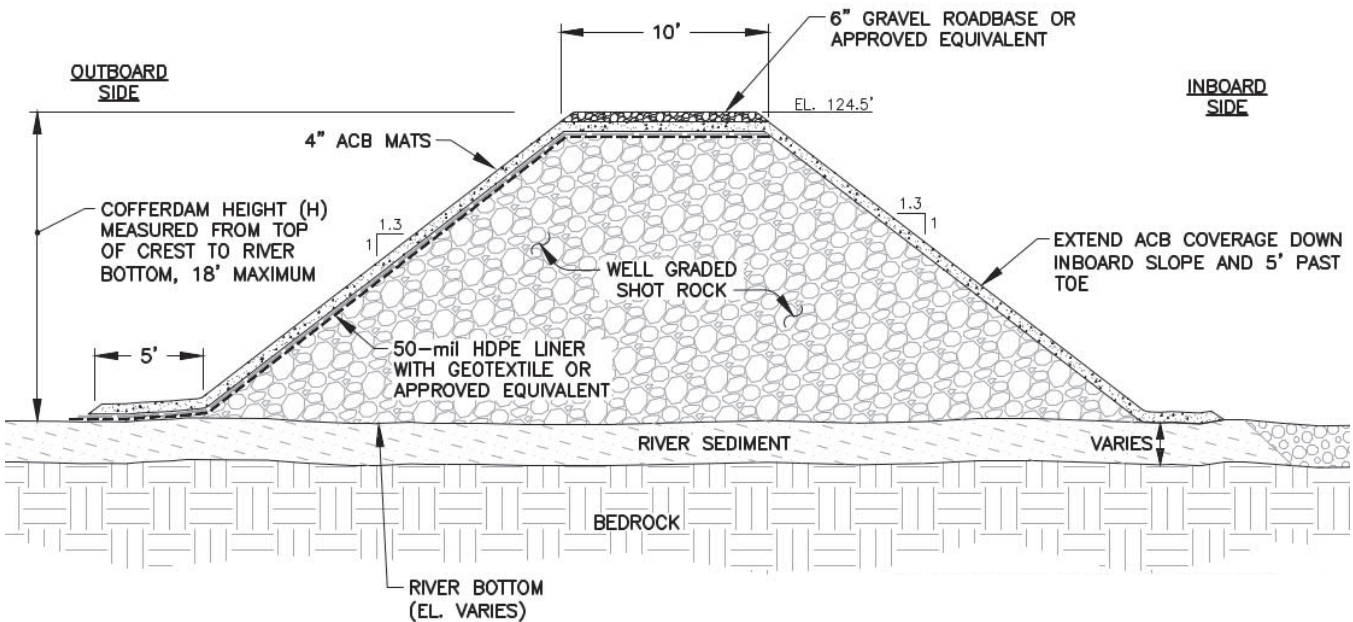


Figure 4: Full ACB Coverage Cofferdam Section



Material Properties

The unit weights, effective friction angles, and cohesion values of the various geotechnical materials are estimated based on standard properties used in the industry. The materials were assumed to be cohesionless and free draining (i.e., less than five percent of fine-grained materials in the rockfill). River sediment properties were based on the materials encountered during the sub-surface investigation.

Five materials are designated for specific regions within the cofferdam for this analysis — shot rock, native foundation rock, HDPE liner, ACB material, and river sediment.

Saturated unit weights are conservatively used in the model for the total unit weight. The model uses total unit weights in all locations and computes effective stresses based on stress calculations rather than unit weights.

The shear strength of the ACB material was estimated using an equivalent cohesion value. To determine the equivalent cohesion, shear capacity of the concrete material was calculated based on the ACI 318 (Eq. 22.8). The steel strands of the ACB elements were ignored in this analysis, conservatively. The unit weight for the ACB material was determined based off product information provided by contractors. Full calculations for ACB material properties can be referenced in Appendix B.

The estimated material properties used in the analysis are presented in Table 2.

Table 2: Material Properties Used in Slope Stability Analysis

Material	Unit Weight	Effective Friction Angle	Cohesion
	γ_{tot}	ϕ'	c
	(pcf)	(degrees)	(psf)
Shot Rock	150	45	0
HDPE Liner	150	30	0
Articulated Concrete Block (ACB)	114	0	5,000
Bedrock (Impenetrable)	-	-	-
River Sediment (silty sand)	110	30	0

Phreatic Surface and Pore Water Pressure

The slope stability analysis for the proposed cofferdam was performed with the water surface at the crest of the overflow section for the upstream side, which corresponds to El. 123.5'.

The phreatic surface is assumed to begin at height of H/4 (where H is the total height of the cofferdam) from the foundation materials. The phreatic surface is assumed to build up after water flows through leaks in the liner.



Results

The computed factors of safety of the critical cofferdam and overflow sections for flood loading conditions are summarized in Table 3. Results are presented for an unreinforced cofferdam, reinforced cofferdam, and for a reinforced cofferdam with limited (i.e., H/4) coverage along the inboard slope. Table 4 presents the results for the reinforced cofferdam with a 4.5 feet thick sediment layer on the river bottom beneath the cofferdam.

Table 3: Factors of Safety for Typical Sections

Section	Slip Surface	Analyzed Slope	Required Factor of Safety	Unreinforced Cofferdam FS	Reinforced FS	Reinforced FS (limited inboard coverage)
Typical	Circular	Outboard (wet)	1.3	1.5	2.6	N/A
Typical	Circular	Inboard (dry)	1.3	1.3	1.6	1.6
Overflow	Circular	Outboard (wet)	1.3	1.4	2.4	N/A
Overflow	Circular	Inboard (dry)	1.3	1.4	1.7	1.5

Table 4: Factors of Safety for Sediment Case

Section	Slip Surface	Analyzed Slope	Excavation Scenario	Required Factor of Safety	Reinforced FS
Full ACB Coverage	Circular	Inboard (dry)	Excavation starts 10 feet from toe of inboard slope	1.3	1.6
Full ACB Coverage	Circular	Inboard (dry)	Excavation starts 5 feet from toe of inboard slope	1.3	1.5
Full ACB Coverage	Circular	Inboard (dry)	Excavation starts 5 feet from toe of inboard slope; material is replaced with shot rock	1.3	1.7



Conclusion/Summary

The results from the slope stability analysis performed for the rockfill cofferdam as shown on Figures 2, 3, and 4 indicate that the upstream and downstream slopes meet the required factors of safety during flood loading conditions (water level at EL 123.5, crest of overflow structure). No additional analyses are required if the cofferdam is constructed as indicated and the design of the cofferdam is considered suitable for the conditions analyzed.

Key assumptions pertaining to the design of the cofferdam and validity of this analysis include:

- Rockfill is free draining and contains less than 5 percent of fine-grained materials (i.e., less than the No. 200 sieve).
- ACB mats cover the cofferdam as shown on Figures 2, 3, and 4, i.e., extend to at least $H/4$ along the inboard slope (where H is the height of the cofferdam measured from the crest to the inboard toe).
- The rockfill consist of angular crusher run material suitable for marine applications.
- The rockfill complies with SCDOT specifications for suitable rockfill.
- The maximum depth of sediment along the inboard toe of slope is 5.5 feet. 1 foot of settlement is assumed during placement of the shot rock, giving a revised sediment thickness of 4.5 feet for this analysis.

References

1. United States, Department of the Army, Army Corps of Engineers. Slope Stability. Washington, D.C.: USACE, October 2003. EM 1110-2-1902.
2. GEO-SLOPE International, Ltd. Stability Modeling with SLOPE/W 2007 Version. An Engineering Methodology. ed. Calgary, Alberta, CA: GEO-SLOPE International.







APPENDICES



Appendix A: SLOPE/W Output

Figure A1: Typical Section (Unreinforced); Model Configuration

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Foundation	Bedrock (Impenetrable)			
	HDPE Liner	Mohr-Coulomb	150	0	30
	Shotrock	Mohr-Coulomb	150	0	45
	Wet Shotrock	Mohr-Coulomb	150	0	45

Max Cofferdam Section 2-14-2020 unrein
 Date: 04/03/2020
 Kind: SLOPE/W
 Method: Spencer

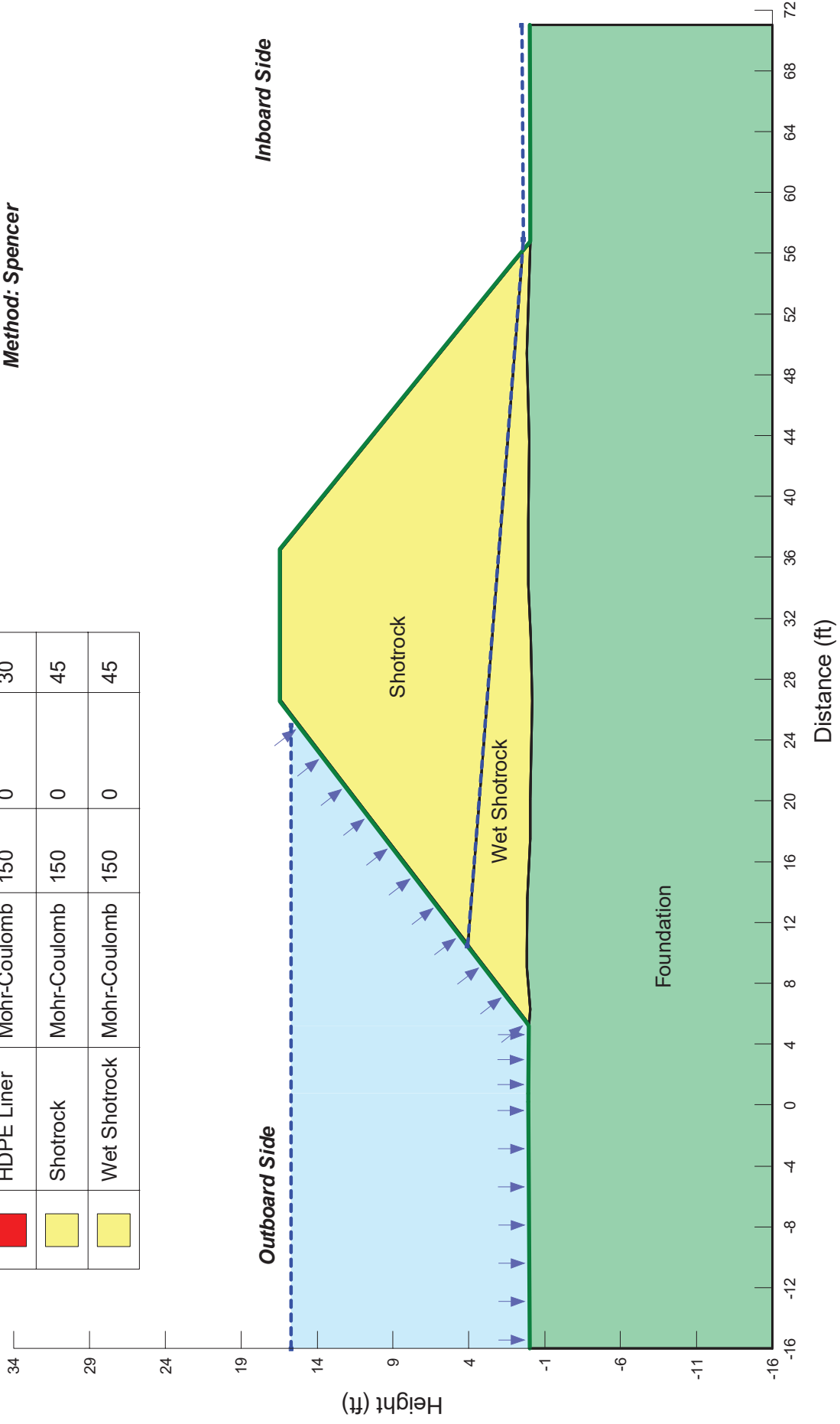






Figure A2: Typical Section (Unreinforced); Outboard Slope Failure Result

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Foundation	Bedrock (Impenetrable)			
	HDPE Liner	Mohr-Coulomb	150	0	30
	Shotrock	Mohr-Coulomb	150	0	45
	Wet Shotrock	Mohr-Coulomb	150	0	45

Max Cofferdam Section 2-14-2020 unreinforced.gsz
 Date: 04/03/2020
 Kind: SLOPE/W
 Method: Spencer

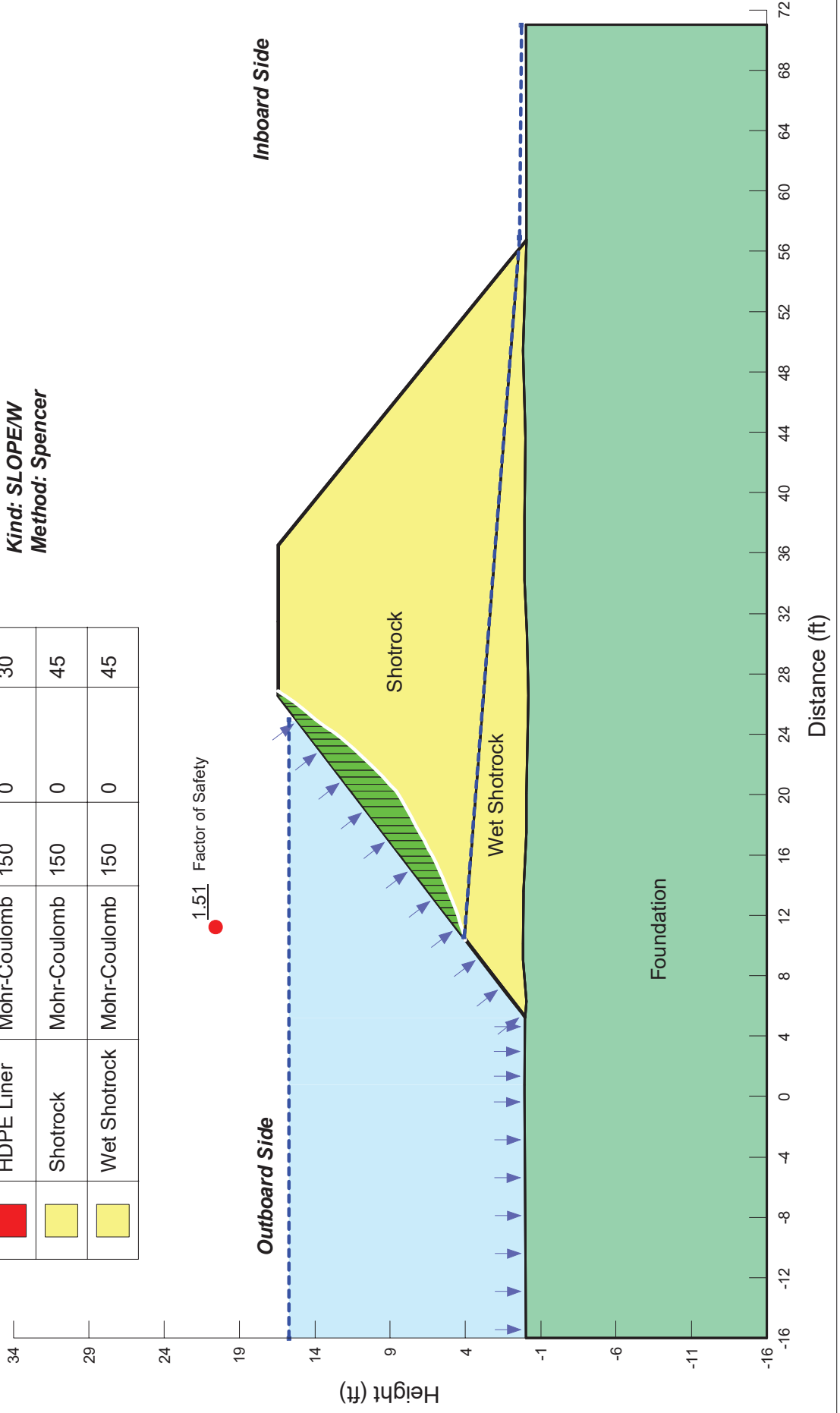






Figure A3: Typical Section (Unreinforced); Inboard Slope Failure Result

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Foundation	Bedrock (Impenetrable)			
	HDPE Liner	Mohr-Coulomb	150	0	30
	Shotrock	Mohr-Coulomb	150	0	45
	Wet Shotrock	Mohr-Coulomb	150	0	45

Max Cofferdam Section 2-14-2020 unreinforced.gsz
 Date: 04/03/2020
 Kind: SLOPE/W
 Method: Spencer

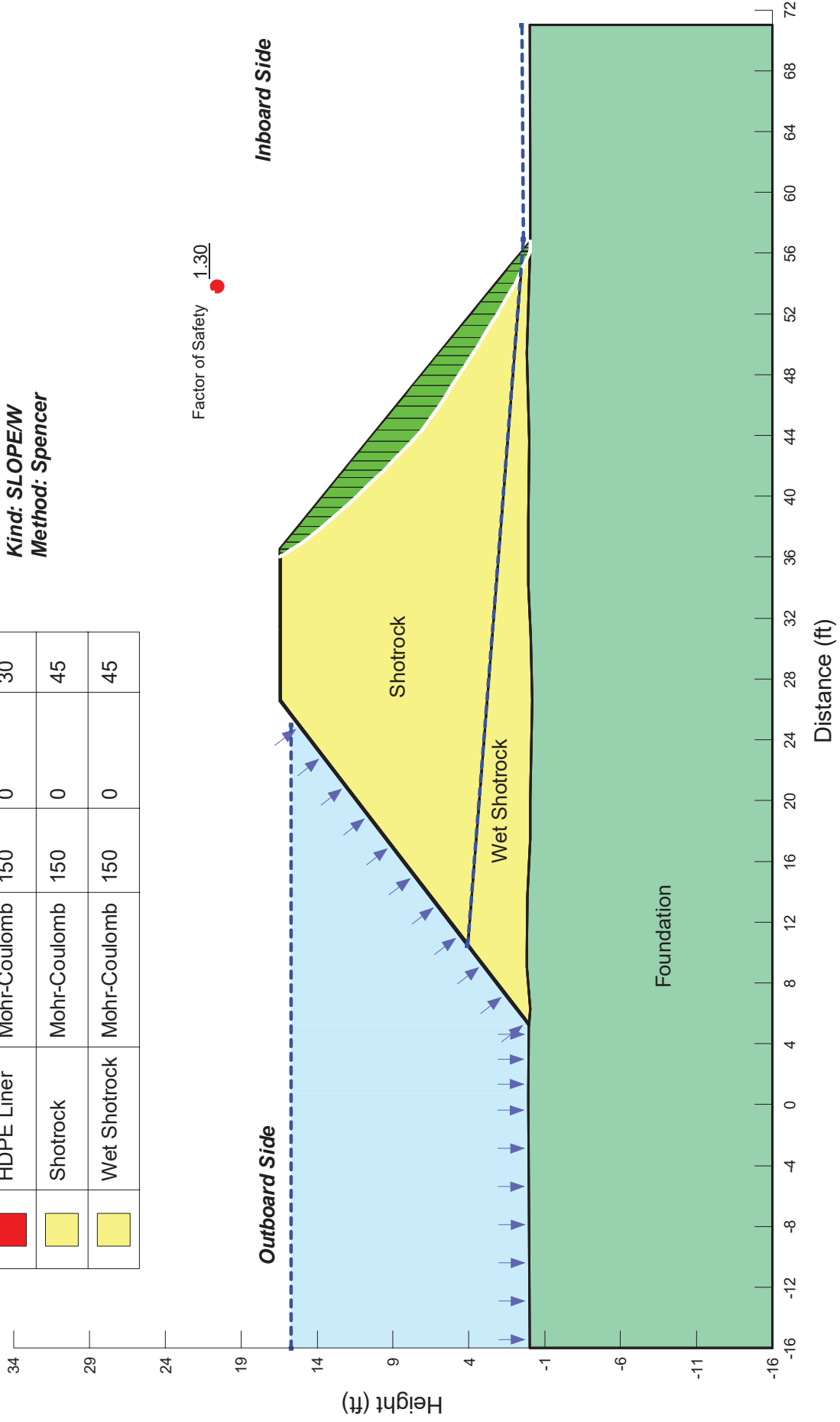
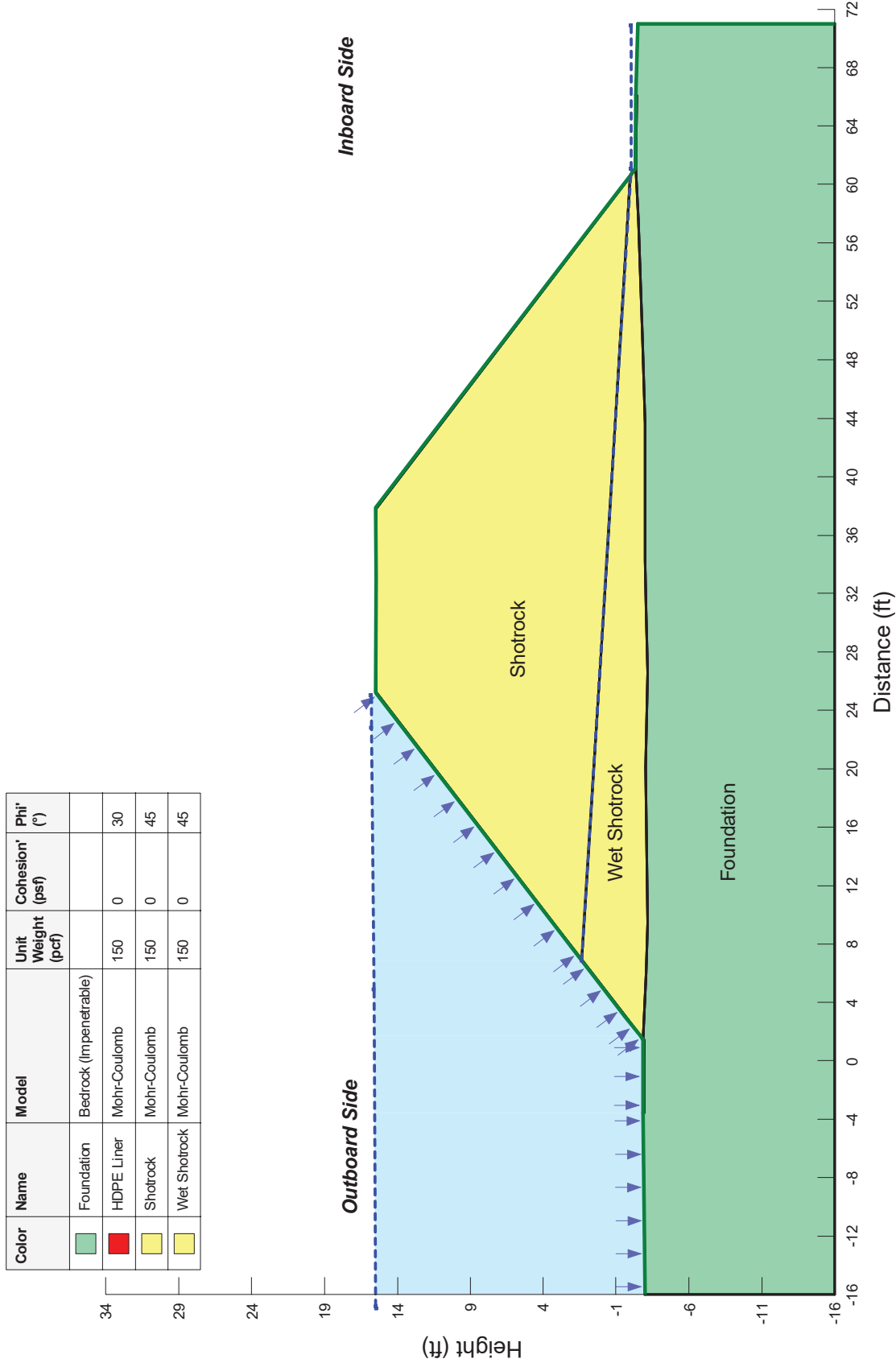
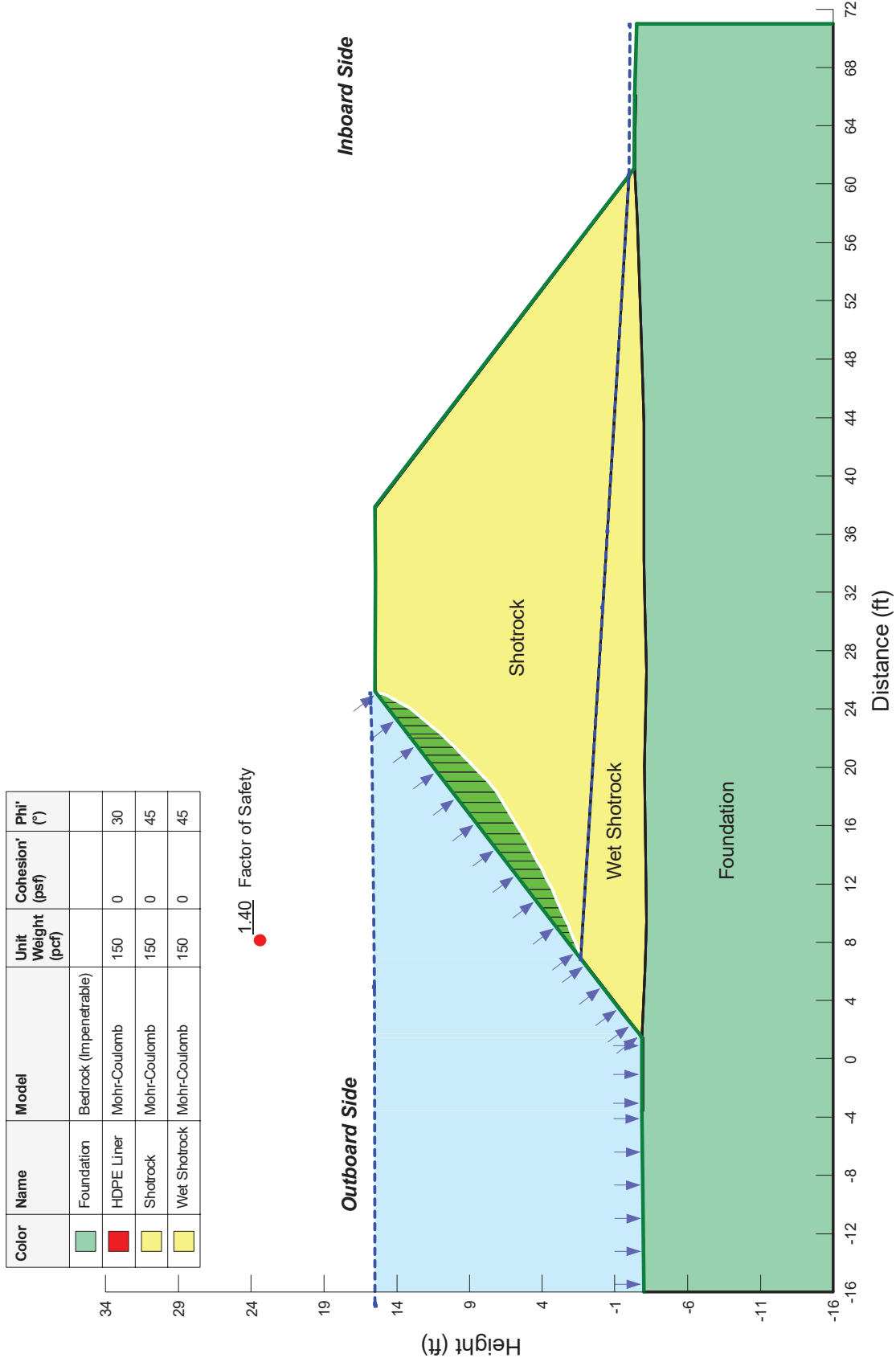


Figure A4: Overflow Section (Unreinforced); Model Configuration



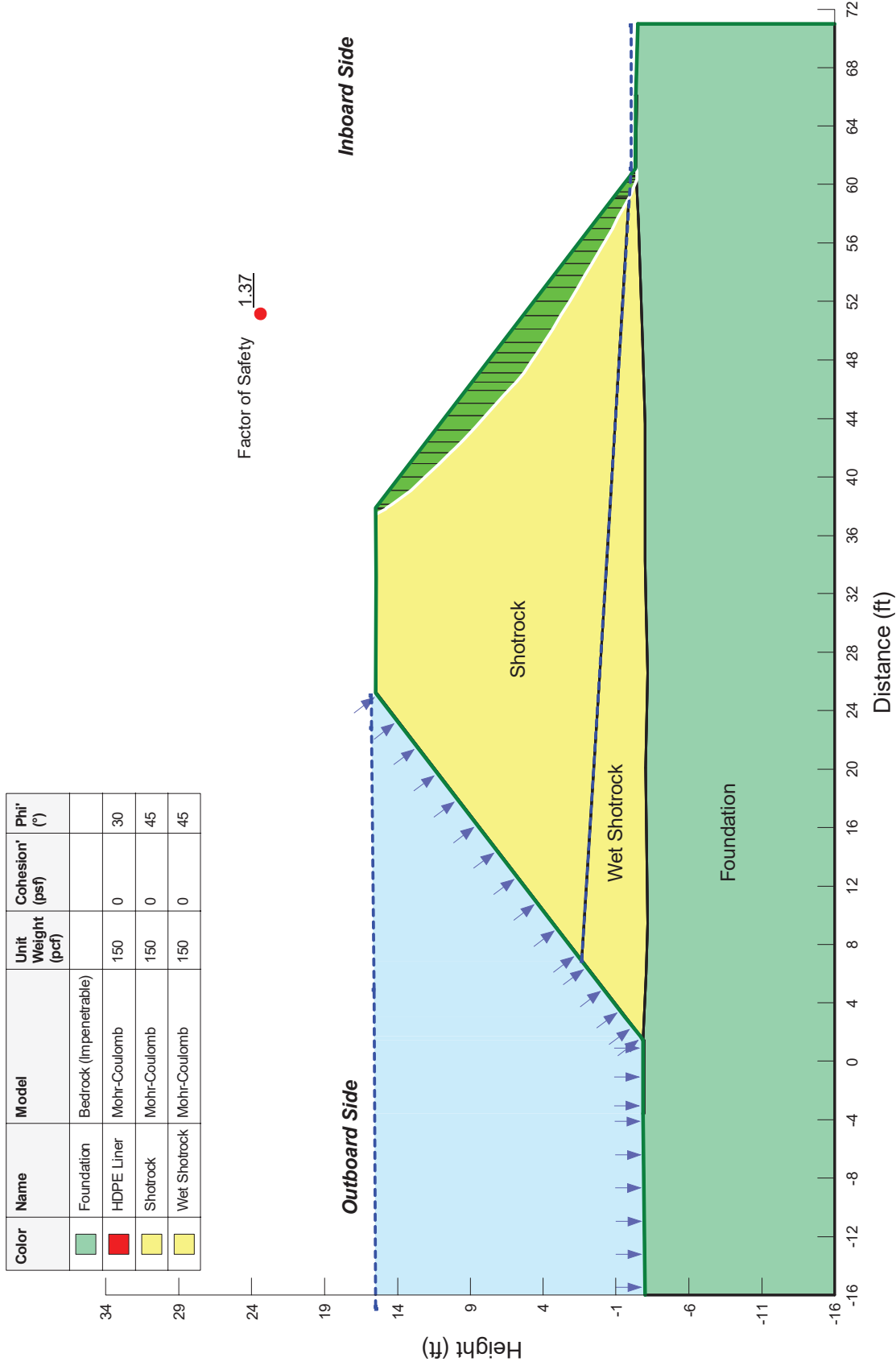
Max Overflow Section 2-14-2020 unreinforced.gsz
 Date: 04/03/2020
 Kind: SLOPE/W
 Method: Spencer

Figure A5: Overflow Section (Unreinforced); Outboard Slope Failure Result



Max Overflow Section 2-14-2020 unreinforced.gsz
 Date: 04/03/2020
 Kind: SLOPE/W
 Method: Spencer

Figure A6: Overflow Section (Unreinforced); Inboard Slope Failure Result



Max Overflow Section 2-14-2020 unreinforced.gsz
 Date: 04/03/2020
 Kind: SLOPE/W
 Method: Spencer

Figure A7: Typical Section (Reinforced); Model Configuration

Max Cofferdam Section 2-14-2020.gsz
 Date: 02/21/2020
 Kind: SLOPE/W
 Method: Spencer

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi (°)
Grey	ACB	Mohr-Coulomb	114	5,000	0
Green	Foundation	Bedrock (Impenetrable)			
Red	HDPE Liner	Mohr-Coulomb	150	0	30
Yellow	Shotrock	Mohr-Coulomb	150	0	45
Light Yellow	Wet Shotrock	Mohr-Coulomb	150	0	45

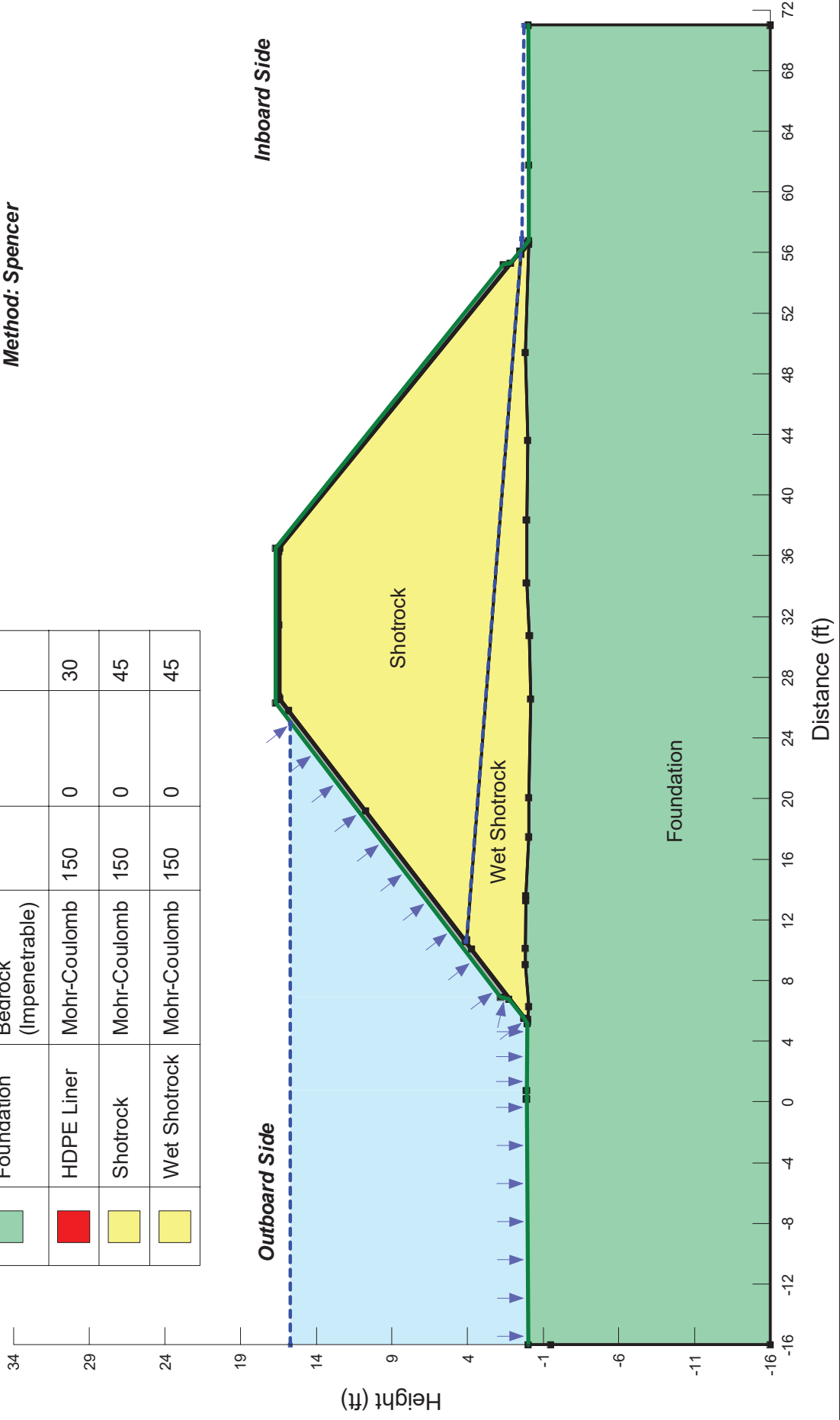







Figure A8: Typical Section (Reinforced); Outboard Slope Failure Result

Max Cofferdam Section 2-14-2020.gsz
 Date: 02/21/2020
 Kind: SLOPE/W
 Method: Spencer

Color	Name	Model	Unit Weight (pcf)	Cohesion (psf)	Phi (°)
	ACB	Mohr-Coulomb	114	5,000	0
	Foundation	Bedrock (Impenetrable)			
	HDPE Liner	Mohr-Coulomb	150	0	30
	Shotrock	Mohr-Coulomb	150	0	45
	Wet Shotrock	Mohr-Coulomb	150	0	45

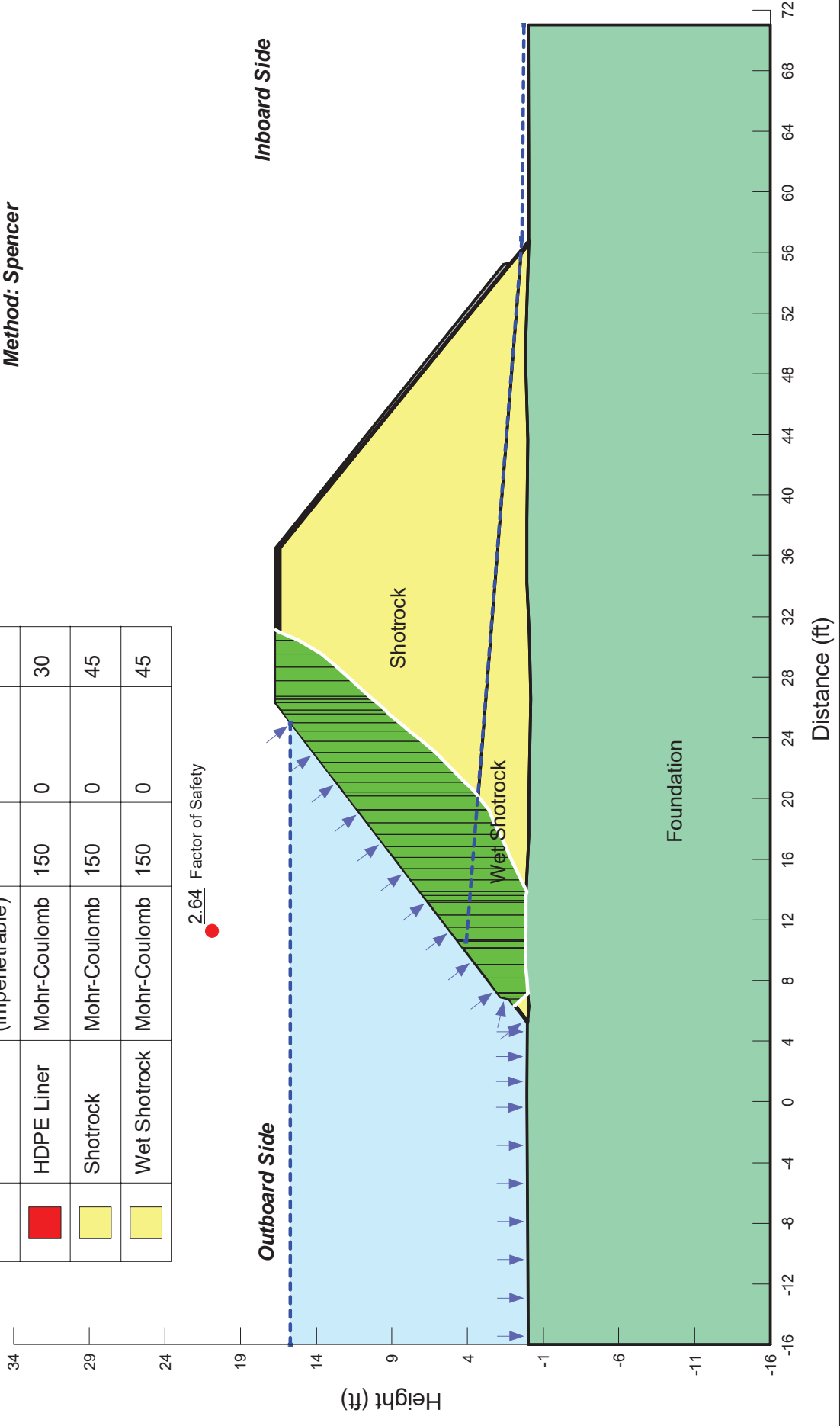


Figure A9: Typical Section (Reinforced); Inboard Slope Failure Result

Max Cofferdam Section 2-14-2020.gsz
 Date: 02/21/2020
 Kind: SLOPE/W
 Method: Spencer

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Grey	ACB	Mohr-Coulomb	114	5,000	0
Green	Foundation	Bedrock (Impenetrable)			
Red	HDPE Liner	Mohr-Coulomb	150	0	30
Yellow	Shotrock	Mohr-Coulomb	150	0	45
Light Yellow	Wet Shotrock	Mohr-Coulomb	150	0	45

Factor of Safety $\frac{1.64}{\bullet}$

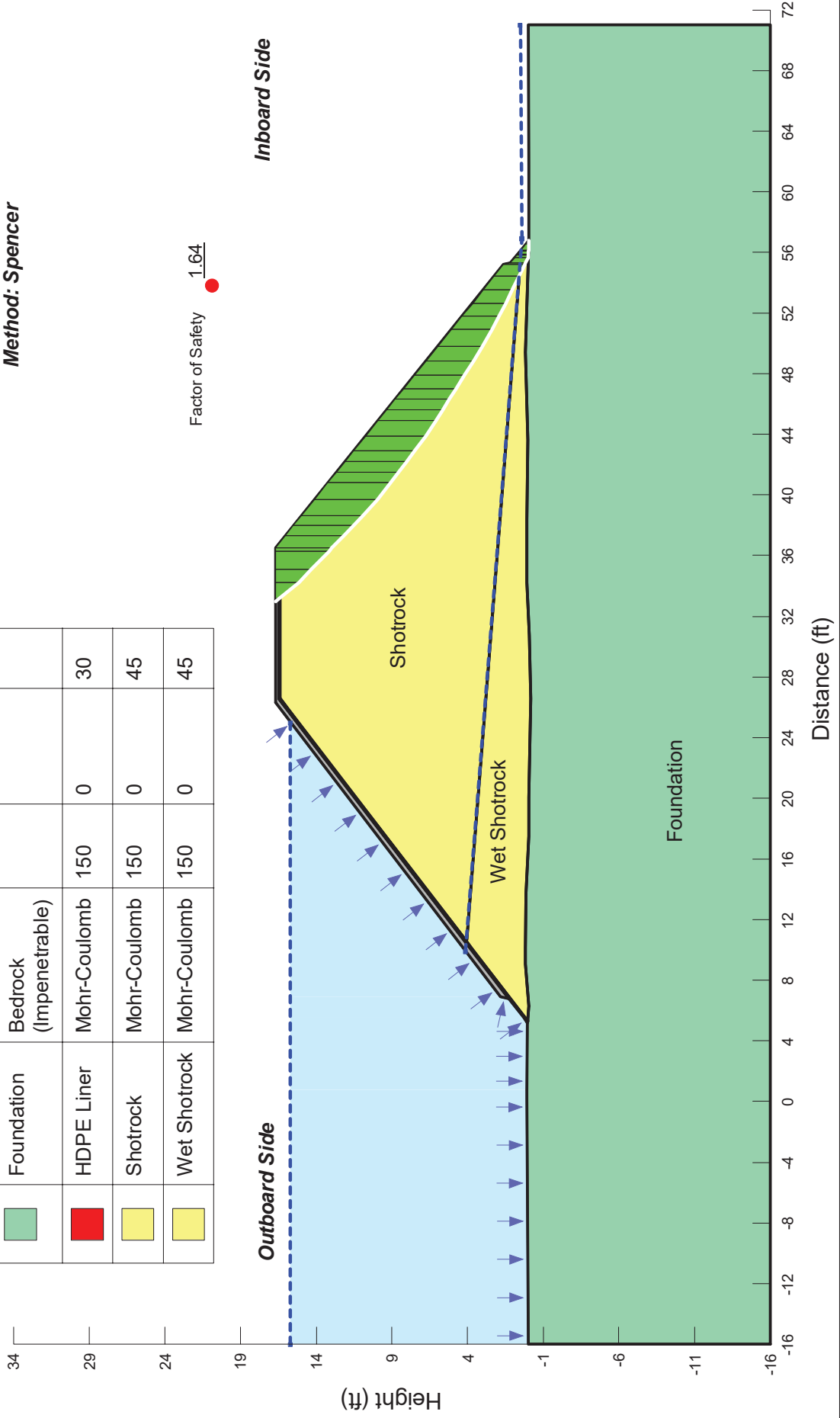
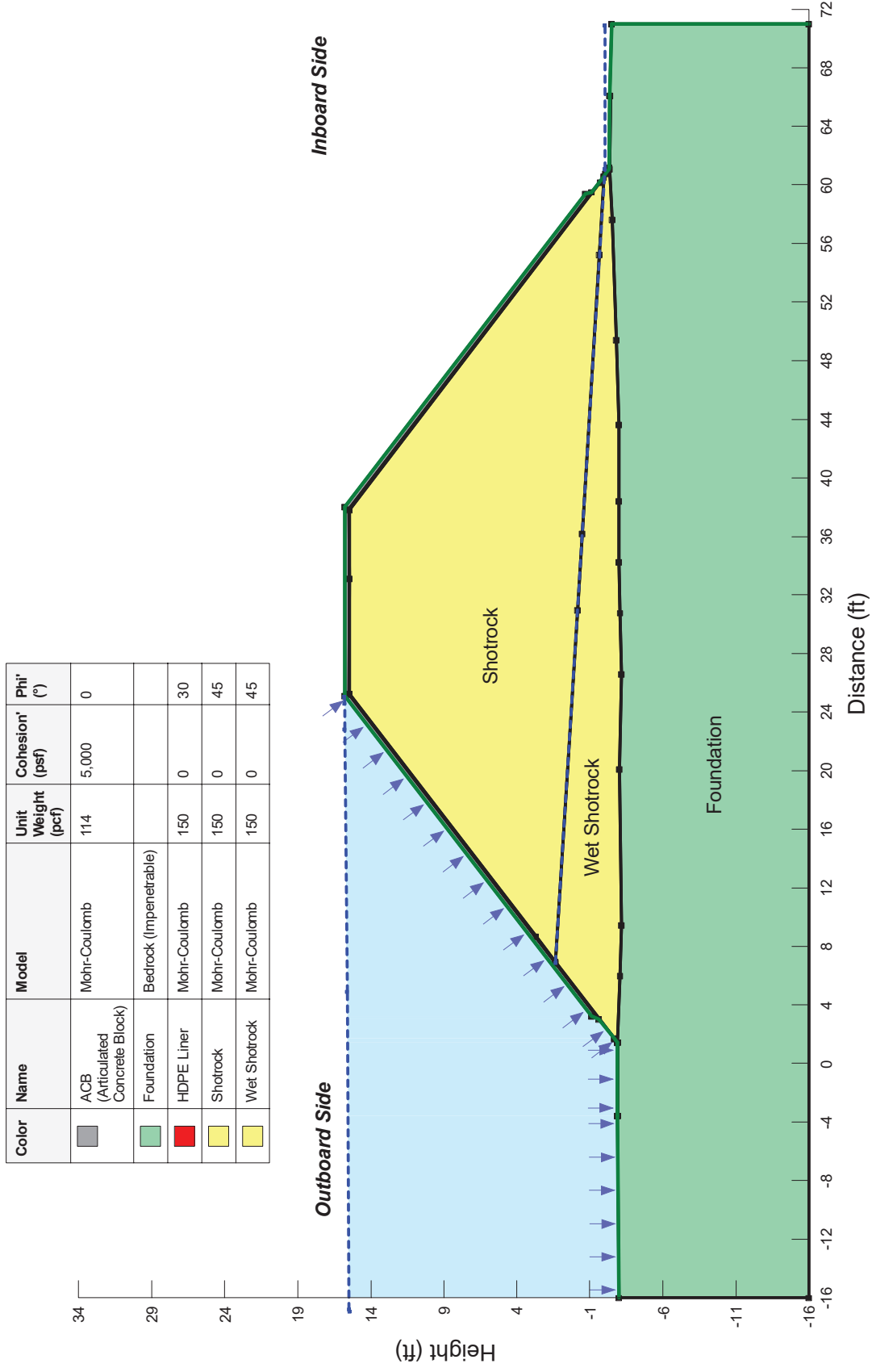
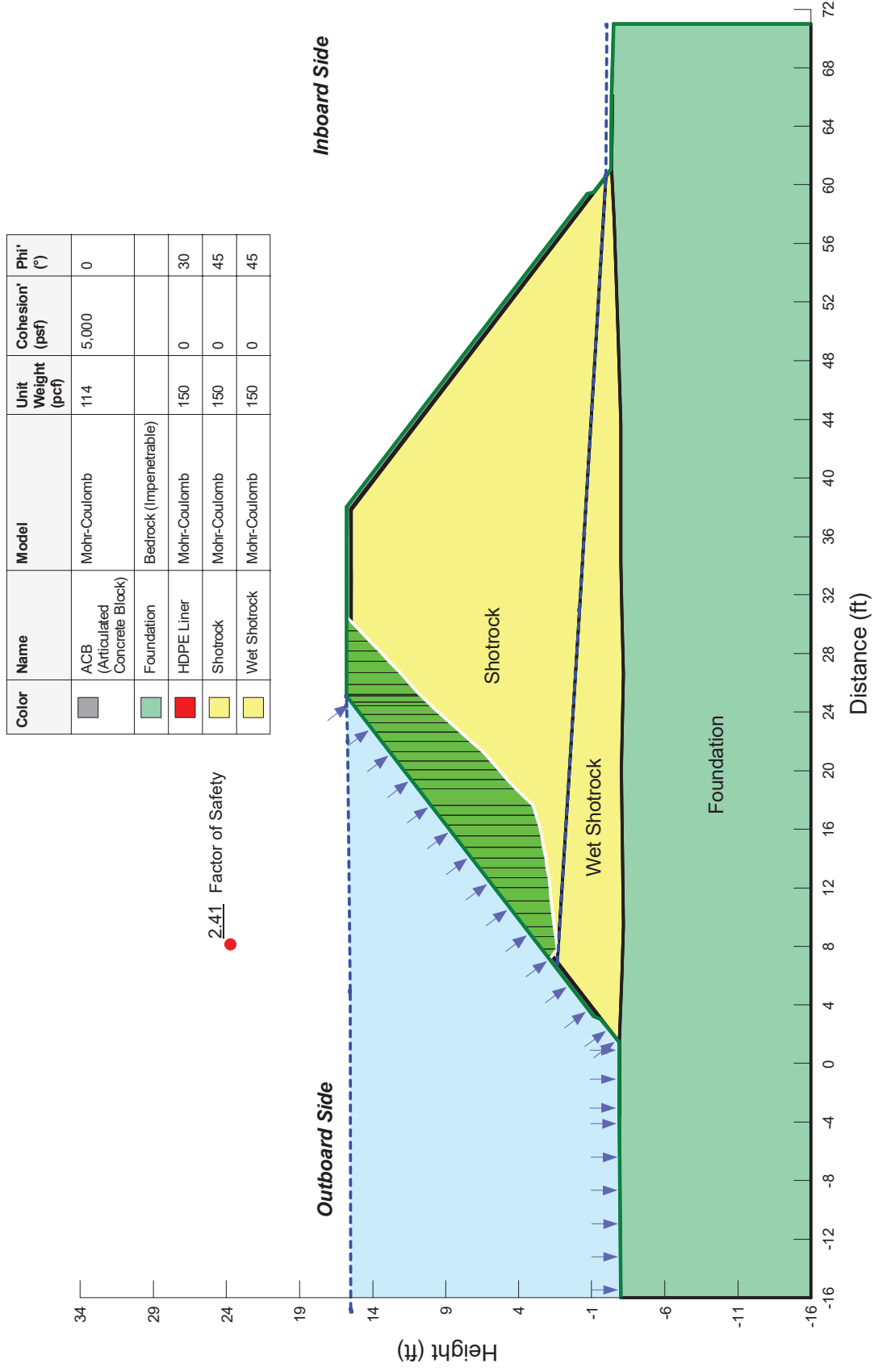


Figure A10: Overflow Section (Reinforced); Model Configuration



Max Overflow Section 2-14-2020.gsz
 Date: 02/21/2020
 Kind: SLOPE/W
 Method: Spencer
 Scale: 1:127.18208

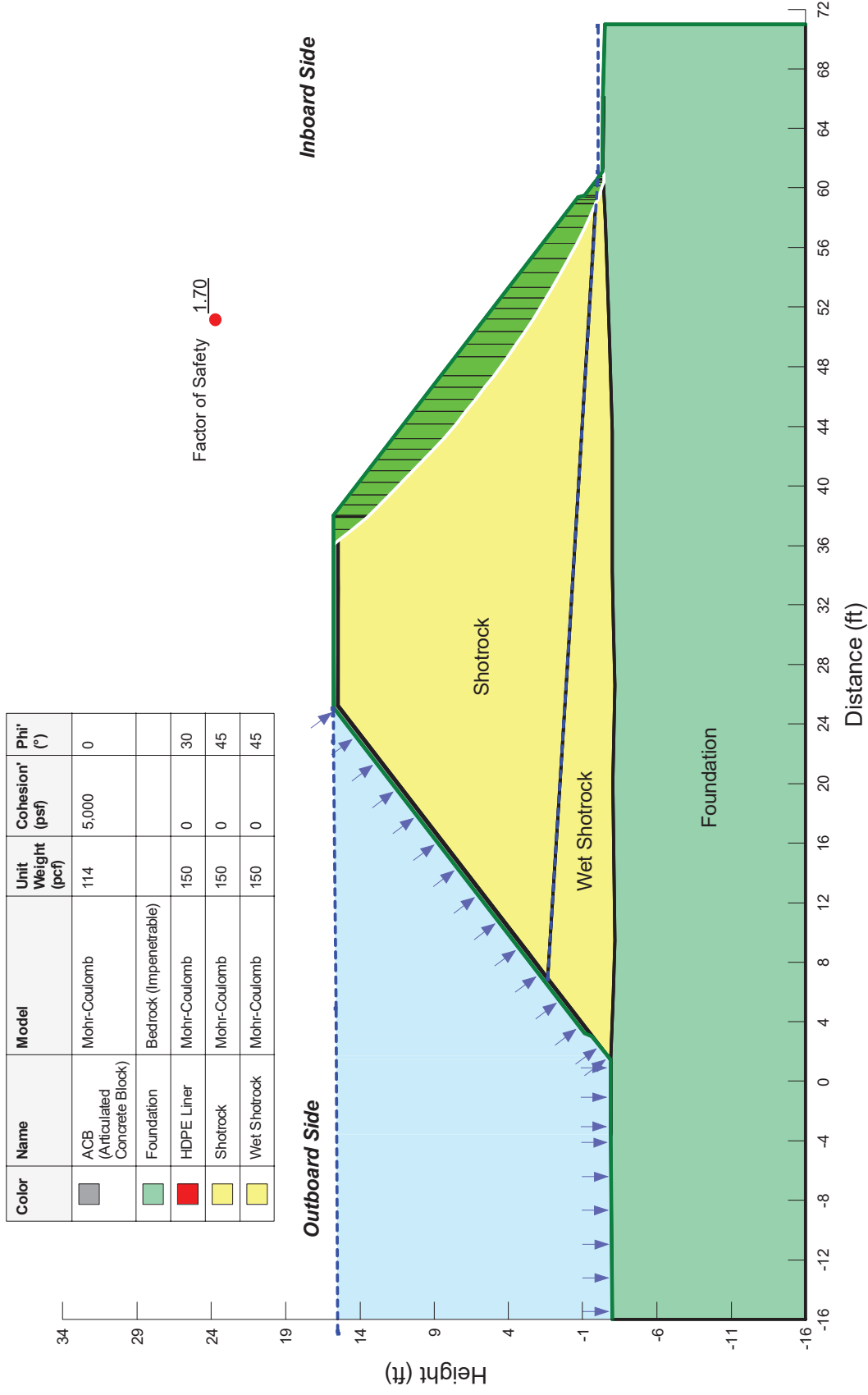
Figure A11: Overflow Section (Reinforced); Outboard Slope Failure Result



Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Grey	ACB (Articulated Concrete Block)	Mohr-Coulomb	114	5,000	0
Green	Foundation	Bedrock (Impenetrable)			
Red	HDPE Liner	Mohr-Coulomb	150	0	30
Yellow	Shotrock	Mohr-Coulomb	150	0	45
Light Yellow	Wet Shotrock	Mohr-Coulomb	150	0	45

Max Overflow Section 2-14-2020.gsz
Date: 02/21/2020
Kind: SLOPE/W
Method: Spencer
 Scale: 1:127.18208

Figure A12: Overflow Section (Reinforced); Inboard Slope Failure Result



Max Overflow Section 2-14-2020.gsz






Date: 02/21/2020

Kind: SLOPE/W

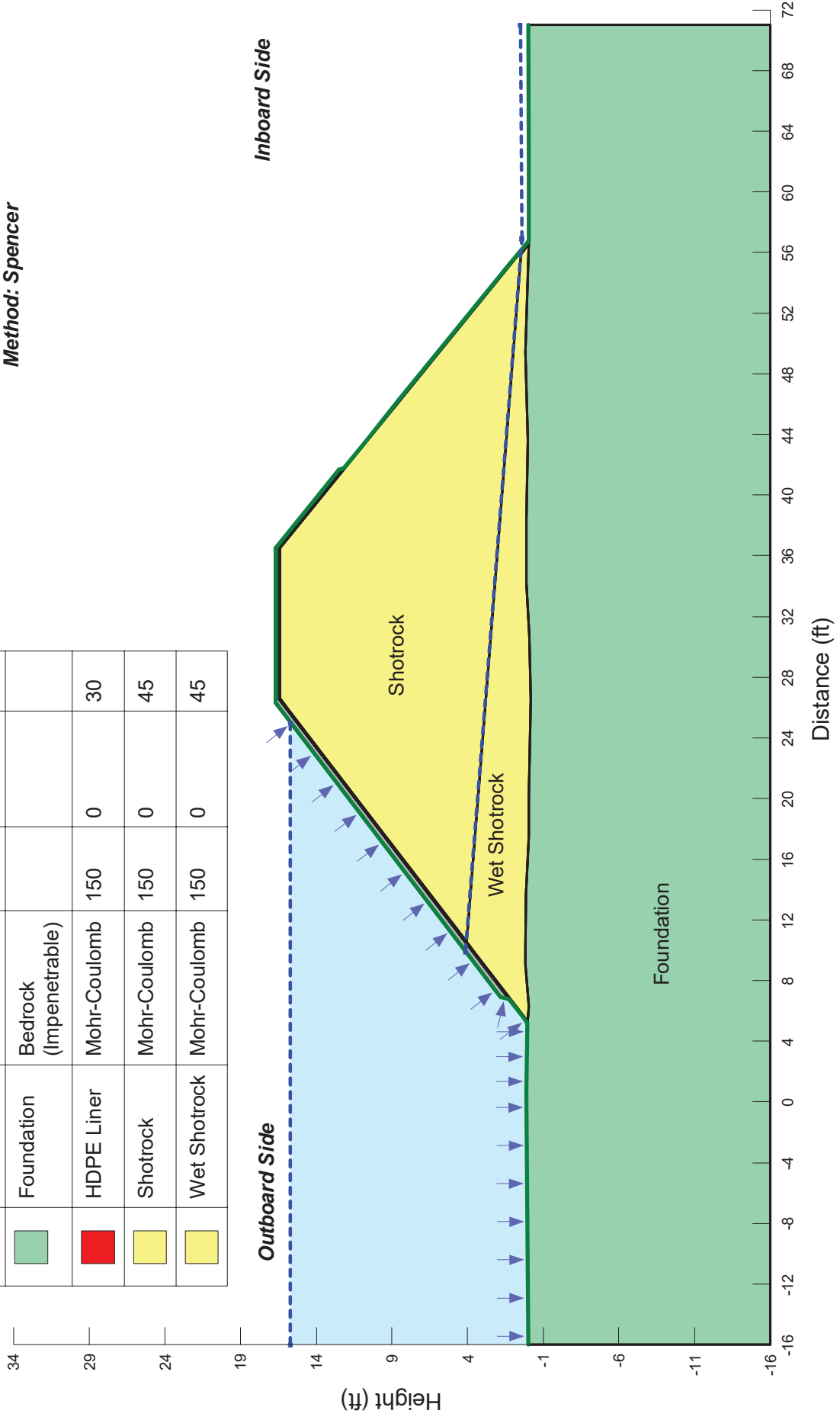
Method: Spencer

Scale: 1:127.18208

Figure A13: Typical Section (Limited Inboard Reinforcement Coverage); Model Configuration

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	ACB	Mohr-Coulomb	114	5,000	0
	Foundation	Bedrock (Impenetrable)			
	HDPE Liner	Mohr-Coulomb	150	0	30
	Shotrock	Mohr-Coulomb	150	0	45
	Wet Shotrock	Mohr-Coulomb	150	0	45

Max Cofferdam Section H4 3-24-2020.gsz
 Date: 04/03/2020
 Kind: SLOPE/W
 Method: Spencer



**Figure A14: Typical Section (Limited Inboard Reinforcement Coverage);
Inboard Slope Failure Result**

Max Cofferdam Section H4 3-24-2020.gsz
 Date: 03/24/2020
 Kind: SLOPE/W
 Method: Spencer

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Grey	ACB	Mohr-Coulomb	114	5,000	0
Green	Foundation	Bedrock (Impenetrable)			
Red	HDPE Liner	Mohr-Coulomb	150	0	30
Yellow	Shotrock	Mohr-Coulomb	150	0	45
Light Yellow	Wet Shotrock	Mohr-Coulomb	150	0	45

Factor of Safety $\frac{1.64}{\bullet}$

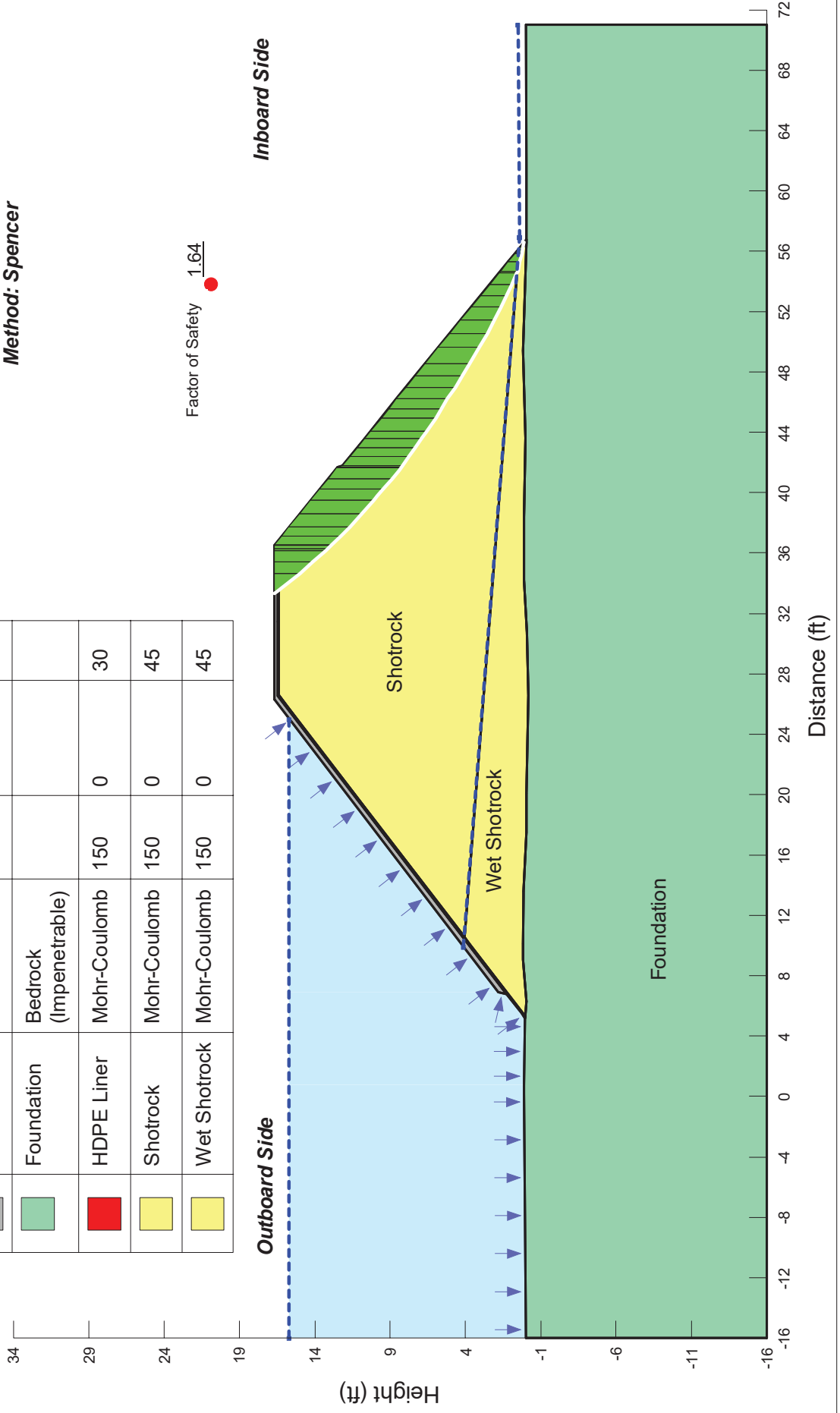
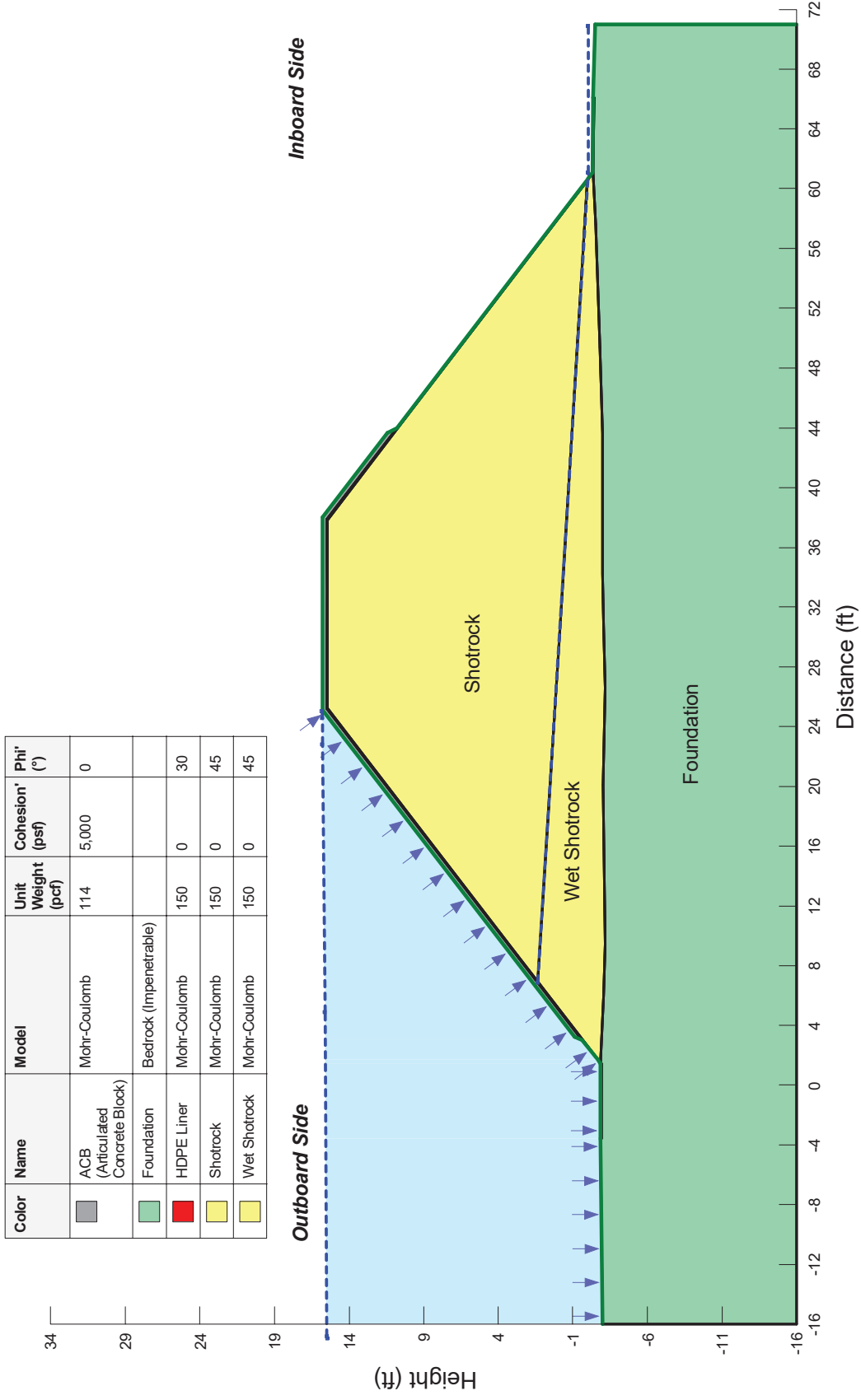
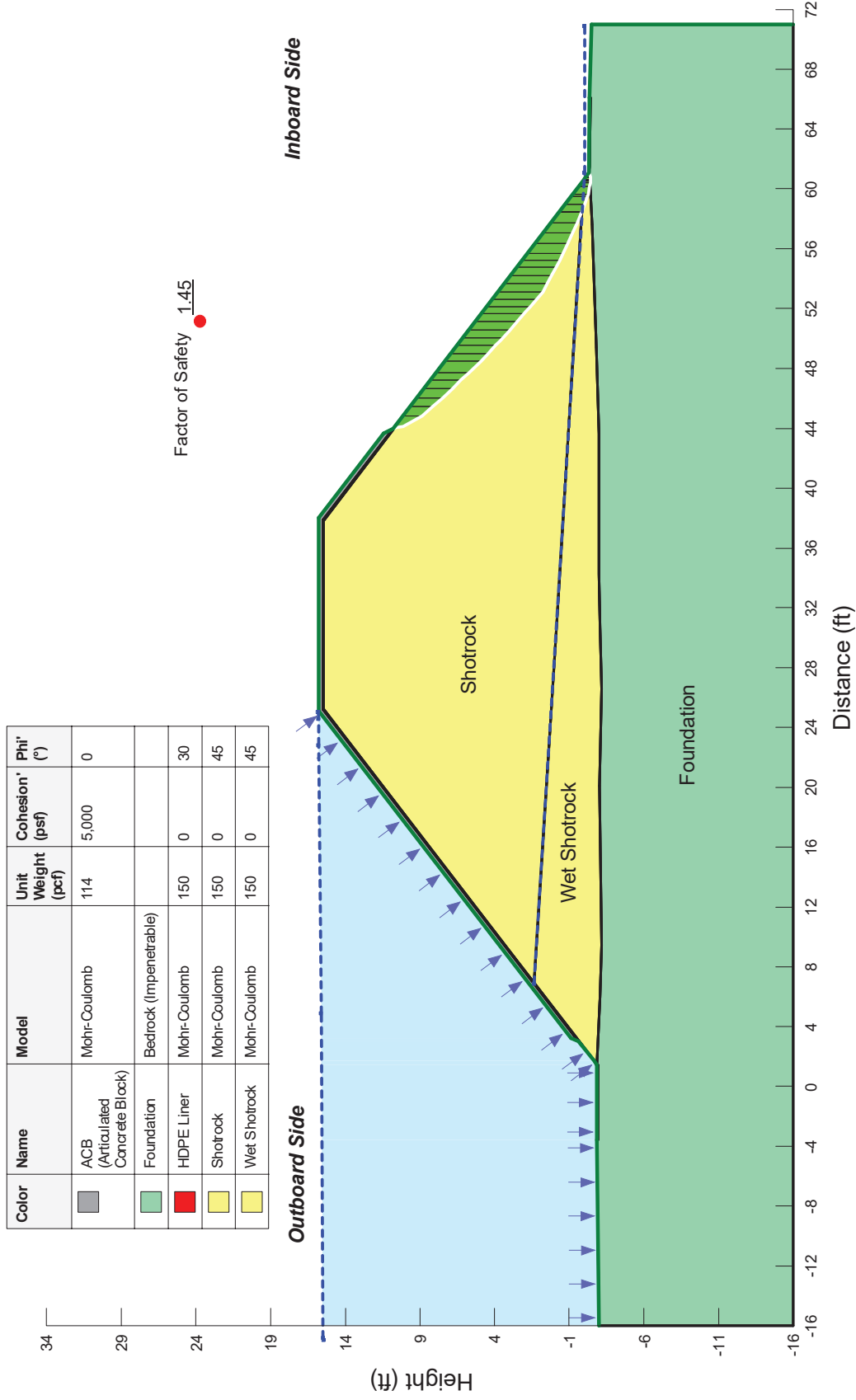


Figure A15: Overflow Section (Limited Inboard Reinforcement Coverage); Model Configuration



Max Overflow Section H4 3-24-2020.gsz
 Date: 04/03/2020
 Kind: SLOPE/W
 Method: Spencer

**Figure A16: Overflow Section (Limited Inboard Reinforcement Coverage);
Inboard Slope Failure Result**

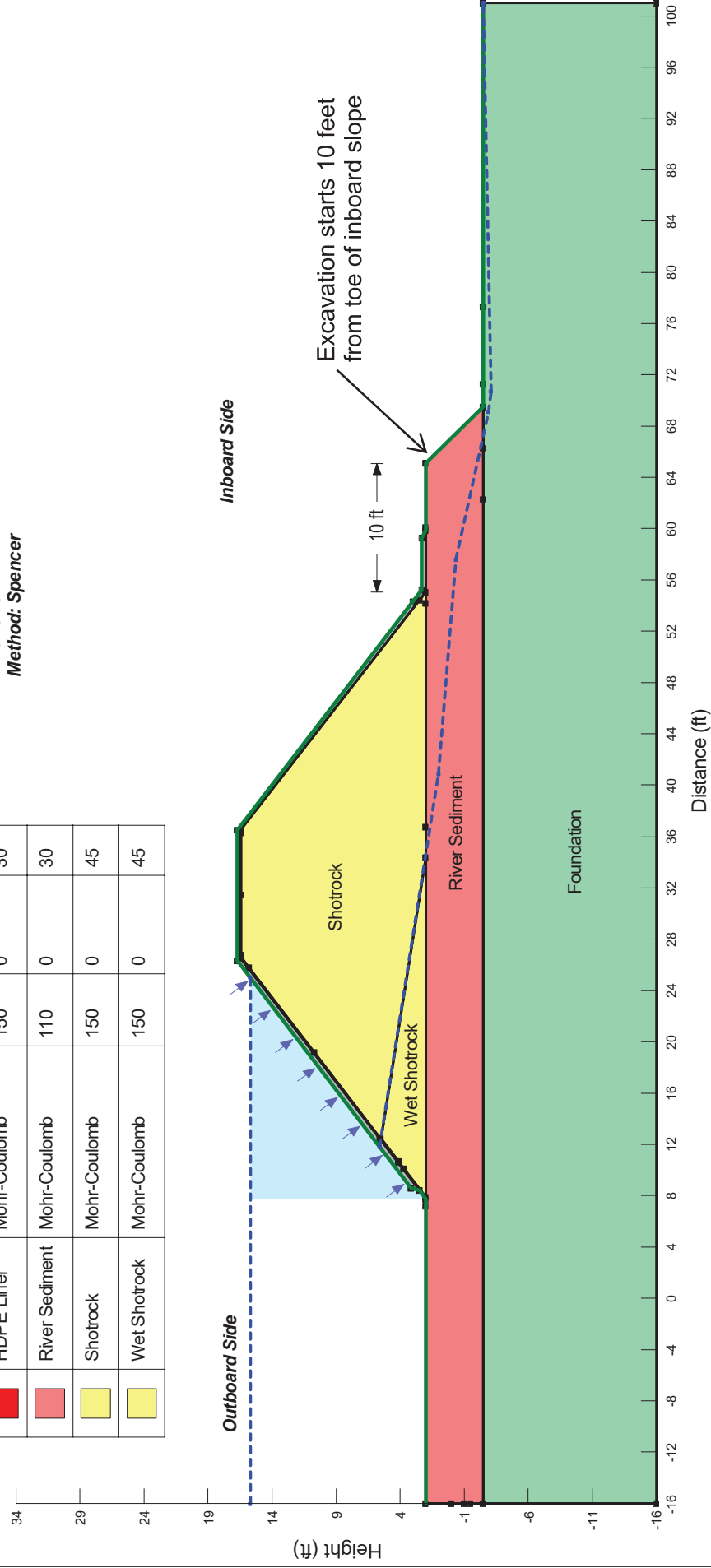


Max Overflow Section H4 3-24-2020.gsz
Date: 04/03/2020
Kind: SLOPE/W
Method: Spencer

**Figure A17: Typical Section (Full ACB Coverage);
Model Configuration [excavation starts 10 feet from toe of inboard slope]**

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Grey	ACB	Mohr-Coulomb	114	5,000	0
Green	Foundation	Bedrock (Impenetrable)			
Red	HDPE Liner	Mohr-Coulomb	150	0	30
Light Red	River Sediment	Mohr-Coulomb	110	0	30
Yellow	Shotrock	Mohr-Coulomb	150	0	45
Light Yellow	Wet Shotrock	Mohr-Coulomb	150	0	45

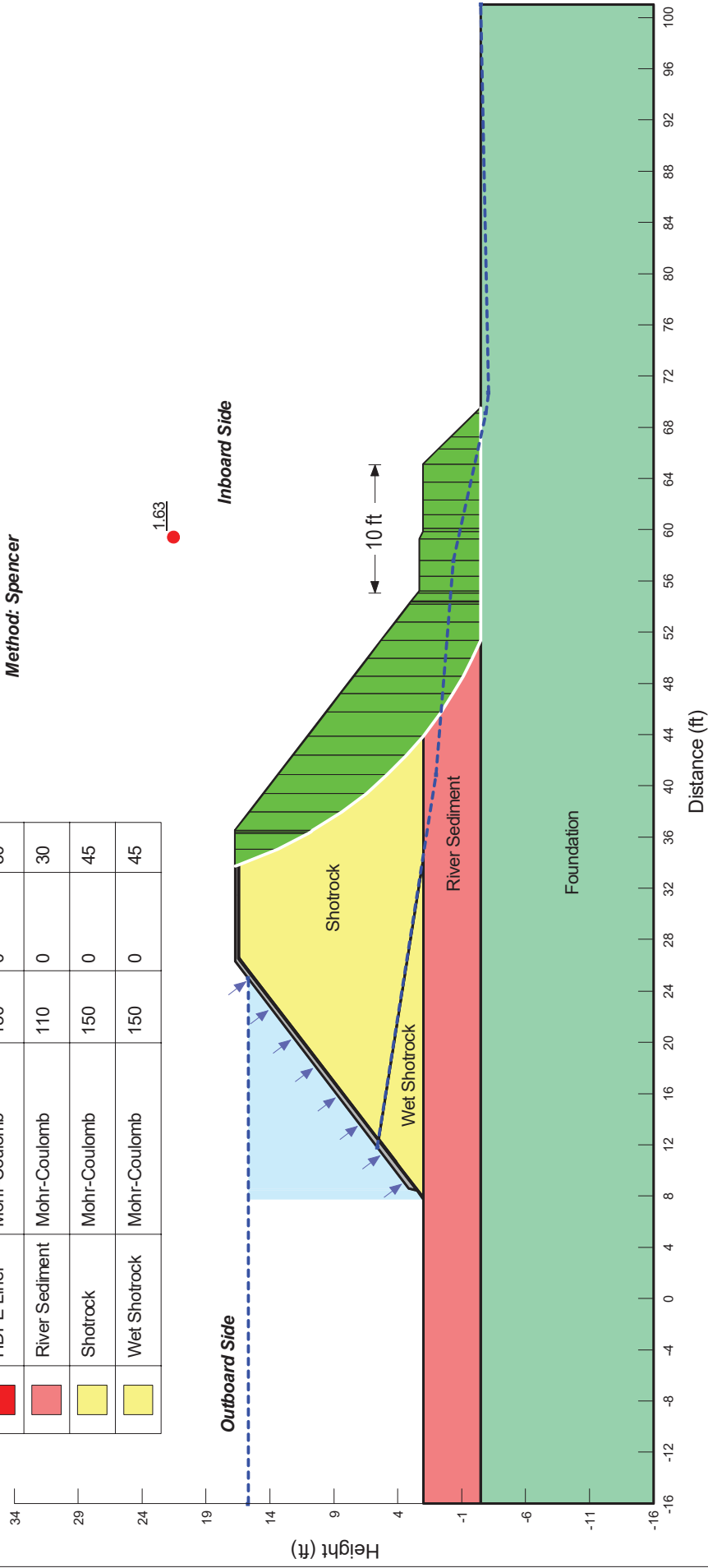
Max Cofferdam Section 4.5ft sediment full 6-1-2020.gsz
Date: 06/09/2020
Kind: SLOPE/W
Method: Spencer



**Figure A18: Typical Section (Full ACB Coverage);
Inboard Slope Failure Result [excavation starts 10 feet from toe of inboard slope]**

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Grey	ACB	Mohr-Coulomb	114	5,000	0
Green	Foundation	Bedrock (Impenetrable)			
Red	HDPE Liner	Mohr-Coulomb	150	0	30
Light Red	River Sediment	Mohr-Coulomb	110	0	30
Yellow	Shotrock	Mohr-Coulomb	150	0	45
Light Yellow	Wet Shotrock	Mohr-Coulomb	150	0	45

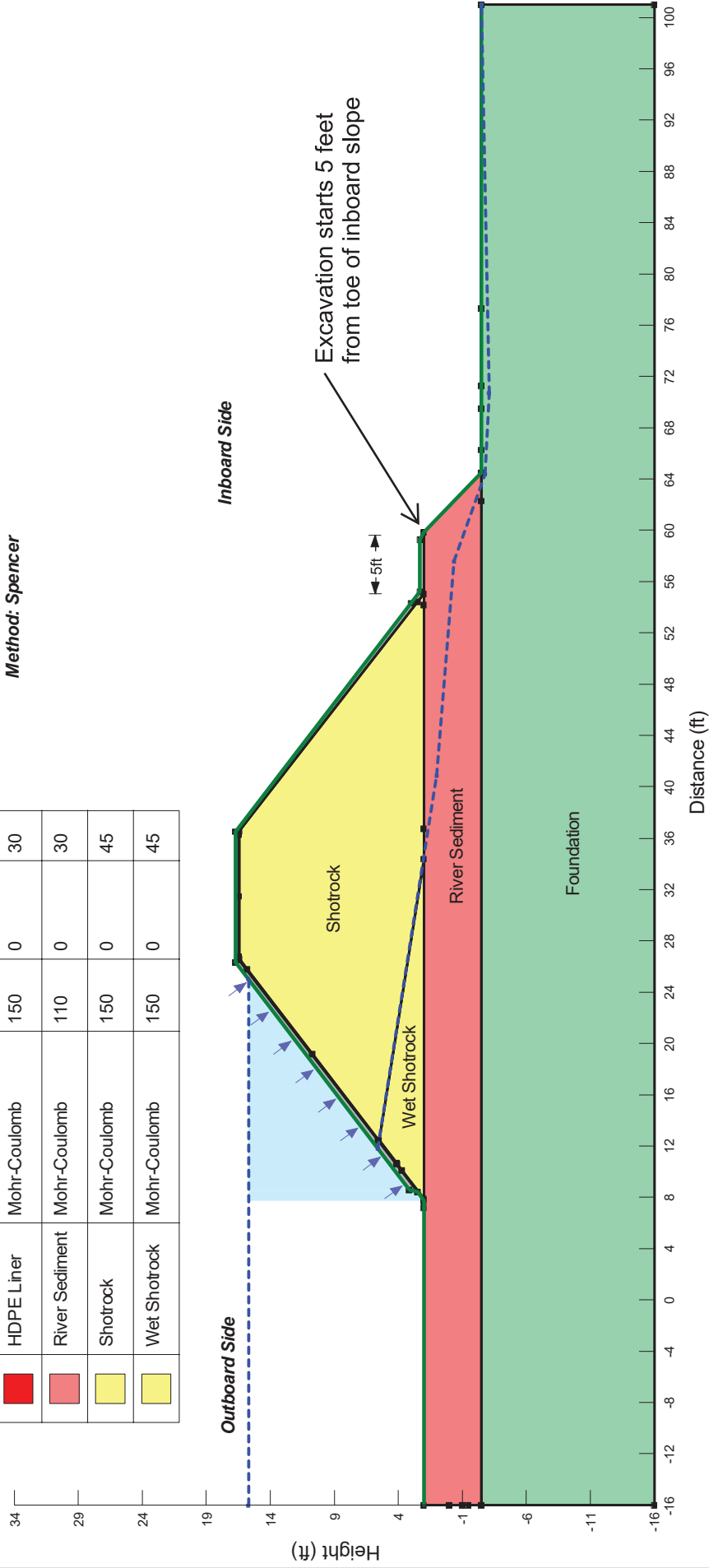
Max Cofferdam Section 4.5ft sediment full 6-1-2020.gsz
Date: 06/09/2020
Kind: SLOPE/W
Method: Spencer



**Figure A19: Typical Section (Full ACB Coverage);
Model Configuration [excavation starts 5 feet from toe of inboard slope]**

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Grey	ACB	Mohr-Coulomb	114	5,000	0
Green	Foundation	Bedrock (Impenetrable)			
Red	HDPE Liner	Mohr-Coulomb	150	0	30
Light Red	River Sediment	Mohr-Coulomb	110	0	30
Yellow	Shotrock	Mohr-Coulomb	150	0	45
Light Yellow	Wet Shotrock	Mohr-Coulomb	150	0	45

Max Cofferdam Section 4.5ft sediment full pre-shotrock.kgsz
Date: 06/09/2020
Kind: SLOPE/W
Method: Spencer



**Figure A20: Typical Section (Full ACB Coverage);
Inboard Slope Failure Result [excavation starts 5 feet from toe of inboard slope]**

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Grey	ACB	Mohr-Coulomb	114	5,000	0
Green	Foundation	Bedrock (Impenetrable)			
Red	HDPE Liner	Mohr-Coulomb	150	0	30
Light Red	River Sediment	Mohr-Coulomb	110	0	30
Yellow	Shotrock	Mohr-Coulomb	150	0	45
Light Yellow	Wet Shotrock	Mohr-Coulomb	150	0	45

Max Cofferdam Section 4.5ft sediment full pre-shotrock.kgsz
Date: 06/09/2020
Kind: SLOPE/W
Method: Spencer

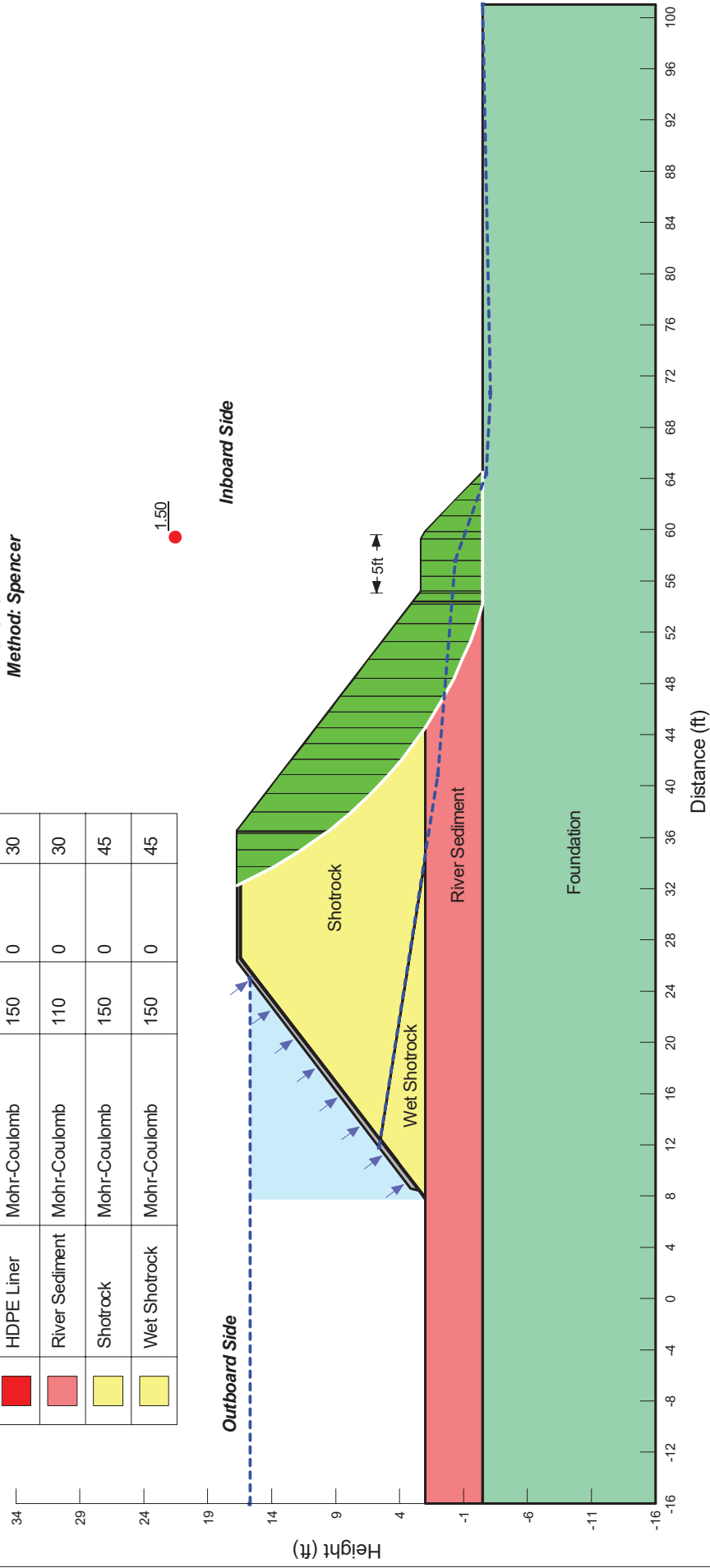


Figure A21: Typical Section (Full ACB Coverage); Model Configuration [excavation starts 5 feet from toe of inboard slope, material is replaced with shot rock]

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Grey	ACB	Mohr-Coulomb	114	5,000	0
Green	Foundation	Bedrock (Impenetrable)			
Red	HDPE Liner	Mohr-Coulomb	150	0	30
Light Red	River Sediment	Mohr-Coulomb	110	0	30
Yellow	Shotrock	Mohr-Coulomb	150	0	45
Light Yellow	Wet Shotrock	Mohr-Coulomb	150	0	45

Max Cofferdam Section 4.5ft sediment full shotrock 6-1-2020.gsz
 Date: 06/09/2020
 Kind: SLOPE/W
 Method: Spencer

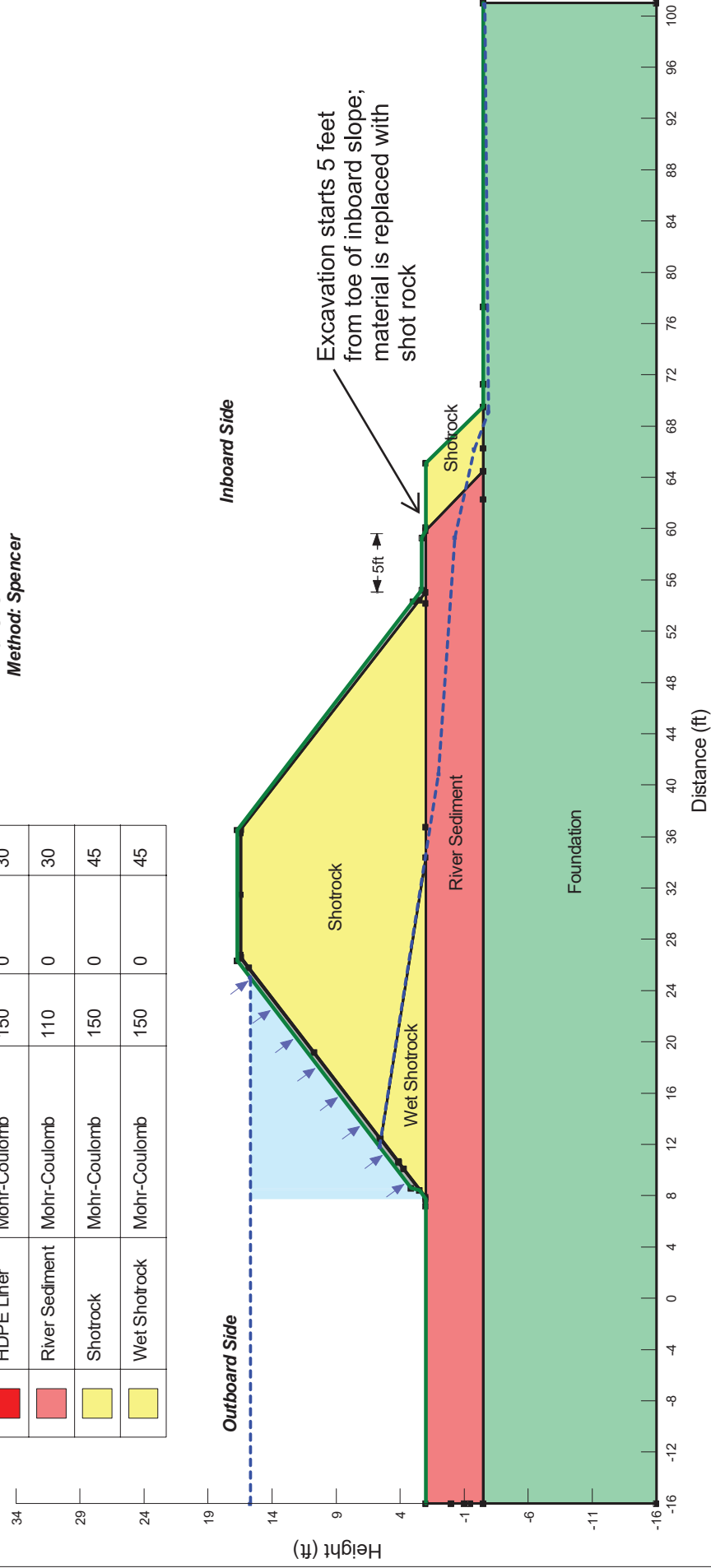
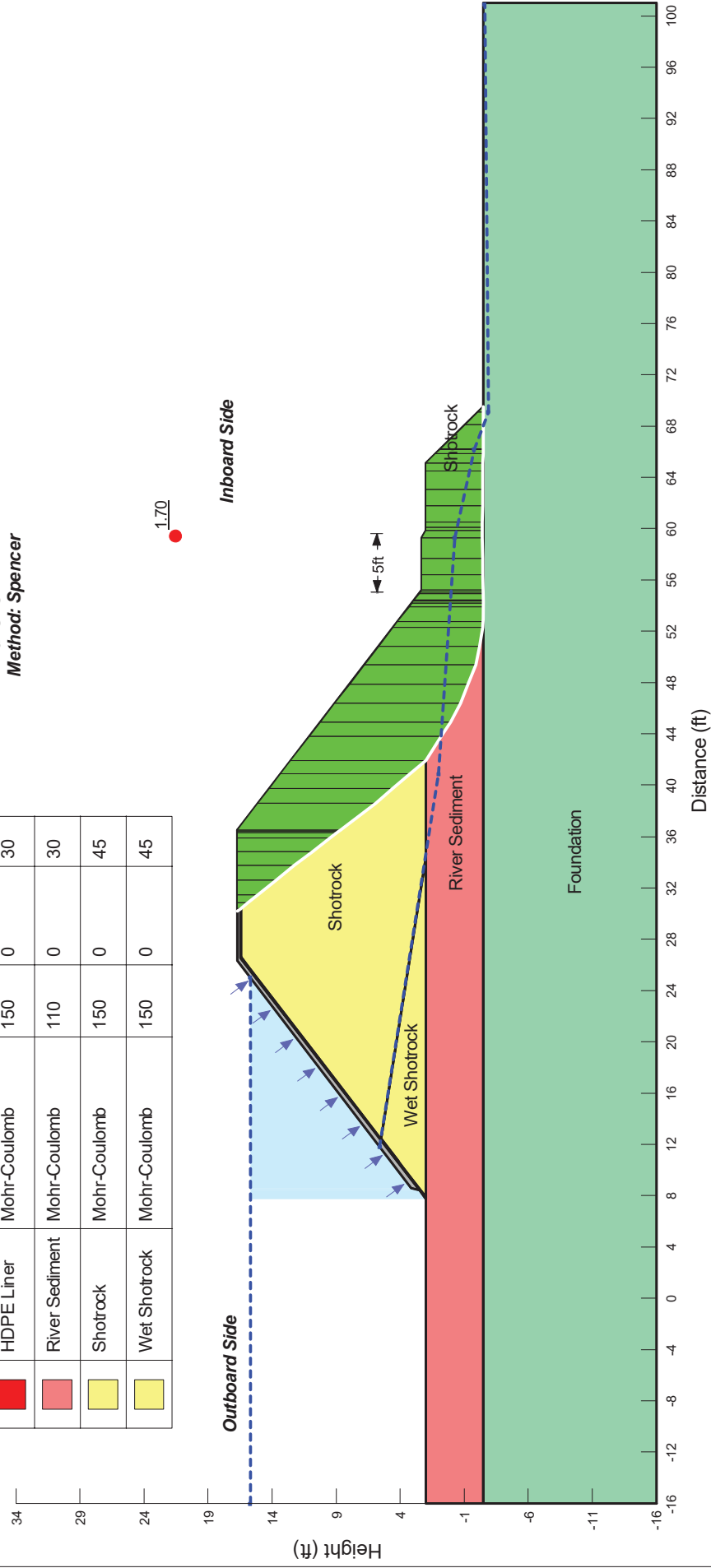


Figure A22: Typical Section (Full ACB Coverage); Inboard Slope Failure Result [excavation starts 5 feet from toe of inboard slope, material is replaced with shot rock]

Color	Name	Model	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
Grey	ACB	Mohr-Coulomb	114	5,000	0
Green	Foundation	Bedrock (Impenetrable)			
Red	HDPE Liner	Mohr-Coulomb	150	0	30
Light Red	River Sediment	Mohr-Coulomb	110	0	30
Yellow	Shotrock	Mohr-Coulomb	150	0	45
Light Yellow	Wet Shotrock	Mohr-Coulomb	150	0	45

Max Cofferdam Section 4.5ft sediment full shotrock 6-1-2020.gsz
 Date: 06/09/2020
 Kind: SLOPE/W
 Method: Spencer





Appendix B: Hand Calculations

Project Consuee River Rem.
 Subject ACR Properties

Computed by JPO
 Checked by ASB

Purpose

Estimate Unit Weight and shear strength for
 of ACR blocks for Slope Stability Analysis

Shear Strength

calculate shear capacity for plain concrete

$$V_n = \frac{4}{3} \times 2 \times \sqrt{f'_c} \text{ bw} \ell$$

$$V_u = \phi V_n, \quad \phi = 0.65$$

} ACI 318
 Chapter 22
 eqn. 22-8
 \(\phi = 0.65\) for \(\phi\)

Model shear strength of ACR blocks
 using an equivalent cohesion = $\frac{V_n}{\text{bw} \ell}$

$$C = \frac{4}{3} \times 2 \times \sqrt{f'_c} \times 0.65$$

Use $f'_c = 4000 \text{ psi}$, and a $FS = 3.0$
 respect shear capacity of steel cables

$$C = \frac{\frac{4}{3} \times 2 \times 0.65 \times \sqrt{4000}}{3.0} = 36.5 \text{ lb/in}^2$$

or 5260 lb/ft²

\(\therefore\) use $C = 5,000 \text{ psf}$

Project Congaree River Rem. Computed by JPO
 Subject Checked by ASB

Unit Weight

#45 Armor tex Mats weigh 45 lb/sf
 (see Richard Hill e-mail on page 3)

Armor tech details show a block height
 of 4.75 in. (0.396 ft)

$$\gamma = \frac{45 \text{ lb/ft}^2}{0.396 \text{ ft}} = \underline{\underline{114 \text{ lb/ft}^3}}$$

3/3

JPO 2/13/20

Osterle, John P.

From: Hill, Richard <RHill@conteches.com>
Sent: Thursday, February 13, 2020 12:04 PM
To: Osterle, John P.
Cc: King, Barrie
Subject: RE: ACB Estimate - Columbia, SC

Hi John,

We typically use 45#/sq. ft. for the estimated handling weight for the #45 ArmorFlex cabled mats. The mat size you reference would be our max. size for shipping purposes. Therefore, the max. estimated individual mat weight would be 13,950#.

Let me know if you need specifications or any other detailed information.

Regards,

Richard A. Hill, P.E.

Bridge Consultant - Western PA and Northern WV (DOH Districts 4 & 6)
Contech Engineered Solutions
Email: RHill@conteches.com
Mobile: (412) 449-6610

From: Osterle, John P. <John.Osterle@wsp.com>
Sent: Thursday, February 13, 2020 11:36 AM
To: Hill, Richard <RHill@conteches.com>
Subject: RE: ACB Estimate - Columbia, SC

Hi Richard,

Quick question for you. What is the total weight of a single ACB mat of closed cell #45 with dimensions of 7'-9"x 40'?

We are finalizing our conceptual design of the cofferdam using ACB mats now. Thanks.

John

From: Hill, Richard <RHill@conteches.com>
Sent: Wednesday, January 22, 2020 3:00 PM
To: Osterle, John P. <John.Osterle@wsp.com>
Subject: ACB Estimate - Columbia, SC

Good afternoon John,

Per your request, we offer the following recommended product and material only estimate for your use:

Approx. 109,021 sf ArmorFlex Closed Cell #45 ACB with Galv. Cabling – 40' lengths

- o Delivered to Columbia, SC



June 8, 2020

Mr. Paul Biery
Senior Project Manager
Dominion Energy South Carolina
400 Otarre Parkway
Cayce, SC 29033

RE: West Bank Erosion Potential Evaluation
SCE&G Fleet Maintenance Site (Congaree River)
Columbia, South Carolina

Dear Mr. Biery,

The State Voluntary Cleanup Program has reviewed the West Bank Erosion Potential Evaluation received by the Department on June 3, 2020. The Department approves of the submittal and the conclusions made in the report.

If you have any questions or comments please contact me at (803) 898-0747 or cassidga@dhec.sc.gov.

Sincerely,

Greg Cassidy
State Voluntary Cleanup Program
Bureau of Land and Waste Management

cc: File 52561
Lucas Berresford, BLWM
Veronica Barringer, Midlands EA Region
Al Peeples, Midlands EA Region



VIA ELECTRONIC MAIL

November 26, 2019

William Zeli, P.E., Environment Program Manager
Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

**Subject: West Bank Erosion Potential Evaluation
Congaree River Remediation Project
Columbia, South Carolina**

Dear Mr. Zeli:

This letter presents a summary of WSP USA's (WSP) west bank erosion potential evaluation completed using a two-dimensional (2D) HEC-RAS model of the Congaree River near the proposed Area 1 and Area 2 cofferdams.

2D MODEL DEVELOPMENT

A 2D HEC-RAS model was developed for the purposes of completing the erosion potential evaluation. The model was constructed using the same bathymetry, topographic survey, and LiDAR data used to develop a one-dimensional (1D) HEC-RAS model for the Hydraulic Analysis (WSP; April 12, 2019) and Low Flow Sensitivity Analysis (WSP; July 26, 2019). Boundary conditions were determined from the Low Flow Sensitivity Analysis model outputs.

The key characteristics of the 2D model are listed below:

- Upstream extent located approximately 1,000 feet (ft) upstream of Gervais Street bridge
- Downstream extent located approximately 500 ft upstream of Blossom Street bridge, at 1D model Sta. 282071
- Typical cell size of 5 ft x 5 ft, giving a total of approximately 225,000 cells
- Constant Manning's roughness value of 0.038 specified for existing river channel (as per 1D model) and proposed cofferdam structures.
- Upstream inflow boundary conditions for normal flow (8,564 cubic feet per second [cfs]) and crest flow (26,000 cfs) from 1D model. Flow split between left and right channels calculated based on flow area of

WSP USA
Suite 950
11 Stanwix Street
Pittsburgh, PA 15222

Tel.: +1 412 281-9900
Fax: +1 412 281-2056
wsp.com

each side of channel at normal/crest flow conditions from 1D model outputs. Results in approximately 50-50 split between channels.

- Downstream water level boundary conditions for normal and crest flow conditions determined from 1D model outputs as 115.0 and 121.8 ft NAVD 88, respectively.
- Separate Digital Elevation Models (DEMs) developed for Existing, Proposed Area-1 Cofferdam, and Proposed Area-2 Cofferdam scenarios. Cofferdams and river banks specified as break lines for all scenarios, ensuring a consistent 2D flow area with identical computation point locations is used for all models. Therefore, any changes in results can be attributed to elevation changes, not model schematization.
- Gervais Street bridge piers are represented in the models assuming an ellipse shape approximately 60 ft long and 20ft wide, based on Google Earth imagery.
- Final model simulations run using the full momentum equations and an adaptive computation interval with a maximum value of 30-seconds.

Figures 1 through 7 provide a summary of the model setup and input data.

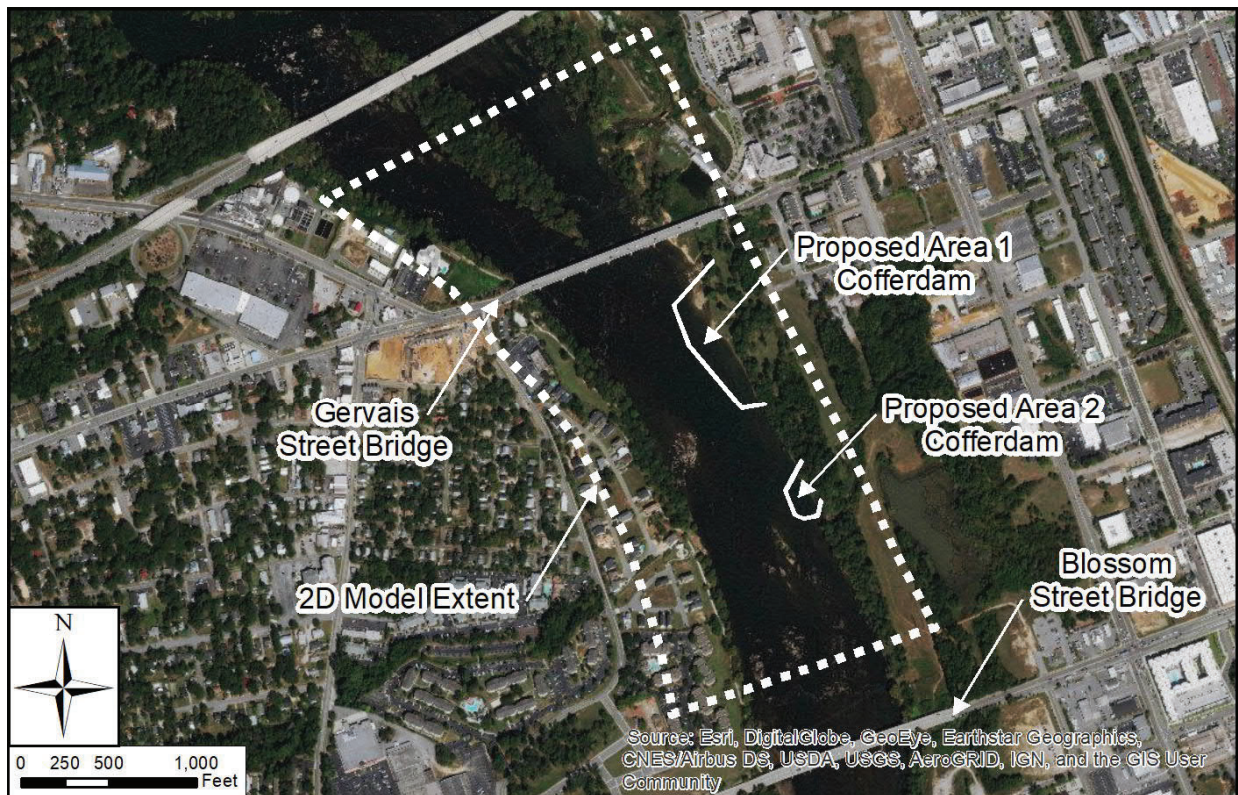


Figure 1: Model Extent

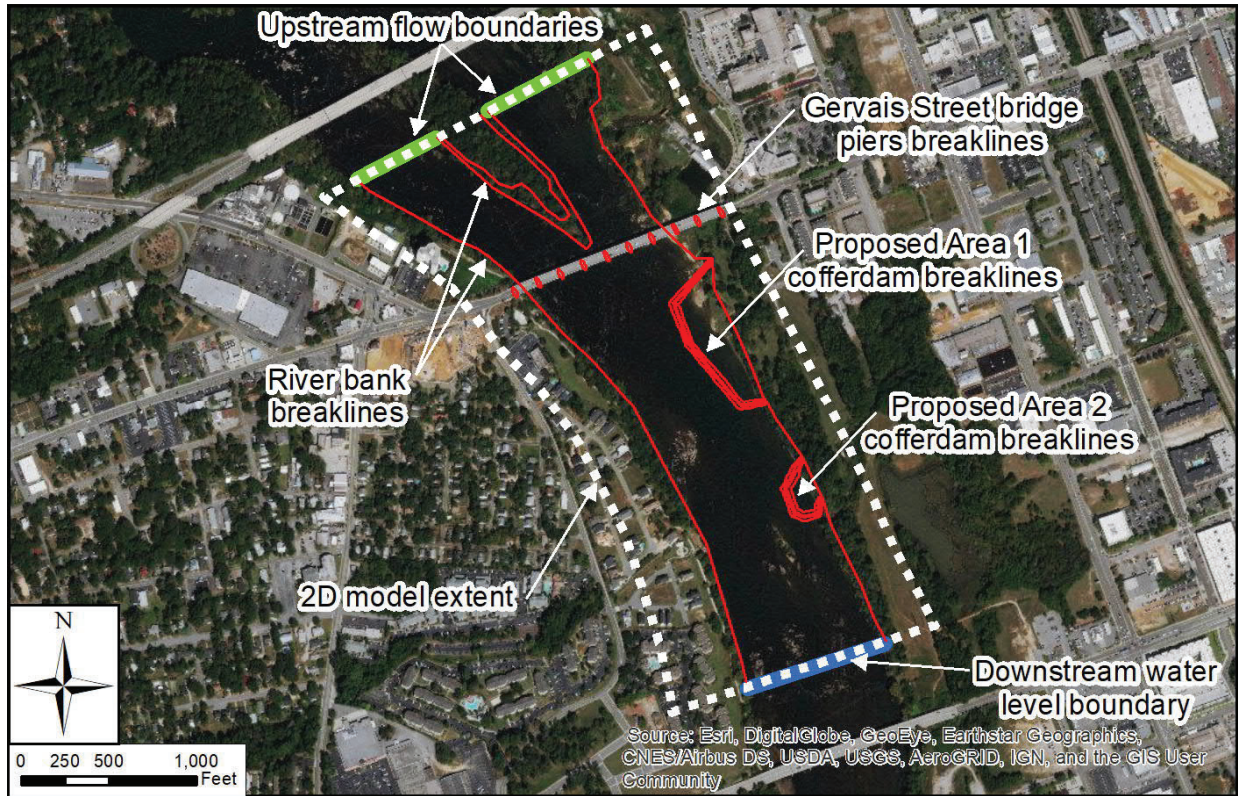


Figure 2: Model Details

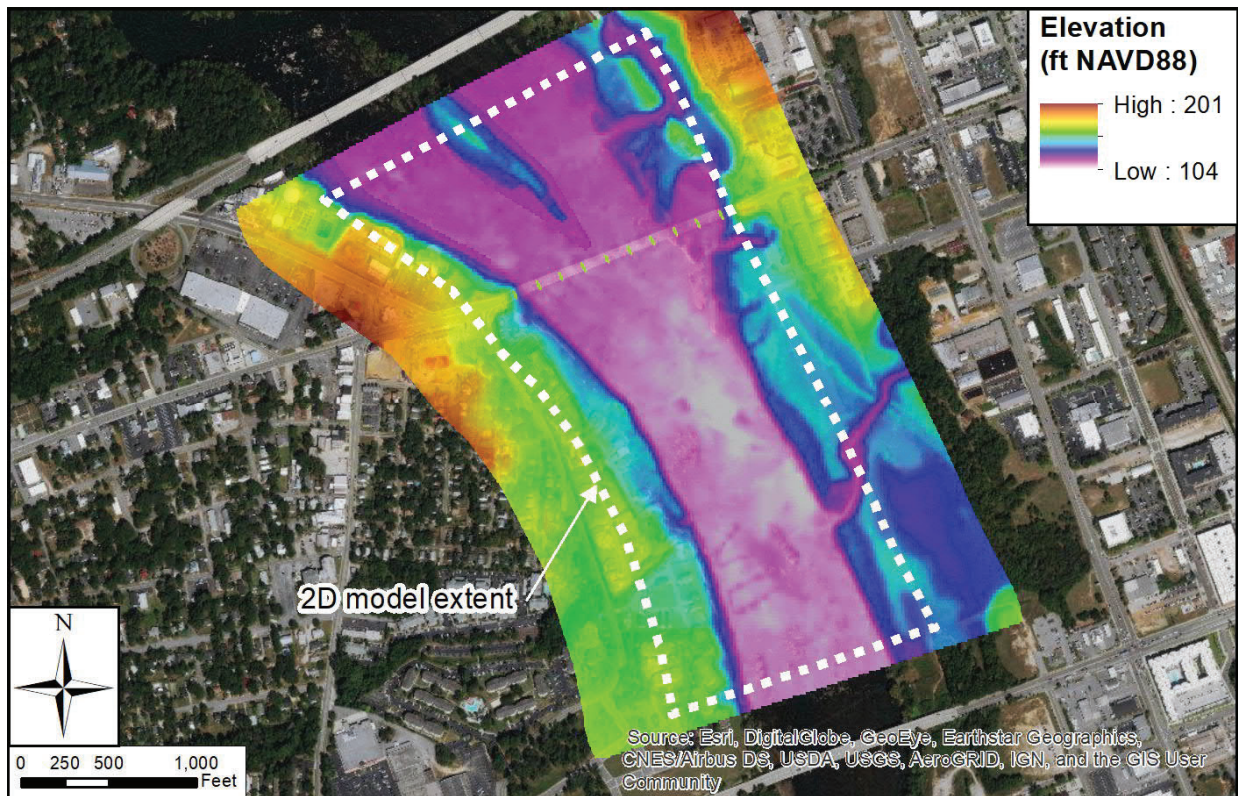


Figure 3: Existing Digital Elevation Model

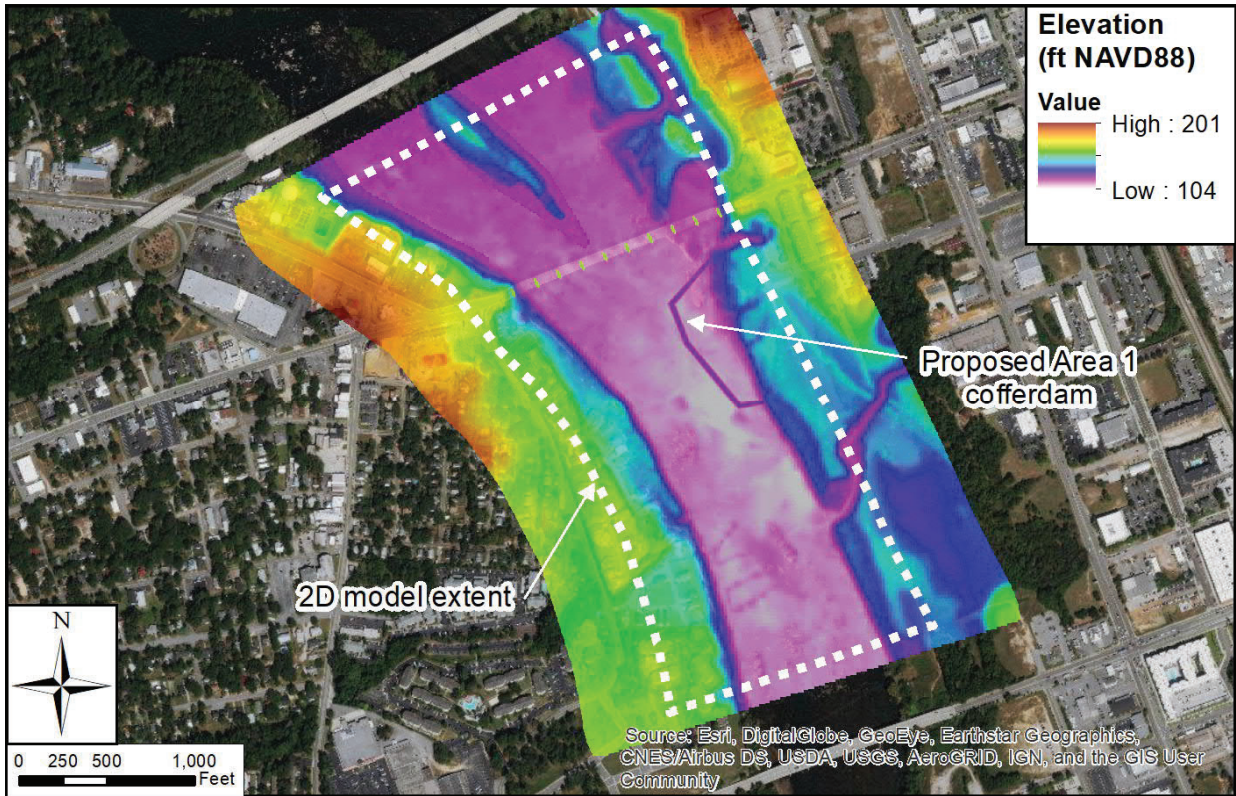


Figure 4: Proposed Area 1 Cofferdam Digital Elevation Model

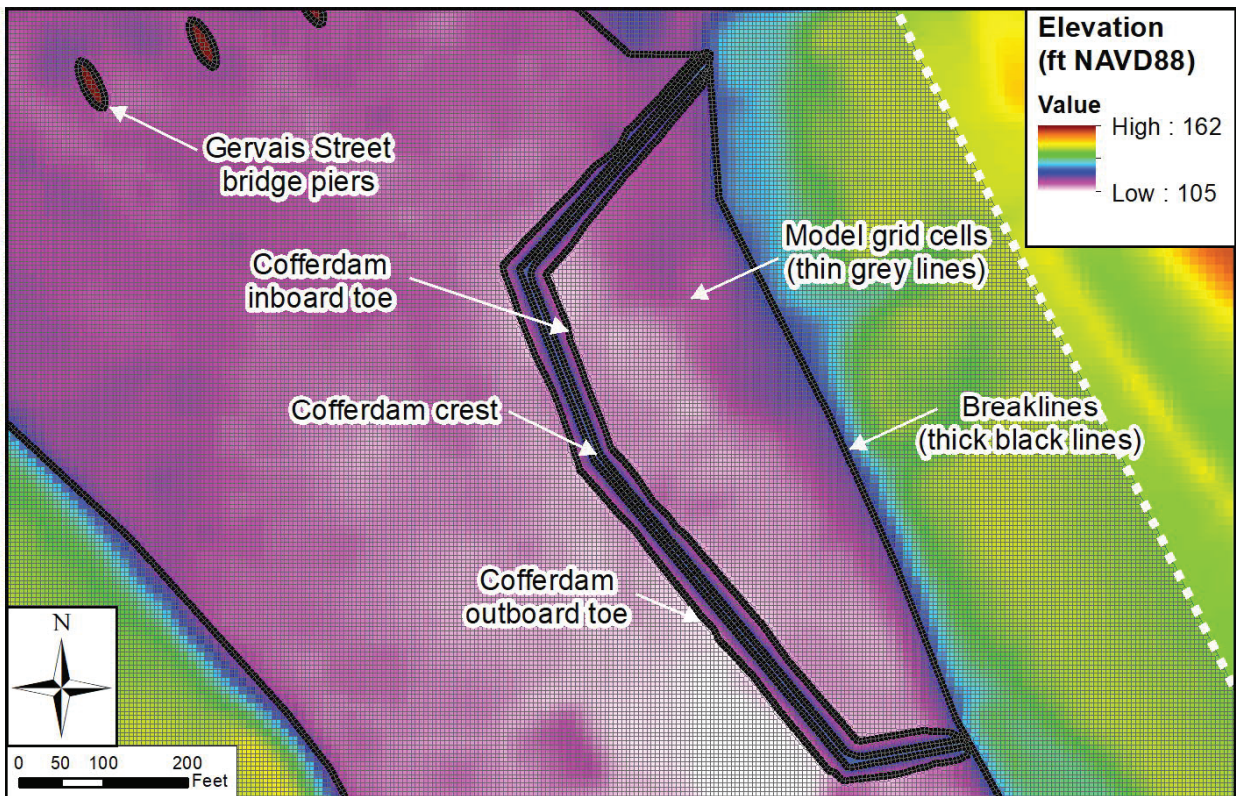


Figure 5: Proposed Area 1 Cofferdam Mesh Details