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FINAL SITE SPECIFIC WORK PLAN ADDENDUM FOR FOCUSED PRELIMINARY
ASSESSMENT/SITE INSPECTION FORMER GUN POSITIONS 41A AND 41B MCB CAMP
LEJEUNE NC
3/1/2008
CH2M HILL

Final

**Site Specific Work Plan Addendum for Focused
Preliminary Assessment/Site Inspection
Former Gun Positions 41A & 41B**

**Marine Corps Base Camp Lejeune
Jacksonville, North Carolina**

Task Order 009

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Prepared by



CH2MHILL

Charlotte, North Carolina

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Acronyms and Abbreviations

AEC	Area of Environmental Concern
AHA	Activity Hazard Analysis
ASR	Archives Search Report
bgs	below ground surface
BMP	Best Management Practice
CAD	Computer-Aided Design
CAMA	Coastal Area Management Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chain-of-Custody
CWM	Chemical Warfare Materiel
DDESB	Department of Defense Explosives Safety Board
DFOW	Definable Features of Work
DGM	Digital Geophysical Mapping
DMM	Discarded Military Munitions
DoD	Department of Defense
DPT	Direct Push Technology
DRMO	Defense Reutilization and Marketing Office
EMP	Explosives Management Plan
EOD	Explosives Ordnance Divisions
ESQD	Explosive Safety Quantity Distance
ESS	Explosives Safety Submission
ESV	Ecological Screening Values
ft	foot/feet
ft ²	square feet
FTL	Field Team Leader
GIP	Geophysical Investigation Plan
GIS	Geographical Information System
GPO	Geophysical Prove-Out
HSP	Health and Safety Plan
IDW	Investigation-derived Waste
INRMP	Integrated Natural Resource Management Plan
IRP	Installation Restoration Program
kg	kilogram
m	meter
MARCORSYSCOM	Marine Corps Systems Command

MARSOC	Marine Special Operations Command
MC	Munitions Constituents
MCB	Marine Corps Base
MEC	Munitions and Explosives of Concern
MGFD	Munition with the Greatest Fragmentation Distance
MI	Multi-Increment
MILCON	Military Construction
MPPEH	Material Potentially Presenting an Explosive Hazard
MR	Munitions Response
MRP	Munitions Response Program
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MTSQ	Mechanical Time Super Quick
NAVFAC	Naval Facilities Engineering Command
NC 2L	North Carolina 2L Groundwater Standards
NC SSL	North Carolina Soil Screening Level
NCDENR	North Carolina Department of Environment and Natural Resources
NEW	Net Explosives Weight
NOSSA	Naval Ordnance Safety and Security Activity
OD	Outer Diameter
PA	Preliminary Assessment
PM	Project Manager
PRG	Preliminary Remediation Goal
PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
QCP	Quality Control Plan
SI	Site Inspection
SLERA	Screening Level Ecological Risk Assessment
SOP	Standard Operating Procedure
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UXO	Unexploded Ordnance
WP	Work Plan

Introduction

1.1 Background and Project Objectives

Marine Corps Base (MCB) Camp Lejeune is planning a military construction (MILCON) project in an area encompassing Former Gun Positions 41A & 41B (Gun Position 41) within the Stone Bay area of the Base. The MILCON plan consists of a Marine Special Operations Command (MARSOC) facility covering approximately 1244 acres, of which approximately four acres include the former location of Gun Position 41 (**Figure 1-1**). Due to the historical activities at Gun Position 41, the potential presence of munitions and explosives of concern (MEC) and their impact upon soil and groundwater will be assessed within this portion of the proposed MILCON area under the munitions response program (MRP) before construction of the MARSOC facility. The following objectives will be accomplished during the Focused Preliminary Assessment/Site Inspection (PA/SI) activities:

1. Identify historical activities at Gun Position 41 that may have resulted in environmental contamination with MEC and/or munitions constituents (MC) by researching archival records and interviewing current and former installation personnel.
2. Evaluate the presence and nature of MC contamination that may exist at Gun Position 41 by conducting an investigation of soil and groundwater.
3. Conduct ecological and human health risk screenings using analytical data collected at Gun Position 41.
4. Conduct digital geophysical mapping (DGM) and perform a MEC intrusive investigation of geophysical anomalies that may represent subsurface MEC. Based on the results of the MEC intrusive investigation, additional MEC activities may be required, including removal actions and/or construction support.

1.2 Work Plan Scope and Organization

The following PA/SI activities will be performed in accordance with methods and procedures detailed in the MCB Camp Lejeune MRP Master Project Plans (CH2M HILL, 2007) (referred to herein as the MRP Master Project Plans) to accomplish the objectives described in Section 1.1:

- Conduct a detailed historical archive search for documents pertaining to Gun Position 41 and prior uses of the property. Interview current installation personnel, and attempt to identify and interview former military personnel, to obtain their accounts of activities that may have impacted the project area.
- Perform DGM over 100 percent of the Gun Position 41 investigation area.
- Conduct a field investigation for MC contamination by sampling and analyzing groundwater and soil.

- Prepare a Focused PA/SI Report.
- Reacquire all geophysical anomalies that were selected as potentially representing subsurface MEC.
- Execute manual digging and identification of sources of anomalies.¹
- Perform demilitarization of all MEC and MPPEH identified during the intrusive activity.
- Perform removal verification and excavation backfilling.
- Prepare an After Action Report documenting the MEC intrusive investigation.

This Work Plan (WP) is divided into sections providing information on the detailed approach, including procedures to be employed during the execution of the project. Appendices to the WP provide supporting documentation that details specific procedures for the execution of the project.

This WP is organized as follows:

- **Section 1, Introduction**, provides general information about this WP, describes Gun Position 41, summarizes the history of the site, and presents the project scope and objectives.
- **Section 2, Technical Management Plan**, identifies the technical approach, methods, and operational procedures that will be used to execute the focused PA/SI project.
- **Section 3, Field Investigation Plan**, identifies the technical approach, methods, and operational procedures that will be used to execute the field investigation activities, including mobilization and demobilization, land surveying, vegetation clearing, temporary well installation, sampling of environmental media, and DGM.
- **Section 4, MEC Intrusive Investigation Plan**, identifies the technical approach, methods, and operational procedures that will be used to execute the MEC intrusive investigation including disposal of non-MEC and non-MPPEH anomaly source material, and blow-in-place demolition of MEC and MPPEH (if required).
- **Section 5, Explosives Management Plan (EMP)**, provides details for management of explosives in accordance with applicable regulations.
- **Section 6, Explosives Siting Plan**, provides explosives safety criteria for planning and siting explosives operations.
- **Section 7, Quality Control Plan (QCP)**, provides details of the approach, methods, and operational procedures to be employed for quality control (QC) of the focused PA/SI at Gun Position 41.
- **Section 8, Environmental Protection Plan**, describes the approach, methods, and operational procedures to be employed to protect the natural environment during the performance of all tasks at Gun Position 41.

¹ An Explosives Safety Submission (ESS) will be submitted to Marine Corps Systems Command (MARCORSYSCOM) for approval before intrusive activity begins on the Site.

- **Section 9, References**, lists the references cited in the preceding sections.
- **Appendix A, Archival Records Search Report**, presents the results of the records search and personnel interviews that were conducted to identify historical activities that may have resulted in environmental contamination of the project area.
- **Appendix B, Geophysical Prove-out (GPO) Plan**, details the activities to be performed for validating DGM systems to be utilized at the site.
- **Appendix C, Geophysical Investigation Plan (GIP)**, details the approach, methods, and operational procedures that will be used in performing geophysical investigations at the site.
- **Appendix D, Health and Safety Plan (HSP)**, provides an interface with CH2M HILL's overall health and safety program. The HSP also includes the MEC avoidance procedures that will be used to ensure that onsite personnel are protected from MEC that may be present at the site.
- **Appendix E, MEC Removal Standard Operating Procedures**, details the approach, methods, and operational procedures that will be used in performing removal of geophysical anomalies and MEC, if discovered, during the MEC intrusive investigation.
- An Explosives Safety Submission (ESS) is being submitted to Marine Corps Systems Command (MARCORSYSCOM) under separate cover for review and approval. The ESS was prepared in support of MEC investigation and removal activities to be performed at the project site. The ESS will be reviewed and approved by MARCORSYSCOM, Naval Ordnance Safety and Security Activity (NOSSA), and Department of Defense Explosives Safety Board (DDESB) for conformance with all applicable Marine Corps, Department of the Navy, and Department of Defense requirements for the safe handling of MEC and explosives. The ESS will be approved by these agencies prior to the start of the intrusive investigation activities.

1.3 Site Location and Description

Gun Position 41, also referred to as Archives Search Report (ASR) site number 2.212 in the *Range Identification and Preliminary Range Assessment* (USACE, 2001), is located in the Stone Bay area east of Rifle Range Road (**Figure 1-1**). A four-acre area encompassing Gun Position 41 will be investigated because it could be reasonably expected to represent the extent of potential MEC and MC contamination. Based on a review of publicly available aerial photographs and site reconnaissance, approximately 70 percent of the investigation area is heavily vegetated with trees and thick undergrowth. Several 'fox holes' were identified during site reconnaissance in addition to ammunition packaging. A portion of the area is cleared and an access road, Red Trail, crosses through the northeast portion of the site. Access to Gun Position 41 is restricted to military personnel and authorized contractors; public access is restricted.

1.4 Site History

In November 2007, CH2M HILL completed a detailed investigative review of information relating to Gun Position 41 and conducted interviews with current and former Base personnel. The investigative review emphasized obtaining information identifying historical activities that may have resulted in environmental contamination within the project area. Information obtained by this effort is presented in the Archival Records Search Report (**Appendix A**).

An interview with the Base Safety Range Officer (BSRO) indicated that Gun Position 41 was established during World War II as a training ground. A Howitzer, a type of artillery piece that is characterized by a relatively short barrel and the use of comparatively small explosive charges to propel projectiles at trajectories with a steep angle of descent, was positioned at the site and fired 105 mm and 155 mm projectiles into the K-2 and G-10 Impact Areas (see **Appendix A, Figure A-1 through A-3**). In addition, according to a former BSRO, other munitions including 4.2-inch mortars, 175 mm guns, 8-inch howitzers, and 120 mm mortars may have been fired at the Gun Position (Redmond, 2007). Live fire training ceased in the 1960s and then resumed in the 1980s due to a change in training philosophy (Redmond, 2007). Presently, the site continues to be used as an official training ground, but no live fire training is conducted in this area. Training may include the use of blanks and pyrotechnics. As a result of the usage and type of training conducted at the site, there should be no discarded military munitions (DMM), although ammunition packaging, range residue, barbwire, and buried garbage may be present (Richardson, 2007).

Gun Position 41 was a former gun firing position used for troop training; the area is not associated with an active impact area, range, range fan, safety danger zone, or with the disposal of military munitions. The area is undeveloped with access restricted to military personnel.

1.5 Climate

The climate in the MCB Camp Lejeune area is discussed in Section 1.4 of the MRP Master Project Plans.

1.6 Geology and Hydrogeology

The regional geology and hydrogeology at MCB Camp Lejeune are discussed in Sections 1.6 and 1.7 of the MRP Master Project Plans. Site-specific geologic and hydrogeologic data are not available for this site, but will be collected during the PA/SI activities and presented in the Focused PA/SI Report.

Technical Management Plan

2.1 Munitions Response Guidance, Regulations, and Policy

The MR intrusive investigation at Gun Position 41 will be conducted under the guidance documents, regulations, and polices described in Section 2.1 of the MRP Master Project Plans.

2.2 MEC Contingency Procedures

Based on the documented history of Department of Defense (DoD) activities at Gun Position 41, it is anticipated that if MEC is discovered it can be destroyed onsite. Therefore, alternatives to onsite disposal are not identified in this WP Addendum. Likewise, the discovery of unidentified MEC is not anticipated. If any MEC items are discovered that cannot be identified, MEC contingency procedures will be conducted in accordance with Section 2.2 of the MRP Master Project Plans.

2.3 Chemical Warfare Materiel Contingency Procedures

Based on the documented history of DoD activities at Gun Position 41, it is not anticipated that chemical warfare materiel (CWM) will be discovered. If CWM is encountered, all work will immediately cease and CWM contingency procedures will be conducted in accordance to Section 2.3 of the MRP Master Project Plans.

2.4 Project Personnel, Organization, and Schedule

2.4.1 Project Organization

The key organizations involved in this project are Naval Facilities Engineering Command (NAVFAC), MCB Camp Lejeune, the North Carolina Department of Environment and Natural Resources (NCDENR), the United States Environmental Protection Agency (USEPA) and CH2M HILL. Project execution will be conducted by CH2M HILL and its subcontractors; specific duties for CH2M HILL and its subcontractors are described in Section 2.4 of the MRP Master Project Plans. CH2M HILL will issue subcontracts for MEC support, buried utility locating, DGM, land surveying, vegetation clearing, direct push technology (DPT) soil sampling, DPT temporary well installation, laboratory analysis, and data validation.

2.4.2 Project Personnel

The reporting relationship between key project personnel and the roles and responsibilities of the key personnel are discussed in Section 2.4 of the MRP Master Project Plans. Contact information for key project personnel is shown in **Table 2-1**.

2.4.3 Project Schedule

Figure 2-1 presents a detailed project schedule, including key milestones.

2.5 Technical Approach

2.5.1 Task 1—Project Planning

This task includes project management, meetings, WP preparation, and subcontractor procurement.

Project management includes all work necessary for controlling the project budget and schedule. This includes monthly status reports and invoicing, as well as all other administrative tasks needed for project performance.

Meetings are planned throughout the course of this project. The meetings will be held to discuss proposed work, present investigation findings, and discuss project status. The meetings are planned to be held at MCB Camp Lejeune, CH2M HILL's Charlotte office, or at other locations as necessary.

Three versions of the WP will be prepared under this task. A draft WP will be submitted electronically for NAVFAC and MCB Camp Lejeune review. A revised WP will be submitted to NAVFAC, MCB Camp Lejeune, USEPA and NCDENR for review upon incorporating comments from NAVFAC and MCB Camp Lejeune. A final WP will be prepared that will address all comments on the draft document.

Subcontractor procurement is also included under this task. Anticipated subcontractor services include MEC support, buried utility locating, DGM, land surveying, vegetation clearing, DPT soil sampling and temporary well installation, laboratory analysis, and data validation.

2.5.2 Task 2—Data Evaluation/Archive Review

An archival records search was performed during preparation of this WP to identify previous site activities that may have environmentally impacted the investigation area. The results are presented in **Appendix A**.

2.5.3 Task 3—Site Investigation

All field investigation activities will be performed under this task. The scope of the field investigation and the technical approach are presented in Section 3. The primary field investigation activities include:

- MEC avoidance
- Surveying
- Vegetation clearance
- DGM
- Field work support
- Temporary well installation and abandonment
- Environmental sampling

2.5.4 Task 4—Sample Management, Analysis, and Validation

This task includes management of environmental sample data from the time the samples are collected until the validated data is received and incorporated into the project reports. Details for this task are provided in Section 8.1 of the MRP Master Plans.

2.5.5 Task 5—Geographical Information System

All DGM data will be collected in preparation for the creation of a geographical information system (GIS) tailored for the investigative needs of Gun Position 41. All digital data will be created using a software platform that will allow it to be loaded directly into the GIS. The main purpose of the GIS is to assemble all the data required to associate the non-intrusive subsurface geophysics investigative data with its correct geographical location, the relational database, mapping, and remote sensing data. The GIS tools are used to manage the project, assemble data, and help determine areas requiring further investigation.

CH2M HILL will also provide the Gun Position 41 GIS data for upload into the existing MCB Camp Lejeune GIS. This data will include ArcView project and shape files that best delineate the area on the basis of uses, site conditions, and other information gathered during the study.

2.5.6 Task 6—MEC Intrusive Investigation

If geophysical anomalies are identified during the site investigation (Task 3) that potentially represent subsurface MEC, a MEC intrusive investigation will be conducted. The scope of the MEC intrusive investigation and the technical approach are presented in Section 3. The primary intrusive investigation activities include the following:

- Site Preparation
- Anomaly reacquisition/detection
- Manual excavation
- Anomaly identification and verification
- MEC/MPPEH demilitarization
- Scrap disposal

2.5.7 Task 7—Reporting

2.5.7.1 Focused PA/SI Report

A draft Focused PA/SI Report will be prepared to document the findings of the field investigation. The draft Focused PA/SI Report will be submitted electronically for concurrent review by NAVFAC and MCB Camp Lejeune. Following receipt of review comments, CH2M HILL will issue a revised draft report to NAVFAC, MCB Camp Lejeune, USEPA and NCDENR for review. A final report will be prepared that will address all comments received on the draft document. The report will provide a summary of site history, summarize all field activities, provide an evaluation of the collected geophysical and environmental data, and present human health and ecological risk screenings.

The preliminary ecological risk screening will include a brief description of the ecosystems potentially at risk, a figure depicting the ecosystems, results of a comparison of maximum detected concentrations (of composite samples) to ecological screening values (ESVs) in

tabular form and recommendations for further evaluation, if required. This preliminary ecological risk screening will not constitute a full Screening Level Ecological Risk Assessment (SLERA).

The human health risk screening will be conducted using data collected during the investigation. The data will be screened using the following criteria:

- Soil data will be compared to USEPA Region 9 residential soil Preliminary Remediation Goals (PRGs) (USEPA, 2004) and the North Carolina Soil Screening Levels (NC SSLs).
- Groundwater data will be compared to USEPA Region 9 tap water PRGs (USEPA, 2004) and North Carolina 2L Groundwater Standards (NC 2L) (NCAC, 2005).

If newer toxicity values are available for a constituent, a new PRG will be calculated using the equations from the USEPA Region 9 PRG table and the updated toxicity values. The soil and groundwater data will also be compared to the MCB Camp Lejeune background soil and groundwater data from the *Final Base Background Soil Study Report* (Baker, 2001). The background values used will be two times the average site background concentrations.

2.5.7.2 After Action Report

An After Action Report will be prepared, in accordance with NOSSA instruction document 8020.15A (NOSSA, 2002) to document the results of the MEC intrusive investigation. The report will provide a summary of all MEC found during the investigation, summarize all the MEC removal activities, and provide an evaluation of the selected removal methods and relative effectiveness. Prior to submittal of the final report, a preliminary draft will be provided in electronic format to MARCORPSYSCOM and NOSSA.

Field Investigation Plan

3.1 Overall Approach

The objectives for this field investigation are to evaluate the presence and nature of MC contamination that may exist within the four-acre investigation area of Gun Position 41 and to evaluate the nature, number, and density of anomalies that could potentially represent subsurface MEC. All field activities will be conducted in accordance with the Standard Operating Procedures (SOPs) provided in the MRP Master Project Plans (CH2M HILL, 2007).

The field investigation will accomplish the above objectives through the following activities:

- Perform DGM over the entire project area
- Collect composite surface soil samples from four decision units using the Multi-Increment (MI) sampling approach; this approach is described in the *Systematic Random Multi-Increment Sampling* SOP in **Appendix C** of the MRP Master Project Plans
- Collect four subsurface soil samples from soil borings using DPT
- Collect four shallow groundwater samples from temporary wells installed within the surficial aquifer using DPT

The field investigation activities are detailed below and reference the MRP Master Project Plans. MEC intrusive investigation activities are addressed in Section 4.

3.2 Site Preparation and Restoration

The following subsections describe the procedures associated with site preparation, including mobilization of personnel and equipment, preparation for intrusive environmental investigation activities, and preparation for DGM.

3.2.1 Mobilization

Mobilization will include identifying, briefing, and mobilizing staff, as well as securing and deploying equipment.

3.2.1.1 General Activities

- Identify/procure, package, ship, and inventory project equipment, including geophysical instrumentation, hand tools and supplies, and vegetation clearance equipment
- Coordinate with local agencies, including MCB Camp Lejeune, Base Range Control, police, hospital, and fire department, as appropriate

- Coordinate communications and other logistical support
- Test and inspect equipment
- Conduct site-specific training on the WP and MEC procedures and hazards
- Review subcontractor Activity Hazard Analysis (AHA) forms
- Verify that all forms and project documentation are in order and project team members understand their responsibilities regarding completing project-reporting requirements

3.2.1.2 Kickoff/Safety Meeting

During mobilization, a kickoff and site safety meeting will be conducted. This meeting will include a review of this WP and a review and acknowledgment of the HSP by all site personnel. Additional meetings will occur as needed, as new personnel, visitors, and/or subcontractors arrive at the site.

3.2.2 Buried Utility Clearance

All buried utilities will be identified within a 20-foot radius of each site sampling location prior to initiation of intrusive activity.

3.2.3 Site Survey

Land surveying services will be conducted in accordance with Section 7.4 of the MRP Master Project Plans (CH2M HILL, 2007). The surveying at Gun Position 41 will consist of three phases:

- **Phase 1** will be a survey of the site boundary (**Figure 1-1**). The site boundary survey will delineate the extent of the investigation area of Gun Position 41 which will also designate the area that will be subjected to vegetation clearing for the DGM effort.
- **Phase 2** will occur after the vegetation clearing and will involve the layout of the DGM grid and decision units (**Figure 3-1**). For the purposes of the DGM, the site will be divided into 50 meter (m) survey grids coinciding with the existing Base-wide grid system previously established for MR investigations to correspond with the North Carolina State Plane coordinate system. The four corners of each survey grid will be marked with non-metallic stakes. Each corner stake will be marked with the grid number and the compass direction (e.g., NE, SW, etc.) indicating which grid corner is represented. After the DGM Grid layout is complete, the decision unit layout survey will be conducted to identify the boundary of each decision unit shown on **Figure 3-1**.
- **Phase 3** of the land surveying will occur after environmental sampling activities have concluded at the site and will entail surveying of the coordinates and elevations of the temporary monitoring wells and soil sampling locations.

MEC avoidance will be performed during all three phases of surveying activities. UXO Technicians will escort surveying personnel while onsite, and will clear all locations where stakes are driven.

3.2.4 Vegetation Clearing

Vegetation less than three inches in diameter will be removed from the four-acre area of investigation. Vegetation clearing will be accomplished using a combination of mechanical and manual methods. Felled brush and trees will be mulched and left in place. Trees greater than three inches in diameter will not be removed unless absolutely necessary.

During the vegetation removal process, UXO technicians will conduct MEC avoidance activities in accordance with the MEC avoidance procedures included in the HSP (**Appendix D**).

The Base will coordinate with Camp Lejeune's Environmental Management Division office to identify federally protected species or archeological sites that may be encountered during vegetation clearing activities. Federally listed plant species will be identified and left in place in accordance with the Environmental Protection Plan (refer to **Section 5**).

3.2.5 Site Restoration and Demobilization

3.2.5.1 Site Restoration

Damage caused by equipment or other site activities (e.g., deep ruts) will be repaired and revegetated as necessary to prevent erosion.

3.2.5.2 Demobilization

Full demobilization will occur when the project is completed and appropriate quality assurance (QA)/QC checks have been performed. The following activities will occur prior to demobilization:

- Confirmation that DGM is complete
- Chain-of-custody (COC) records will be reviewed to ensure that all field and QC samples were collected as planned and were submitted for appropriate analyses
- Verification of adequate site restoration
- All field equipment will be inspected, packaged, and shipped to the appropriate location

3.3 Geophysical Prove-out Plan

A geophysical prove-out (GPO) will be performed as part of the process for validating DGM systems to be utilized during the DGM activities. A GPO Plan is provided in **Appendix B** which provides details of the equipment, approach, methods, operational procedures and quality control to be used in performing the GPO at Gun Position 41.

3.4 Geophysical Investigation Plan

DGM will be conducted over the entire four acres of Gun Position 41 using a single coil EM61-MK2 to map geophysical anomalies that could potentially represent subsurface MEC within the subject site. The EM61-MK2 is a high-resolution time-domain electromagnetic instrument designed to detect, with high spatial resolution, shallow ferrous and non-ferrous

metallic objects. For the purposes of the DGM, the site will be divided into 50 m survey grids coinciding with the existing Base-wide grid system previously established for MR investigations to correspond with the North Carolina State Plane coordinate system. The locations and actual acreages surveyed will be based on field conditions, including presence of utilities, buildings, fences, and other cultural features that may interfere with the collection of DGM data.

The Geophysical Investigation Plan provided in **Appendix C** provides details of the equipment, approach, methods, operational procedures and QC to be used in performing the geophysical investigations at Gun Position 41.

3.5 Geospatial Information and Electronic Submittals

Methods, equipment, accuracy, and submittal requirements for location surveys and mapping are described in Section 7.4 MRP Master Project Plans.

3.6 Field Sampling Plan

3.6.1 Field Operations

In order to assess the presence and nature of MC contamination that may exist at the four-acre investigation area, the project team will investigate groundwater and soil at Gun Position 41. This will include collecting surface soil samples using multi-increment sampling procedures, subsurface soil samples by DPT, and groundwater samples from temporary wells. QA/QC samples will be collected per Section 3.6.2.

3.6.1.1 Multi-increment Surface Soil Sampling

Three composite multi-increment (MI) surface soil samples will be collected from each of four Decision Units (designated ASR2.212-GP41-DU01-SS## through ASR2.212-GP41-DU04-SS##) for a total of 12 composite MI samples (**Figure 3-1²**). MEC anomaly avoidance will be practiced as described in Section 2.3 of the HSP (**Appendix D**). The dimensions each decision unit are proposed to be approximately to be 64 m x 64 m. The MI samples will be collected using the *Systematic Random Multi-Increment Sampling* SOP in **Appendix C** of the MRP Master Project Plans. Since explosives residues are generally immobile within the soil profile, the MI samples will be collected from depths of zero to two inches bgs where the highest MC contamination is mostly likely to exist if present (USAE 2002). Each composite sample must weigh at least 2.2lbs.

Samples will be analyzed by a fixed base laboratory for the following parameters (refer to **Tables 3-1** through **3-3**):

- Explosives residues (SW-846 USEPA Method 8330)
- Perchlorate (USEPA Method 6850)
- RCRA metals (SW-846 USEPA Method 6010B/7000)

² If modifications of sample locations are necessary due to utilities or accessibility issues, the revised sample location(s) will be located as near as possible to the original proposed location.

3.6.1.2 Direct Push Subsurface Soil Sampling

A track-mounted DPT rig will be used to collect subsurface soil samples in accordance with the *Direct-Push Soil Sample Collection* SOP in **Appendix C** of the MRP Master Project Plans. Four subsurface soil samples (designated ASR2.212-GP41-IS01 through ASR2.212-GP41-IS04) will be collected from just above the water table (estimated to range from 5 to 10 ft bgs) at the approximate locations shown in **Figure 3-2**. If geophysical anomalies indicative of potential subsurface MEC are identified during the DGM surveys, the subsurface soil and groundwater sampling locations may be altered to be within the vicinity of these signatures.

Soil types encountered will be classified according to ASTM Standard D2488-69, "Description of Soils (Visual-Manual Procedure)." The soil boring logs will show the depths at which each distinct stratum is encountered. Soil descriptions will comply with the Unified Soil Classification System (USCS), including grain-size classifications (i.e., fine, medium, and coarse sand and gravel); the use of the percentage terms "trace" (1 to 10 percent), "little" (11 to 20 percent), "some" (21 to 35 percent), and "and" (36 to 50 percent); the group symbols; the color; and relative moisture.

MEC anomaly avoidance will be practiced during DPT subsurface soil sampling as described in Section 2.3 of the HSP (**Appendix D**). At the start of each borehole, a UXO technician will hand auger to a depth of five feet bgs, checking the borehole with a downhole magnetometer at one foot increments. Due to the anticipated shallow depth to the water table, a separate borehole will be advanced adjacent to the borehole cleared by the UXO technician in order to collect each subsurface soil sample.

Samples will be analyzed by a fixed base laboratory for the following parameters (refer to **Tables 3-1** through **3-3**):

- Explosives residues (SW-846 USEPA Method 8330)
- Perchlorate (USEPA Method 6850)
- RCRA metals (SW-846 USEPA Method 6010B/7000)

The water table in each boring will be observed in the field by visual identification of saturated conditions in the soil cores removed from the boreholes. The water table is estimated to occur at approximately 5 ft to 10 ft bgs throughout the site.

3.6.1.3 DPT Temporary Well Installation and Sampling

Temporary monitoring wells will be installed in each of the four boreholes used for subsurface soil sample collection, as shown on **Figure 3-2**. Each well will consist of one-inch inner diameter (ID) polyvinyl chloride (PVC) casing and screen, with a pre-packed sand filter attached to the screened interval. The wells will be constructed accordance with *Temporary Well Installation* SOP in **Appendix C** of the MRP Master Project Plans (CH2M HILL, 2007).

Groundwater samples will be collected from each temporary well using low-flow purge rates in accordance with the *Low-Flow Groundwater Sampling from Monitoring Wells* SOP in **Appendix C** of the MRP Master Project Plans.

Samples will be analyzed by a fixed base laboratory for the following parameters (refer to **Tables 3-1** through **3-3**):

- Explosives residues (SW-846 USEPA Method 8330)
- Perchlorate (USEPA Method 6850)
- Total and dissolved RCRA metals (SW-846 USEPA Method 6010B/7000)

Following sampling and surveying, all temporary wells will be removed from the boreholes and the boreholes will be abandoned by the DPT subcontractor following NCDENR guidelines (NCAC, 2001) by grouting from the bottom of the boring to the ground surface.

A summary of the sampling program for PA/SI activities at Gun Position 41 site is presented in **Table 3-1**.

3.6.2 Analytical Requirements and Sample Handling

3.6.2.1 Sample Preservation and Handling

Sample preservation must occur in the field immediately after collection. The containers supplied by the laboratory will contain the applicable preservative. This will protect field personnel from transporting, handling, and measuring concentrated acids and bases. QA/QC samples, will be collected in the same types of preserved containers as the field samples. The preservative and holding time requirements for analysis are shown in **Table 3-2**.

3.6.2.2 Quality Assurance and Quality Control

QA/QC requirements for environmental sampling, handling, and management are detailed in Section 4 of the MRP Master Project Plans (CH2M HILL, 2007). Field QC samples (including field blanks, equipment blanks, duplicate samples, and matrix spike/matrix spike duplicate [MS/MSD] samples) will be collected during the investigation and submitted for laboratory analysis. Required QA/QC samples and the required frequency of collection are summarized in **Table 3-3**.

3.6.2.3 Sample Collection Frequencies

Table 3-4 presents the anticipated number of field samples and their associated QA/QC samples.

3.6.2.4 Sample Identification System

The following is a general guide for sample identification; an electronic sample-tracking program will be used to manage the flow of information from the field sampling team to the laboratory and to internal and external data users. The tracking program is used to manage the entry of sampling-related data, such as station locations and field measurements.

While in the custody of the sampling team, the sample analysis data will be recorded in field logbooks, along with sample identity information.

Labels for samples to be shipped to a fixed-base laboratory will be produced electronically. If they cannot be produced electronically, they must be written legibly in indelible ink.

The following information typically is included on the sample label:

- Site name or identifier
- Unique sample identification number
- Date and time of sample collection
- Sampler's initials
- Sample matrix or matrix identifier
- Type of analyses to be conducted

Each analytical sample will be assigned a unique number using the following format:

Site#-Media/Station# or QA/QC-Year/Quarter or Depth Interval

An explanation of each of these identifiers is given below.

Site#: This investigation includes MRP Gun Position 41 under the Munitions Response Program. Therefore, the prefix "ASR2.212-GP41-" will be used

Media: TW = Groundwater from temporary wells
 SS = Surface soil
 IS = Subsurface soil

Station#: Each monitoring well will be identified with a unique identification number. Soil borings will be numbered consecutively.

QA/QC: D = Duplicate sample (following sample type/number)
 FB = Field blank
 ER = Equipment rinsate

All MS/MSD samples will be entered in the same line as the field sample on the COC. The total number of sample containers submitted will be entered on the COC and "MS/MSD" will be indicated in the comments section.

Year/Quarter#: Year/Quarter indicators will be used for samples collected from monitoring wells. Each round of sampling will have a distinct identification number:

"08" = year 2008

"A" = Sampling during the first quarter at the site

Depth Interval: Depth indicators will be used for soil samples collected using direct push technology. The number will reference the depth interval (in feet) of the sample:

2-3 = 2 to 3 ft bgs

Under this sample designation format, "ASR2.212-GP41-TW01-08A" would mean the following:

ASR2.212-GP41-TW01-08A MRP Gun Position 41 (ASR 2.212)
ASR2.212-GP41-TW01-08A Groundwater sample from temporary well #1
ASR2.212-GP41-TW01-08A Sampled during the first quarter of 2008

This sample designation format will be followed throughout the project. Required deviations to this format in response to field conditions will be documented in the log book.

3.6.2.5 Sample Packaging and Shipping

Samples will be packed in a cooler with bubble wrap packaging material and double-bagged ice. The samples will be either picked up at the site by the analytical laboratory or shipped to the laboratory via overnight courier. The Field Team Leader (FTL) is responsible for the following activities related to shipment of the samples:

- Verification that all sample bottles are correctly labeled, sealed, and packaged
- Check to ensure that sample bottles in each cooler correspond to the accompanying COC form
- Affixing a custody seal to each cooler
- Use of appropriate labels and forms required for shipment

Custody of the samples will be maintained and documented at all times. COC will begin with the collection of the samples in the field and will continue through the analysis of the sample at the analytical laboratory (sampler's must transfer custody to the person responsible for shipping the samples).

3.6.3 Investigation-Derived Waste Management

All investigation-derived waste (IDW) generated during the investigation will be managed in accordance with Section 10 of the MRP Master Project Plans. IDW includes soil cuttings from the DPT borings and liquid waste (e.g., purged groundwater or decontamination fluids) generated during temporary well development and sampling.

3.7 Health and Safety Plan

The HSP is provided in **Appendix D**. Due to the potential presence of MEC at this site, MEC avoidance techniques will be employed throughout the field investigation to ensure the safety of all onsite personnel. Procedures for conducting MEC avoidance are provided in the HSP.

3.8 Data Documentation and Processing Procedures

Documentation and processing of field data, lab data, and investigation results will be completed in accordance with Section 7.2 of the MRP Master Project Plans.

3.9 Project File Requirements

This project will require the administration of a central project file. Project data and records will be managed in accordance with Section 7.3 of the MRP Master Project Plans.

MEC Intrusive Investigation Plan

Based on the results of the DGM survey a MEC intrusive investigation of selected geophysical anomalies will also be conducted to evaluate the nature and density of MEC that may be present at Gun Position 41. The equipment, approach, methods, operation procedures and quality control to be used during the MEC intrusive investigation is detailed below.

4.1 Planning

The following actions require advanced planning and will be conducted prior to mobilization:

- Finalize procurement actions for items and services needed during the mobilization.
- Hold a pre-mobilization meeting and Operations Readiness Review with the project team.
- Coordinate with NAVFAC Project Manager (PM) and Base Point of Contact on notification to local stakeholders of upcoming project activities.
- Reconfirm site personnel documentation of proper training, certifications, and medical monitoring.
- Coordinate with the MCB Camp Lejeune EOD Safety Specialist for potential emergency support for MEC identification and disposal.

4.2 Site Preparation

The following subsections describe the procedures associated with site preparation, including mobilization of personnel and equipment and the activities required to prepare the site for intrusive activities.

4.2.1 Mobilization

A mobilization period will include identifying, briefing, and mobilizing staff and securing and deploying equipment. Mobilization activities include general activities, establishing a command post, and a kickoff and safety meeting.

4.2.1.1 General Activities

- Identify/procure, package, ship, and inventory project equipment, including geophysical detection equipment, hand tools and supplies, portable toilets, and any other miscellaneous supplies.

- Coordinate with local agencies, including police, hospital, and fire department, as appropriate.
- Coordinate communications with MCB Camp Lejeune EOD and other logistical support.
- Finalize operating schedules.
- Establish MD/non-MEC scrap storage area.
- Organize support facilities and test communication equipment.
- Test and inspect equipment.
- Assemble and transport the work force.
- Conduct site-specific training on the WP, HSP, and MEC procedures and hazards.
- Verify that all forms and project documentation are in order and project team members understand their responsibilities with regard to completion of project reporting requirements.

4.2.1.2 Command Post

- A project command post will be established in an area that is convenient to intrusive activities, but outside the exclusion zones (EZs) that will be established for intrusive activities.
- A field office equipped with power and communications will be established at the command post. The field office will be the central point of communications for the project and the command location for direction and coordination of intrusive activities at Gun Position 41. Personnel will report to this building at the beginning of each workday for the daily H&S briefing. Site documents, including H&S records, will also be maintained in the field office.
- Sanitary facilities will be located at the command post.
- Lockable storage will be provided, either in the field office or in storage trailers, for portable field equipment.

4.2.1.3 Kickoff/Safety Meeting

During mobilization, a kickoff and site safety meeting will be conducted. This meeting will include a review of this WP and review and acknowledgment of the HSP by all site personnel. Additional meetings will occur as needed, as new personnel, visitors, and/or subcontractors arrive at the site.

4.3 MEC Removal Operations

Anomaly Reacquisition/Intrusive Investigation is the only MEC removal technique anticipated to be employed during the MEC intrusive investigation at Gun Position 41. This operation will be performed using hand excavation procedures to identify the source of individual anomalies following reacquisition operations.

4.3.1 Anomaly Reacquisition/Intrusive Investigation

All geophysical anomalies identified for excavation will be reacquired by an intrusive investigation team, composed of UXO technicians, to an exact location using RTK GPS and handheld magnetometer. After locating the approximate anomaly position with the GPS, the magnetometer will be used to confirm the exact position of the anomaly. If the anomaly is not immediately intrusively investigated, the location will be flagged using a PVC flag with the unique identifier number recorded in indelible ink. The location will be flagged one 1 foot (ft) north of the actual field location of each reacquired anomaly shown on the tracking sheet.

Excavation of individual geophysical anomalies will be performed by qualified UXO technicians using hand-excavation tools. The UXO teams performing this work will be composed of at least one UXO Technician II and up to four additional UXO Technicians II or I supervised by a Technician III. Details associated with this operation are included in **Appendix E**, MEC Removal Standard Operating Procedures, of this WP. The Standard Operating Procedure will be provided by the subcontractor once procured.

Small hand tools, such as shovels, spades, trowels, and pry bars, will be used to access potential MEC/MPPEH. Hand tools will be used for the majority of the items, which generally are expected to be found near the surface. The following basic technique will be used for anomaly excavation:

MEC Removal Standard Operating Procedures

- The UXO technician will investigate within a 1-meter (m) radius of the flagged anomaly with an appropriate geophysical instrument.
- Until identified otherwise, the anomaly is assumed to be MEC. Excavation will be initiated adjacent to the subsurface anomaly. The excavation will continue until the excavated area has reached a depth below the top of the anomaly as determined by frequent inspection with an appropriate geophysical instrument.
- Using progressively smaller and more delicate tools to remove the soil carefully, the excavation team will expand the sidewall to expose the metallic item for inspection and identification without moving or disturbing the item.
- Once the item is exposed for inspection, the excavation team will determine if it is MEC.
- If the item is MEC, it will be handled as discussed in Section 4.6.
- If the item is not MEC, it will be removed and the area will be rechecked with an EM-61 to ensure that a MEC item was not hidden beneath the removed item. The excavation team will then annotate the results of the excavation on the dig sheet and move on to the next marked geophysical anomaly.

4.4 Removal Verification

The following is the procedure to be followed for quality control QC inspections of the MEC intrusive investigation:

1. After the dig team intrusively investigates an anomaly location, the hole is to be left open to the depth investigated and the PVC flag placed in the hole or bent after the investigation is completed.
2. The UXO QC Specialist (UXOQCS) will inspect at least 10% percent of the intrusively investigated anomaly locations using an EM-61 geophysical instrument to determine whether all detectable metallic items within a two-foot radius of the hole to a depth of two feet have been removed. The locations checked will be distributed in a spatially representative sample across each grid.
3. All holes related to intrusive investigations will be filled back to original grade or covered before departing the project site each day.
4. Anomaly locations inspected, along with results of the inspection and corrective actions planned in the event that the UXOQCS determines that inspection results require a change in intrusive team procedures or a re-performance of any work, will be documented by USA and provided to the CH2M HILL geophysicist.
5. Additional QC analysis of intrusive results vs. original amplitude of geophysical anomalies will be performed by the CH2M HILL Project Geophysicist. Anomaly locations that are determined to need re-investigation through this process will be re-inspected.

4.5 Demobilization

Full demobilization will occur when the project is completed and appropriate QA/QC checks have been performed. Personnel who are no longer needed during the course of field operations may be demobilized prior to the final project completion date. The following will occur prior to demobilization:

- All areas to be investigated will be verified as completed.
- Restoration of the site to an appropriate level will be verified.
- All equipment will be inspected, packaged, and shipped to the appropriate location.
- All facilities-support infrastructures will be dismantled and shipped to the appropriate location, and the field site will be returned to the original condition prior to mobilization.

4.6 Procedures for Reporting and Disposition of MEC and MPPH Items

This section discusses the procedures for reporting and disposing of MEC and MPPEH items encountered during the project, including the responsibilities of personnel, overall safety precautions, data reporting, transportation, safe holding areas, operations in populated/sensitive areas, demolition operations, and required engineering controls and EZs for intrusive operations and intentional detonations.

4.6.1 Responsibilities of Personnel

The general responsibilities of project personnel are described in Section 2.4.

4.6.2 Overall Safety Precautions

The overall safety precautions described in Section 2.5.1 of the MRP Master Project Plan will be adhered to during the intrusive investigation.

Qualified UXO personnel will dispose of all MEC items using blow-in-place (BIP) procedures by countercharging these items with an explosive donor charge and detonating the donor charge. This will be performed by a demolition team consisting of one UXO Technician III as the Demolition Supervisor and two UXO Technician II personnel, with the SUXOS responsible for the operation.

4.6.3 Data Reporting

Data reporting for each metallic anomaly will be done in accordance with Section 2.5.2 of the MRP Master Project Plan.

4.6.4 Operations in Populated and Sensitive Areas

There are no populated areas located directly within the Gun Position 41 exclusion zone for intrusive and demolition activities; however, there is a small training trail, Red Trail, which runs through the northwest corner the site. The Red Trail will be closed during MEC intrusive and if required, detonation operations due to the trail being located within the public transportation route (PTR) distance on more than half of the investigation area. The SUXOS will coordinate with Base operations to implement traffic controls (**Figures 4-1 and 4-2**). As shown on **Figure 4-1**, no buildings are located within the Inhabited Building Distance (IBD). There are no current sensitive habitats or threatened and endangered species located within the project area.

4.6.5 Exclusion Zones and Separation Distance

Based on the types of munitions used at Gun Position 41, the Munition with the Greatest Fragmentation Distance (MGFD) assumed for the site is a net explosives weight (NEW) RDX 0.06025 pound (lb) Fuze Mechanical Time Super Quick (MTSQ). In addition, of all the suspected munitions that may have been used at the Gun Position 41, a NEW 38.8 lb Comp B 8-inch M106 High Explosives (HE) will be included as a contingency in the unlikely event that such an item is identified during intrusive operations. Explosive Safety Quantity Distance (ESQD) arcs were developed based on the primary and contingency MGFD calculations and are shown on **Figures 4-1 and 4-2**, respectively.

Primary and contingency ESQD values are identified on **Tables 4-1 and 4-2** respectively, which include the team separation distance (TSD) for personnel conducting intrusive operations within Gun Position 41, the minimum separation distance (MSD) for non-essential personnel, the public transportation route (PTR) distance, and the inhabited building distance (IBD) for the Fuze MTSQ, the 8 inch M106 HE, and MPPEH under specified scenarios.

If, during the course of this project, a MEC item with a greater fragmentation range than the primary MGFDF is encountered, the ESQD arcs will be adjusted to the contingency MGFDF distances. In the unlikely case a MEC item with a greater fragmentation range than the contingency MGFDF is encountered, the ESQD arcs will be adjusted and the ESS will be amended.

4.7 Scrap and MD Disposition

4.7.1 Inspection and Segregation

The approach for collecting, inspecting, and segregating site debris is discussed in Section 2.6.1 of the MRP Master Project Plan. If the item is identified as MEC, it is handled as described in Section 6.

4.7.2 Inspection, Certification, and Verification

MPPEH will be inspected, certified, and verified in accordance with Section 2.6.2 of the MRP Master Project Plan. MPPEH that cannot be certified and verified as "Safe" will remain at the grid collection point and will be treated in the same manner as MEC (see Section 6).

4.7.3 Recording, Reporting, and Implementation of Lessons Learned during the Project

Lessons learned will be performed in accordance with Section 2.7 of the MRP Master Project Plan.

SECTION 5

Explosives Management Plan

The management of explosives to support the removal and disposal of MEC and MPPEH items that may be discovered during the investigation at Gun Position 41 will be done in accordance with Section 3 of the MRP Master Project Plan.

SECTION 6

Explosives Siting Plan

Explosives safety criteria for planning and siting explosives operations for the MEC removal action at Gun Position 41 are provided in Section 4 of the MRP Master Plan. There are no planned or established MEC detonation areas. MEC will be blown in place where it is found. In addition, UXO collection points will not be used because items will be disposed of at the location where they are encountered.

Quality Control Plan

All applicable work conducted by CH2M HILL and its subcontractors at Gun Position 41 will be performed in accordance with the QCP in Section 8 of the MRP Master Project Plans. The QCP describes the QC approach and procedures to be employed during the investigation of Gun Position 41. The QCP is divided into two parts: Section 8.1 addresses environmental investigation activities and Section 8.2 addresses MEC avoidance, surveying, and DGM activities.

The specific QC audit procedures for the definable features of work (DFOW) to be employed at Gun Position 41, including the phase during which it is performed, the frequency of performance, the pass/fail criteria, and actions to take if failure occurs, are presented in **Table 7-1**.

Environmental Protection Plan

8.1 Regional Ecological Summary

A summary of the regional ecological is provided in Section 9.1 of the MRP Master Project Plans (CH2M HILL, 2007).

8.2 Endangered/Threatened Species within the Project Site

Many protected species have been sited in the vicinity of and aboard MCB Camp Lejeune such as the American alligator, the green sea turtle, the loggerhead sea turtle, the piping plover, the red-cockaded woodpecker, bald eagle, seabeach amaranth, and the rough-leaf loosestrife (Marine Corps, 2006). **Table 8-1** lists those species that could occur in or adjacent to MCB Camp Lejeune that are listed as threatened, endangered, or of special concern by the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act of 1973, as amended.

MCB Camp Lejeune has active programs in place to protect the three federally protected avian species (American bald eagle, piping plover, and red cockaded woodpecker) that are known to occur on the base. Gun Position 41 is not within the vicinity of any of the current red-cockaded woodpecker management areas. However, the Gun Position 41 site is within designated future habitat for the red-cockaded woodpecker.

A bald eagle's nest is documented aboard MCB Camp Lejeune, located at the junction of Sneads Creek and the New River, 3.0 miles northeast from the Gun Position 41. Three protective buffers that restrict ground and air-use activities have been established at approximately 750 ft; 1,000 ft; and 1,500 ft from the nest site. Gun Position 41 is not within any of these buffer zones. Non-nesting eagles may use Gun Position 41 for foraging habitat. However, the proposed work is not expected to impact any special habitat where eagles are concentrating.

Suitable habitat for the piping plover does not exist at the Gun Position 41.

Gun Position 41 is approximately 6.2 miles from the Atlantic Coast. The federally protected marine species (e.g., green sea turtle, leatherback sea turtle, loggerhead sea turtle, West Indian manatee) listed in **Table 8-1** are unlikely to inhabit Gun Position 41.

The eastern cougar is the only federally listed mammal species that could occur in Onslow County. The only extant population of eastern cougar is located in south Florida and the species has not been observed in North Carolina in over 50 years.

Two of the four federally listed plant species have been identified on the base: rough-leaved loosestrife and seabeach amaranth. Approximately 22 rough-leaved loosestrife sites are found on Camp Lejeune with 76 acres buffered and marked to protect this species. Rough-leaved loosestrife sites are visited annually to visually inspect for changes in extent and

apparent health. Approximately half of the rough-leaved loosestrife sites occur within protected red-cockaded woodpecker sites, obviating the need for marking each of these sites individually. The other sites, mostly falling within the Greater Sandy Run Area are marked with white paint around a perimeter that extends 100 ft from the outermost individuals. None of these sites are located on or adjacent to Gun Position 41.

Seabeach amaranth is an annual that has been described as a dune-builder because it frequently occupies areas seaward of primary dunes often growing closer to the high tide line than any other coastal plant. As such, this plant is generally found along Onslow Beach and thus is not located on or adjacent to Gun Position 41.

Environmental reviews completed in preparation for the INRMP determined that the remaining species listed in **Table 8-1** are not expected to exist at the site. No adverse impacts to listed species are expected to result from the proposed work at Gun Position 41. Project design features have been developed to prevent impacts to listed species.

8.3 Wetlands within the Project Site

Jurisdictional wetland areas are not known to be located at Gun Position 41. No wetlands on or downstream of the Gun Position 41 area are expected to be impacted by the project. Due to the size of the area of investigation, the site is below the threshold for requiring a storm water pollution prevention plan. However if the potential for runoff to jurisdictional wetlands exist, appropriate protection measures will be put in place.

8.4 Cultural and Archaeological Resources within the Project Site

The environmental sampling and DGM activities proposed to support this work plan involve only a limited degree of intrusive activity. The probability that any significant cultural or archeological resources will be impacted by the field investigation is low. Consultation with the base archaeologist confirmed that no cultural or archaeological resources are known to lie within the area of investigation. If any unmapped cultural or archaeological materials or resources are discovered within the project area, the Base archaeologist will be notified to provide guidance on performing further work in the area.

8.5 Water Resources within the Project Site

As shown in **Figure 1-1**, the Gun Position 41 does not encompass nor is it bounded or bordered by surface water bodies. No water resources are expected to be impacted by the project. There is adequate vegetative buffer surrounding the sites to protect surface water from additional runoff. Should clearing of vegetation be required in areas adjacent to a water body, appropriate silt barriers or other best management practices (BMP) will be put in place to prevent sediment from migrating to the water body.

8.6 Coastal Zones within the Project Site

Onslow County is subject to the rules and policies of the North Carolina Coastal Resources Commission, which administers the Coastal Area Management Act (CAMA). The CAMA requires permits for development in Areas of Environmental Concern (AEC) if it meets all of the following conditions:

- It is in one of the 20 counties covered by CAMA.
- It is considered "development" under CAMA.
- It is in, or it affects, an AEC established by the Coastal Resources Commission.
- It doesn't qualify for an exemption.

"Development" includes activities such as dredging or filling coastal wetlands or waters, and construction of marinas, piers, docks, bulkheads, oceanfront structures, and roads.

The PA/SI activities at the Gun Position 41 will include surface investigations and the collection of subsurface soil and groundwater samples using DPT. These activities do not fit the definition of "development" under CAMA; therefore, a CAMA permit is not necessary for this project.

8.7 Vegetation to be removed within the Project Site

Vegetation removal is anticipated in association with the field investigations described in this WP. Vegetation will primarily be removed for geophysical transects and temporary well installation. It is estimated that 100 percent of vegetation less than three-inches diameter will be cut to allow for the use of DGM equipment. Only vegetation up to three-inches in diameter will be cut as part of the investigation. Procedures in place will prevent excessive exposure of bare ground. Consultation with the base wildlife biologist confirms no threatened or endangered species have been located within the project area. However, Gun Position 41 is within designated future habitat for the red-cockaded woodpecker. Any cutting of large trees will have to be reviewed by the Base wildlife biologist.

8.8 Existing Waste Disposal Sites within the Project Site

No known waste disposal sites are present within the area of investigation.

8.9 Compliance with Applicable or Relevant and Appropriate Requirements

CH2M HILL will follow all applicable regulations concerning environmental protection, pollution control, and abatement for the proposed project work as described in Section 9.3 of the MRP Master Project Plans. No permits have been determined to be required for the proposed work.

8.10 Detailed Procedures and Methods to Protect and/or Mitigate the Resources/Sites Identified

During the proposed work, a general survey of the project area will be conducted by the field personnel to identify obvious environmental concerns. The PM, in conjunction with a qualified ecologist, will provide instructions to field personnel regarding the protection of onsite environmental resources. Such protective measures will include, but are not limited to, the following:

- Should federally protected plant be identified within the project area, the specimens will be flagged for easy relocation and verification.
- Should cultural or archaeological material or resource be discovered within the project area, a qualified archaeologist will be notified to provide guidance on performing further work in the area.
- The PM will seek the guidance of the qualified ecologist to determine appropriate mitigation measures in the event that the performed work activities impact an environmental resource.

SECTION 9

References

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Tables

TABLE 2-1

Project Personnel Contact Information

*Work Plan for Focused Preliminary Assessment/Site Inspection, Former Gun Position 41A & 41B**MCB Camp Lejeune**Jacksonville, North Carolina*

Name/Title/Organization	Mailing Address	Telephone/Fax/E-mail
Phil Smith Program Manager	CH2M HILL 5700 Cleveland Street Suite 101 Virginia Beach, VA 23462	757-518-9666 (office) 757-460-4592 (fax) Phillip.Smith@ch2m.com
Jessica Skeeane, P.E. Project Manager	CH2M HILL 4824 Parkway Plaza Blvd Suite 200 Charlotte, NC 28217	704-329-0073 (office) 704-329-0141 (fax) Jessica.Skeeane@ch2m.com
Matt Louth Activity Manager	CH2M HILL 5700 Cleveland Street Suite 101 Virginia Beach, VA 23462	757-518-9666 (office) 757-460-4592 (fax) Matt.Louth@ch2m.com
Thomas M. Roth, P.E. Senior Consultant	CH2M HILL 2607 Lavista Road Decatur, GA 30033-1725	404-474-7640 (office) 404-259-6674 (cell) 770-604-9183 (fax) Tom.Roth@ch2m.com
Michael Goldman, C.I.H. Program H&S Manager	CH2M HILL 1000 Abernathy Road Suite 1600 Atlanta, GA 30328	770-604-9095 (office) 770-604-9183 (fax) Michael.Goldman@ch2m.com
Ben Redmond Munitions Response Market Segment Director	CH2M HILL 2035 Lakeside Centre Way Suite 200 Knoxville, TN 37922	865-560-2801 (office) 865-560-2802 (fax) bredmond@ch2m.com
Tim Garretson MEC Integrator/Senior MEC Technical Consultant	CH2M HILL 5700 Cleveland Street Suite 101 Virginia Beach, VA 23462	757-671-8311 (office) 757-460-4592 (fax) timothy.garretson@ch2m.com
Dan Young, CSP, CSRP Corporate MEC H&S Manager	CH2M HILL 10687 Aloe Lane Lillian, AL 36549	251-962-2963 (home office) 251-752-0148 (cell) Dan.Young@ch2m.com
Kevin Lombardo MR Operations Manager	CH2M HILL 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703-376-5175 (office) 703-608-8247 (cell) Kevin.Lombardo@ch2m.com

TABLE 3-1
 Summary of Sampling Program
 Work Plan for Focused Preliminary Assessment/Site Inspection, Former Gun Position 41A & 41B
 MCB Camp Lejeune
 Jacksonville, North Carolina

Sample Media	Sample ID Number	Sample Depth/Location and Rationale	Analysis			
			Explosives Residues	Perchlorate	RCRA Metals	RCRA Metals (Dissolved)
Multi-Increment Surface Soil	ASR2.212-GP41--DU01-SS01 through ASR2.212-GP41-DU04-SS03	Collected from an interval of 0 - 2 inches bgs. Will allow for characterization of MC and metals in surface soil across the site.	x	x	x	
Direct Push Soil	ASR2.212-GP41-IS01-T-B through ASR2.212-GP41-IS04-T-B	Collected from a 2 ft interval just above the water table at each location shown on Figure 3-2. Will allow for characterization of soil across site.	x	x	x	
Temporary Well Groundwater	ASR2.212-GP41-TW01 through ASR2.212-GP41-TW04	Samples from TW-01 through TW-04 will be collected from 20 ft below ground surface. Will allow for characterization of groundwater across site, including upgradient and downgradient locations.	x	x	x	x

Notes and Abbreviations:
 For Direct Push Soil Samples: "T-B" refers to the top depth and bottom depth of the sample interval

TABLE 3-2

Analyses, Bottleware, Preservation, and Holding Time Requirements

Work Plan for Focused Preliminary Assessment/Site Inspection, Former Gun Position 41A & 41B

MCB Camp Lejeune

Jacksonville, North Carolina

Media	Analysis	Method	Container	Preservation & Storage	Holding Times
Soil	Explosive Residues	SW-846 8330	1x8-oz bottle, Teflon cap(8330)	4°C	7 days to extraction, 40 days from extraction to analysis
	Perchlorate	USEPA 6850	1x8-oz bottle, Teflon cap	4°C	14 days to extraction, 40 days from extraction to analysis
	Total Metals	SW-846 6010B/7000	1x4-oz bottle, Teflon cap	4°C	6 months, Mercury: 28 days
Groundwater	Explosive Residues	SW-846 USEPA Method 8330	2x1-L amber jar	4°C	7 days to extraction, 40 days from extraction to analysis
	Perchlorate	USEPA 6850	1x1-L Poly bottle	4°C	7 days to extraction, 40 days from extraction to analysis
	Total and Dissolved Metals	SW-846 6010B/7000	1x1-L Poly bottle	HNO ₃ to pH <2 and cool to 4°C	6 months, Mercury: 28 days

Notes:

L = Liter; oz = ounce; HNO₃ = nitric acid

TABLE 3-3

Required QA/QC Samples

*Work Plan for Focused Preliminary Assessment/Site Inspection, Former Gun Position 41A & 41B**MCB Camp Lejeune**Jacksonville, North Carolina*

Sample Type	Description	Frequency	Analytes
Field Blank	Designed to detect contamination in the decontamination water. A field blank is decontamination water collected directly in the sample bottle. It shall be handled like a sample and transported to the laboratory for analysis.	One field blank from each source of decontamination water for each sampling event, where a sampling event is defined as one week	All laboratory analyses requested for the environmental samples collected at the site for that week
Equipment Blank	Designed to detect contamination of environmental samples caused by contamination of sampling equipment. An equipment blank is analyte-free water that is poured into or pumped through the sampling device, transferred to a sample bottle, and transported to the laboratory for analysis.	One per each day of sampling	All laboratory analyses requested for environmental samples collected at the site on that day
Field Duplicate	Designed to check precision of data in the laboratory. A field duplicate is a sample collected in addition to the native sample at the same sampling location during the same sampling event.	10%	Same parameters as native sample
MS/MSD	Designed to evaluate potential matrix interferences, accuracy, and precision. Three aliquots of a single sample—one native and two spiked with the same concentration of matrix spike compounds—are analyzed.	5%	Same parameters as native sample

TABLE 3-4

Sample Collection Frequencies

*Work Plan for Focused Preliminary Assessment/Site Inspection, Former Gun Position 41A & 41B**MCB Camp Lejeune**Jacksonville, North Carolina*

Analysis	Sample Matrix	Field Samples	Field Duplicates	Equipment Blanks	Field Blanks	MS/MSDs
Surface Soil Samples						
Explosives Residues		12	2	3	1	1
Perchlorate	Solid	12	2	3	1	1
Total Metals		12	2	3	1	1
Subsurface Soil Samples						
Explosives Residues		4	1	4	1	1
Perchlorate	Solid	4	1	4	1	1
Total Metals		4	1	4	1	1
Temporary Well Groundwater Samples						
Explosives Residues		4	1	4	1	1
Perchlorate		4	1	4	1	1
Total Metals	Aqueous	4	1	4	1	1
Dissolved Metals		4	1	4	1	1

Notes:

MS/MSD = Matrix Spike and Matrix Spike Duplicate pair

Field duplicates are collected at the rate of 1 for every 10 environmental samples

Equipment rinsate blanks are typically collected at the rate of 1 per day per media

Field blanks are typically collected at the rate of 1 per week during sampling

MS/MSDs are collected at the rate of 1 for every 20 samples

TABLE 4-1

Exclusion Zone Parameters – Primary MGF D

Work Plan for Focused Preliminary Assessment/Site Inspection, Former Gun Position 41A & 41B

Scenario	Item	Net Explosives Weight (NEW)	TSD (feet)	MSD for Public & Non-essential Personnel (feet)	IBD (feet)	PTR (feet)
Unintentional Detonation	Fuze MTSQ M564	RDX 0.06025 lb	16	300	NA	NA
Intentional Detonation	Fuze MTSQ M564	RDX 0.06025 lb	300	300	NA	NA
Onsite Consolidation, Storage, and Re-inspection	MPPEH	1 lb	NA	NA	40 ^a	NA

NOTES:

All exclusion zone parameters are based on the fragmentation distances in Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP) 16

^a Based on K40 of the NEW

IBD – Inhabited Building Distance

MPPEH – Material Presenting a Potential Explosive Hazard

MSD – Minimum Separation Distance

MTSQ – Fuze Mechanical Time Super Quick

NA – Not Applicable

PTR – Public Transportation Route

TSD – Team Separation Distance

TABLE 4-2

Exclusion Zone Parameters – Contingency MGF

Work Plan for Focused Preliminary Assessment/Site Inspection, Former Gun Position 41A & 41B

Scenario	Item	Net Explosives Weight (NEW)	TSD (feet)	MSD for Public & Non-essential Personnel (feet)	IBD (feet)	PTR (feet)
Unintentional Detonation	8-inch M106 HE	38.8 lbs of Comp B	136	530	NA	NA
Intentional Detonation for public and all personnel	8-inch M106 HE	38.8 lbs of Comp B	NA	3, 287	NA	NA
Onsite Consolidation, Storage, and Re-inspection	MPPEH	1 lb	NA	NA	40 ^a	NA

NOTES:

All exclusion zone parameters are based on the fragmentation distances in DDESB TP 16

^a Based on K40 of the NEW

IBD – Inhabited Building Distance

MPPEH – Material Presenting a Potential Explosive Hazard

MSD – Minimum Separation Distance

MTSQ – Fuze Mechanical Time Super Quick

NA – Not Applicable

PTR – Public Transportation Route

TSD – Team Separation Distance

TABLE 7-1
 Definable Features of Work Auditing Procedures
 Work Plan for Focused Preliminary Assessment/Site Inspection, Former Gun Position 41A & 41B
 MCB Camp Lejeune
 Jacksonville, North Carolina

Definable Feature of Work with Auditable Function	Responsible Person(s) ¹	Audit Procedure ²	QC Phase ³	Freq. of Audit	Pass/Fail Criteria	Action if Failure Occurs
Planning						
Geographical Information System (GIS) Setup (Pre-mobilization Activities)	Project GIS Manager	Verify GIS system has been set up and is ready for site data.	PP	O	GIS system has been set up and is ready for site data.	Do not proceed with field activities until criterion is passed.
Document management and control (Pre-mobilization Activities)	Project Manager/Site Manager	Verify appropriate measures are in place to manage and control project documents.	PP	O	Appropriate measures are in place to manage and control project documents.	Do not proceed with field activities until criterion is passed.
Data Management (Pre-mobilization Activities)	Project Manager, Project Geophysicist	Verify appropriate measures are in place to manage and control project data.	PP	O	Appropriate measures are in place to manage and control project data.	Do not proceed with field activities until criterion is passed.
Subcontracting (Pre-mobilization Activities)	Project Manager, Site Manager	Verify subcontractor qualifications, training, and licenses.	PP/IP	O	Subcontractors' qualifications, training, and licenses are up to date and acceptable.	Ensure subcontractor provides the qualifications, training, and licenses or change subcontractor.
Technical and Operational approach (Project Planning)	Project Manager/Site Manager	Verify technical and operational approaches have been agreed on by the project team.	PP/IP	O	Technical and operational approaches have been agreed on by project team and incorporated into the Work Plans.	Do not proceed with field activities until criterion is passed
Geophysical Prove-out (GPO) Plan preparation and approval	Project Manager/Site Manager	Verify GPO Plan has been prepared and approved.	PP/IP	O	GPO Plan has been approved	Do not proceed with field activities until criterion is passed.
Work Plan preparation and approval	Project Manager	Verify Work Plan prepared and approved.	PP/IP	O	Work Plan has been approved	Do not proceed with field activities (excluding site mobilization) until criterion is passed.
Field Operations						
Site preparation (Mobilization)	Project Manager, Site Manager	Verify local agencies are coordinated.	PP/IP	O	Local agencies are coordinated.	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	Project Manager, Site Manager	Verify equipment has been inspected and tested.	PP/IP	E	Equipment passes inspection and testing.	Proceed only with activities for which equipment has passed inspection and testing.
Site preparation (Mobilization)	Project Manager, Site Manager	Verify communications and other logistical support are coordinated.	PP/IP	O	Communications and other logistical support are coordinated.	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	Project Manager, Site Manager	Verify emergency services have been coordinated.	PP/IP	O	Emergency services are coordinated.	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	UXOQCS, Project Manager, Site Manager	Verify site-specific training is performed and acknowledged.	PP/IP	O	Site-specific training is performed and acknowledged	Do not proceed with field activities until criterion is passed.
Site preparation (Mobilization)	UXOQCS, Project Manager, Site Manager	Hold pre-mobilization meeting and Operations Readiness Review (ORR) with the project team.	PP/IP	O	Project plans are reviewed and acknowledged by team members.	Do not proceed with field activities until criterion is passed.
Site Preparation (Site Survey)	Site Manager	Verify benchmarks for survey have been established and documented.	PP/IP	O	Benchmarks for survey have been established and documented.	Ensure benchmarks for survey are established and documented prior to performing survey.
Site Preparation (Site Survey)	Site Manager	Verify site boundaries and grids have been established.	PP/IP	O	Site boundaries and grids have been established.	Do not proceed with dependent field activities until criterion is passed.
Site Preparation (Site Survey)	Site Manager	Verify surveyor notes are legible, accurate, and complete.	IP	O	Surveyor notes are legible, accurate and complete.	Ensure surveyor replaces deficient notes with legible, accurate and complete notes.
Site Preparation (Vegetation Removal)	Site Manager	Verify personnel qualifications and training.	PP/IP	O	Personnel qualifications and training are appropriate.	Ensure subcontractor provides appropriately trained and qualified personnel or replace with properly trained personnel.
Site Preparation (Vegetation Removal)	Site Manager	Verify environmental controls are correct and functional.	IP/FP	O	Environmental controls are correct and functional.	Ensure that appropriate environmental controls are in place prior to proceeding with vegetation removal.
Site Preparation (Vegetation Removal)	Site Manager, UXOQCS	Verify vegetation removal is conducted IAW Work Plan.	FP	D	Vegetation removal is conducted IAW Work Plan.	Stop vegetation removal activities until full compliance can be assured and any activities not performed within compliance are re-evaluated and re-performed if necessary.

TABLE 7-1
 Definable Features of Work Auditing Procedures
 Work Plan for Focused Preliminary Assessment/Site Inspection, Former Gun Position 41A & 41B
 MCB Camp Lejeune
 Jacksonville, North Carolina

Definable Feature of Work with Auditable Function	Responsible Person(s) ¹	Audit Procedure ²	QC Phase ³	Freq. of Audit	Pass/Fail Criteria	Action if Failure Occurs
GPO Execution	Project Manager, Project Geophysicist	Verify data quality objectives (DQOs) established in GPO Plan have been accomplished.	PP/IP	O	DQOs identified in GPO Plan have been achieved	Continue with GPO until DQOs are achieved.
DGM Survey	Project Geophysicist	Verify DGM Survey conducted IAW Geophysical Investigation Plan	IP/FP	O/D	DGM Survey conducted IAW Geophysical Investigation Plan	Stop activity until full compliance can be assured and any activities not performed within compliance are re-evaluated and re-performed if necessary.
DGM Survey	Project Geophysicist	Check results of QC tests performed as specified in GIP	FP	E	QC tests must pass IAW standards determined during the GIP	If a QC test does not pass, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action.
DGM Survey	Project Geophysicist	Confirm that DGM survey DQOs established during GPO are being met.	FP	E	DGM survey DQOs are being met.	If the DQOs are not being met, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action.
DGM Data Processing	Project Geophysicist	Verify data checks specified in GIP and GPO Work Plan	FP	E	Data checks must pass in accordance with standards determined during the GPO and referenced SOPs.	If a QC test does not pass, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action.
Reacquisition Accuracy	Project Geophysicist	Confirm that anomalies are located within a 1-meter radius of flagged location as selected by DGM.	FP	E	Anomaly located within 1-meter radius of flag	If anomalies are being located beyond 1-meter radius of flag or are not being located within 1-meter radius of the flag, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action.
Intrusive Investigation	UXOQCS	Verify equipment tested IAW Section 7.0 of the Work Plan	IP/FP	D	Equipment testing performed and tests passed	Repair or replace instrument.
Intrusive Investigation	UXOQCS	Verify team separation distance is as established in Section 4.6.5 of the Work Plan	IP/FP	D	Team separation distance is appropriate for work being performed	Stop activities until appropriate separation distance is being followed
Intrusive Investigation	UXOQCS	Verify that the anomaly recovered during intrusive excavations is appropriate to the amplitude of the initial anomaly detected during the DGM.	IP/FP	D	Recovered anomaly is appropriate to the amplitude of the initial anomaly detected during the DGM.	Return to the location of the anomaly excavation to determine if additional anomalies are present. If anomalies being recovered continue to be inappropriate for the amplitude as detected during the DGM, a root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action.
Intrusive Investigation	QC Geophysicist	QC seed items to be placed at detectable depths IAW GPO Work Plan	IP/FP	E	All QC seed items in area of operation recovered.	A root-cause analysis must be performed and the project team must meet to discuss and determine appropriate action
Intrusive Investigation	UXOQCS	Verify operations are conducted IAW Work Plan, MEC Removal SOPs, and the HSP: - Survey/Sweeps - MEC Surface Sweeps - Analog Detection and Removal Actions - DGM Anomaly Investigation - Ammunition and Explosives Transportation - Explosives Storage and Accountability - Disposal/Demolition Operations - Scrap Inspection Operations	IP/FP	D	Work performed IAW Work Plan, referenced MEC SOPs, and the HSP.	Stop activity until full compliance can be assured and any activities not performed within compliance are re-evaluated and re-performed if necessary
MPPEH/MD Management	UXOQCS	Verify inspections conducted IAW Work Plan	IP/FP	D/E	Inspections being conducted IAW Work Plan	Stop activity until full compliance can be assured and any activities not performed within compliance are re-evaluated and re-performed if necessary
MPPEH/MD Management	UXOQCS	Verify certification conducted IAW Work Plan	IP/FP	D/E	Certification is conducted IAW Work Plan	Stop activity until full compliance can be assured and any activities not performed within compliance are re-evaluated and re-performed if necessary
MPPEH/MD Management	UXOQCS	Verify disposal is conducted IAW Work Plan	IP/FP	D/E	Disposal is conducted IAW Work Plan	Stop activity until full compliance can be assured and any activities not performed within compliance are re-evaluated and re-performed if necessary
Site Restoration	Site Manager	Verify the damage caused by excavation and removal of anomalies is backfilled and laid to original grade and completed IAW Work Plan.	FP	O	Damage caused by excavation and removal of anomalies is backfilled and laid to original grade	Ensure that damage caused by excavation and removal of anomalies is backfilled and laid to original grade
Demobilization	Project Manager, Site Manager	Verify facilities-support infrastructures are dismantled and shipped to appropriate location and area is returned to original condition.	FP	O	Facilities-support infrastructures are dismantled and shipped to appropriate location and site is returned to original condition.	Ensure that all support facilities are removed and that the site is returned to original condition
Final Project Reports and Closeout						

TABLE 7-1
 Definable Features of Work Auditing Procedures
 Work Plan for Focused Preliminary Assessment/Site Inspection, Former Gun Position 41A & 41B
 MCB Camp Lejeune
 Jacksonville, North Carolina

Definable Feature of Work with Auditable Function	Responsible Person(s) ¹	Audit Procedure ²	QC Phase ³	Freq. of Audit	Pass/Fail Criteria	Action if Failure Occurs
Site Specific Final Report preparation and approval	Project Manager, Project Geophysicist	Verify tabulations of all material identified/recovered during the field actions are accurate and complete.	IP	O	Tabulations of all material identified/recovered during the field actions are accurate and complete.	Ensure tabulations of all material identified/recovered during the field actions are accurate and complete.
Site Specific Final Report preparation and approval	Project Manager, Project Geophysicist	Verify all dig sheets where geophysical mapping and investigation performed are accurate and complete.	FP	O	All dig sheets where geophysical mapping and investigation performed are accurate and complete.	Ensure all dig sheets where geophysical mapping and investigation performed are accurate and complete
Archiving	GIS Manager	Verify data back-up systems are in place.	IP	O	Data back-up systems are in place	Ensure data back-up systems are in place
Project Closeout	Project Manager	Verify purchase orders have been closed out.	IP	O	Purchase orders have been closed out	Ensure purchase orders are closed out
Project Closeout	Project Manager	Verify invoices completed and approved.	IP	O	Invoices completed and approved	Ensure invoices are completed and approved

Notes:
 IAW = in accordance with

<u>QC Phase</u>	<u>Frequency</u>
PP = Preparatory Phase	O = Once
IP = Initial Phase	D = Daily
FP = Follow-up Phase	W = Weekly
	E = Each occurrence

¹ The responsible person (if other than the UXOQCS) is the individual with whom the UXOQCS will coordinate with to ensure compliance with requirements and to verify that any necessary follow-up actions are taken.

² Where appropriate, a reference has been included referring the reader to a more detailed description of the procedures being audited.

³ Documentation to be in accordance with the three-phase control process as outlined in the Quality Control Plan.

TABLE 8-1

Species Potentially Occurring on or Adjacent to Camp Lejeune, in Onslow County, Listed as Threatened, Endangered, or of Special Concern by the USFWS

Work Plan for Focused Preliminary Assessment/Site Inspection, Former Gun Position 41A & 41B

MCB Camp Lejeune

Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
<i>Anguilla rostrata</i>	American eel	FSC	The American eel is catadromous; it spawns in oceanic waters but uses freshwater, brackish and estuarine systems for most of its developmental life. Migrates in autumn to the Sargasso Sea to spawn. Occurs usually in permanent streams with continuous flow. Hides during the day in undercut banks and in deep pools near logs and boulders.
<i>Chelonia mydas</i>	Green sea turtle	T	Green turtles are generally found in fairly shallow waters (except when migrating) inside reefs, bays, and inlets. The turtles are attracted to lagoons and shoals with an abundance of marine grass and algae. Open beaches with a sloping platform and minimal disturbance are required for nesting.
<i>Caretta caretta</i>	Loggerhead sea turtle	T	The loggerhead is widely distributed within its range. It may be found hundreds of miles out to sea, as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers.
<i>Dermochelys coriacea</i>	Leatherback sea turtle	E	An open ocean species, it sometimes moves into shallow bays, estuaries and even river mouths.
<i>Trichechus manatus</i>	West Indian Manatee	E	Manatees inhabit both salt and fresh water of sufficient depth (1.5 meters to usually less than 6 meters) throughout their range.
<i>Alligator mississippiensis</i>	American alligator	T(S/A)	Rivers, swamps, estuaries, lakes, and marshes
<i>Charadrius melodus</i>	Piping plover	T	Open, sandy beaches close to the primary dune of the barrier islands and coastlines of the Atlantic for breeding. They prefer sparsely vegetated open sand, gravel, or cobble for a nest site. They forage along the rack line where the tide washes up onto the beach.
<i>Aimophila aestivalis</i>	Bachman's sparrow	FSC	Occurs only in pine forests of the southeastern U.S.
<i>Haliaeetus leucocephalus</i>	American bald eagle	T	A single bald eagle's nest is found on Camp Lejeune- at the junction of Sneads Creek and the New River near the back gate. Three protective buffers have been established at approximately 750', 1000', and 1500' from the nest site.
<i>Laterallus jamaicensis</i>	Black rail	FSC	Marsh/wetlands; The "Eastern" Black Rail can be found in appropriate saltmarsh habitat along the eastern seaboard from Connecticut to Florida and along the Gulf Coast.

TABLE 8-1

Species Potentially Occurring on or Adjacent to Camp Lejeune, in Onslow County, Listed as Threatened, Endangered, or of Special Concern by the USFWS

Work Plan for Focused Preliminary Assessment/Site Inspection, Former Gun Position 41A & 41B

MCB Camp Lejeune

Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
<i>Acipenser brevirostrum</i>	Shortnose sturgeon	E	Sturgeon inhabits the lower sections of larger rivers and coastal waters along the Atlantic coast. It may spend most of the year in brackish or salt water and move into fresh water only to spawn. The fish feeds on invertebrates (shrimp, worms, etc.) and stems and leaves of macrophytes.
<i>Rana capito capito</i>	Carolina crawfish frog	FSC	Carolina crawfish frogs live primarily in the sandhills and pine barrens of the North Carolina Coastal Plain. Crawfish frogs are more terrestrial than most frogs, generally only coming to the water to breed. They are also nocturnal, spending daylight hours underground in burrows.
<i>Puma concolor cougar</i>	Eastern cougar	E	No preference for specific habitat types has been noted. The primary need is apparently for a large wilderness area with an adequate food supply. Male cougars of other subspecies have been observed to occupy a range of 25 or more square miles, and females from 5 to 20 square miles.
<i>Passerina ciris ciris</i>	Eastern painted bunting	FSC*	Found mainly in southern states and Mexico, where the brushy, weedy shrub-scrub habitat that this bird prefers abound
<i>Ammodramus henslowii</i>	Eastern Henslow's sparrow	FSC	A species of tallgrass prairies, agricultural grasslands, and pine savannas of the eastern U.S.; the species migrates south to spend the non-breeding season in the native pine savanna habitats of the southeastern U.S.
<i>Ophisaurus mimicus</i>	Mimic glass lizard	FSC	This species is found in the southeastern Coastal Plain. They are most common in pine flatwoods and open woodlands.
<i>Picoides borealis</i>	Red-cockaded Woodpecker	E	For nesting/roosting habitat, open stands of pine containing trees 60 years old and older. Red-cockaded woodpeckers need live, older pines in which to excavate their cavities. Longleaf pines (<i>Pinus palustris</i>) are most commonly used, but other species of southern pine are also acceptable. Dense stands (stands that are primarily hardwoods, or that have a dense hardwood understory) are avoided. Foraging habitat is provided in pine and pine hardwood stands 30 years old or older with foraging preference for pine trees 10 inches or larger in diameter. In good, moderately-stocked, pine habitat, sufficient foraging substrate can be provided on 80 to 125 acres.
<i>Heterodon simus</i>	Southern hognose snake	FSC	These snakes are found in sandy fields and woods of the Coastal Plain, particularly in the Sandhills region.

TABLE 8-1

Species Potentially Occurring on or Adjacent to Camp Lejeune, in Onslow County, Listed as Threatened, Endangered, or of Special Concern by the USFWS

Work Plan for Focused Preliminary Assessment/Site Inspection, Former Gun Position 41A & 41B

MCB Camp Lejeune

Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
<i>Agrotis buchholzi</i>	Buchholz's dart moth	FSC	Found in Forested wetlands, scrub-shrub wetlands, shrubland/chaparral and coniferous woodlands. This moth is found mostly in recently burned habitats. Populations can persist up to about a decade or rarely two without fire, until litter accumulates sufficiently to cover foodplants. In most cases habitat is probably suboptimal beginning about five years after a fire.
<i>Atrytonopsis sp.</i>	a skipper	FSC	One species, the dusteds are fairly rare at the coast but found throughout North Carolina (<i>A. hianna</i>). An assumption is made that the genus is generally defined.
<i>Isoetes microvela</i>	A quillwort	FSC	Quillworts are usually restricted to areas of clean water where other plants are absent. Occasionally, quillwort may grow partly or entirely out of the water.
<i>Rhexia aristosa</i>	Awned meadowbeauty	FSC	Found in a variety of wet habitats in the Coastal Plain from New Jersey to Alabama.
<i>Lobelia boykinii</i>	Boykin's lobelia	FSC	Grows in swamps and cypress ponds from the coastal plain of Delaware to Florida. The lower portion is often immersed in water, at least seasonally.
<i>Solidago pulchra</i>	Coastal goldenrod	FSC	Bogs, freshwater habitats, grasslands
<i>Parnassia caroliniana</i>	Carolina grass-of-parnassus	FSC	Bogs, freshwater habitats, grasslands
<i>Trillium pusillum var. pusillum</i>	Carolina trillium	FSC	Grows in alluvial woods, pocosin borders and savannahs
<i>Asplenium heteroresiliens</i>	Carolina (wagner) spleenwort	FSC	Rock outcrops
<i>Rhynchospora pleiantha</i>	Coastal beaksedge	FSC	Extremely rare, found at fewer than 25 sites throughout its North Carolina-to-Alabama range
<i>Solidago villosicarpa</i>	Coastal Goldenrod	FSC	Known to occur in only 5 populations in three counties in eastern North Carolina. Three of these populations occur on Camp Lejeune. The other sites occur in Pender and Brunswick Counties. Currently the North Carolina Natural Heritage Program is conducting a survey of likely habitat to look for coastal goldenrod.

TABLE 8-1

Species Potentially Occurring on or Adjacent to Camp Lejeune, in Onslow County, Listed as Threatened, Endangered, or of Special Concern by the USFWS

Work Plan for Focused Preliminary Assessment/Site Inspection, Former Gun Position 41A & 41B

MCB Camp Lejeune

Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
<i>Thalictrum cooleyi</i>	Cooley's meadowrue	E	Cooley's meadowrue occurs in moist to wet bogs and savannahs. It grows along fireplow lines, roadside ditches, woodland clearings, and powerline rights-of-way, and needs some type of disturbance to maintain its open habitat.
<i>Carex lutea</i>	Golden sedge	E	Biologists have located golden sedge in only eight locations, all in coastal savannas in Onslow and Pender Counties that are underlain by calcareous, or chalk, deposits.
<i>Sagittaria weatherbiana</i>	Grassleaf arrowhead	FSC	Found in shallow water of brackish swamps
<i>Dichanthelium sp.</i>	Hirst's panic grass	FSC	Worldwide, Hirst's panic grass occurs in four extant populations. Historically, it was found in coastal plain habitats in the states of New Jersey, Delaware, North Carolina and Georgia. Currently Hirst's panic grass is known to exist in one site in Delaware and two known sites in North Carolina, both of which are on Camp Lejeune.
<i>Myriophyllum laxum</i>	Loose watermilfoil	FSC	Riparian habitats
<i>Calopogon multiflorus</i>	Many-flower grass-pink	FSC	Grasslands, pinelands; typically in wet areas
<i>Plantago sparsiflora</i>	Pineland plantain	FSC	Savannahs, roadsides and ditches
<i>Lindera melissifolia</i>	Pondberry	E	Associated with wetland habitats such as bottomland and hardwoods in the interior areas, and the margins of sinks, ponds and other depressions in the more coastal sites. The plants generally grow in shaded areas but may also be found in full sun.
<i>Litsea aestivalis</i>	Pondspice	FSC	Freshwater habitats
<i>Lysimachia asperulaefolia</i>	Rough-leaved loosestrife	E	Species generally occurs in the ecotones or edges between longleaf pine uplands and pond pine pocosins (areas of dense shrub and vine growth usually on a wet, peaty, poorly drained soil), on moist to seasonally saturated sands and on shallow organic soils overlaying sand. Rough-leaved loosestrife has also been found on deep peat in the low shrub community of large Carolina bays
<i>Amaranthus pumilus</i>	Seabeach amaranth	T	Occurs on barrier island beaches
<i>Allium sp.</i>	Savanna onion	FSC	Wet savannahs
<i>Scleria sp.</i>	Smooth-seeded hairy nutrush	FSC	Dry woods, pineland and savannahs (<i>S. triglomerata</i>)

TABLE 8-1

Species Potentially Occurring on or Adjacent to Camp Lejeune, in Onslow County, Listed as Threatened, Endangered, or of Special Concern by the USFWS

Work Plan for Focused Preliminary Assessment/Site Inspection, Former Gun Position 41A & 41B

MCB Camp Lejeune

Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
<i>Rhynchospora decurrens</i>	Swamp forest beakrush	FSC	Swamp forests, very rare
<i>Solidago verna</i>	Spring-flowering goldenrod	FSC	The only spring-flowering goldenrod that occurs in the Sandhills and Coastal Plain of the Carolinas. It can be found in a wide array of habitats, including pine savannas, pocosins, and pine barrens
<i>Rhynchospora thornei</i>	Thorne's beaksedge	FSC	Bogs, freshwater habitats, pinelands
<i>Dionea muscipula</i>	Venus flytrap	FSC	Bogs, pinelands

E = Endangered—A taxon in danger of extinction throughout all or a significant portion of its range.

T = Threatened—A taxon likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

FSC = Federal species of special concern—species may or may not be listed in the future.

T(S/A)—Threatened due to similarity of appearance (e.g., American alligator)—a species that is threatened due to similarity of appearance with other rare species and is listed for its protection. These species are not biologically endangered or threatened and are not subject to Section 7 consultation.

*Historic record—the species was last observed in the county more than 50 years ago.

Figures



- Legend**
- Road Centerline
 - Surface Water Course Centerline
 - Proposed MARSOC MILCON Area
 - Former Gun Position Investigation Area



Figure 1-1
 Site Location Map
 MILCON Plan Schematics and Former Gun Positions 41A & 41B
 Marine Corps Base, Camp Lejeune
 North Carolina

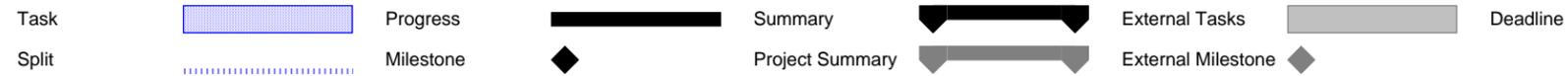
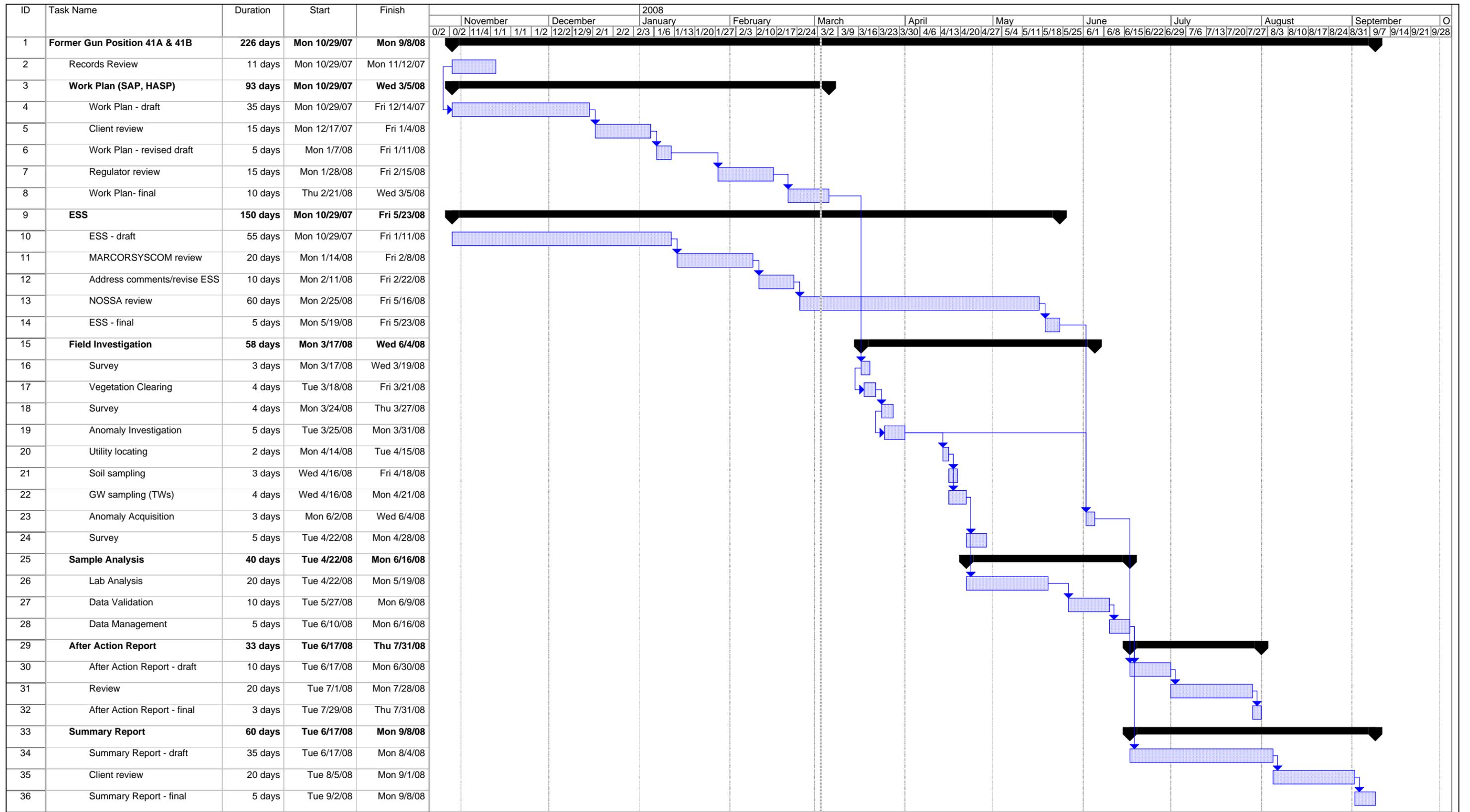
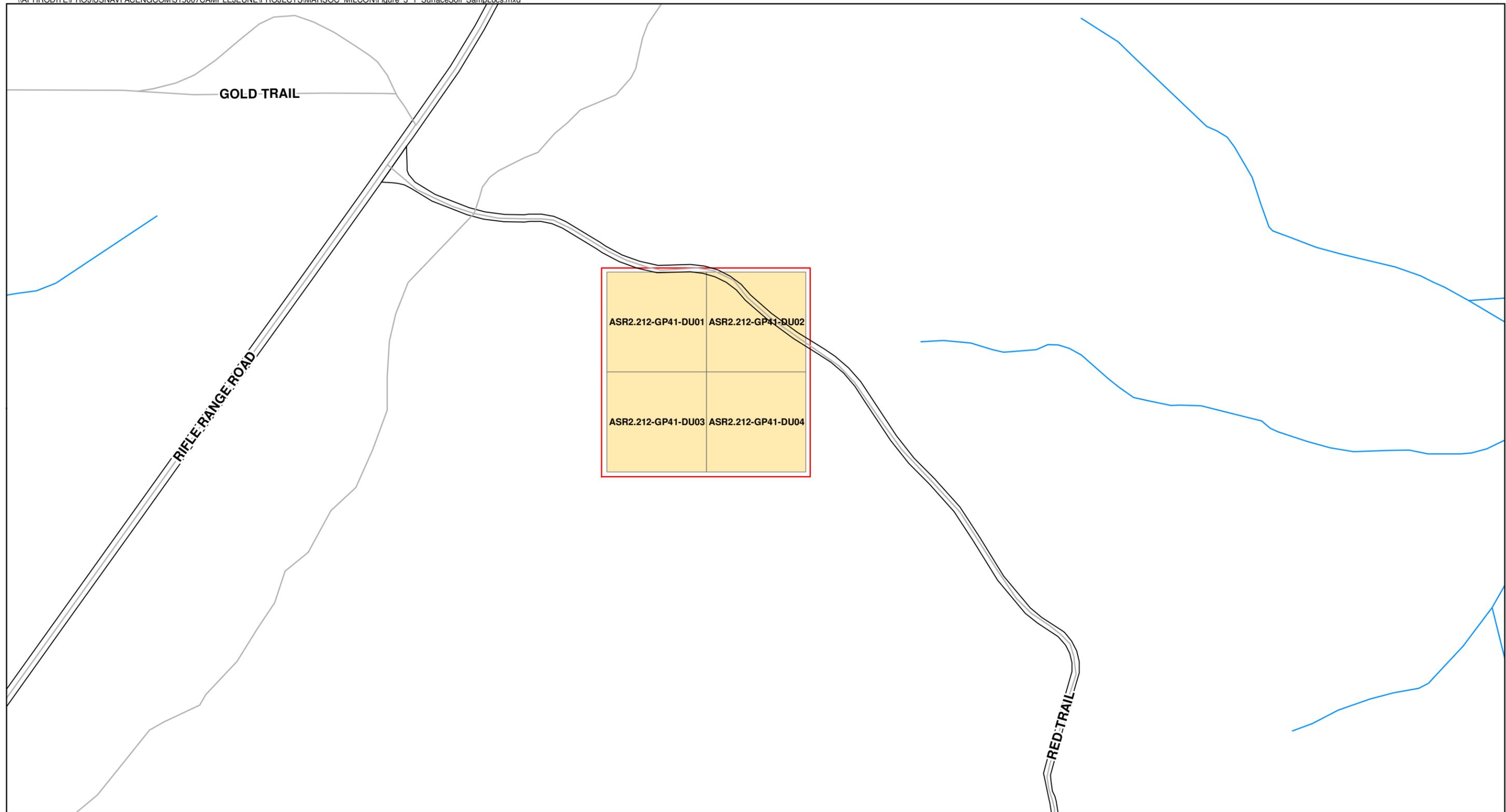


Figure 2-1
 Project Schedule - Former Gun Position 41A & 41B
 Proposed MARSOC MILCON Area
 MCB Camp Lejeune, North Carolina



- Legend**
- Surface Water Course Centerline
 - Road Centerline
 - ▭ Road Area
 - ▭ Decision Units
 - ▭ Former Gun Positions 41A & 41B

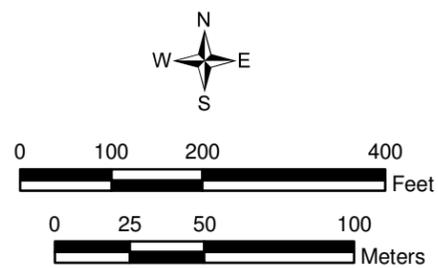
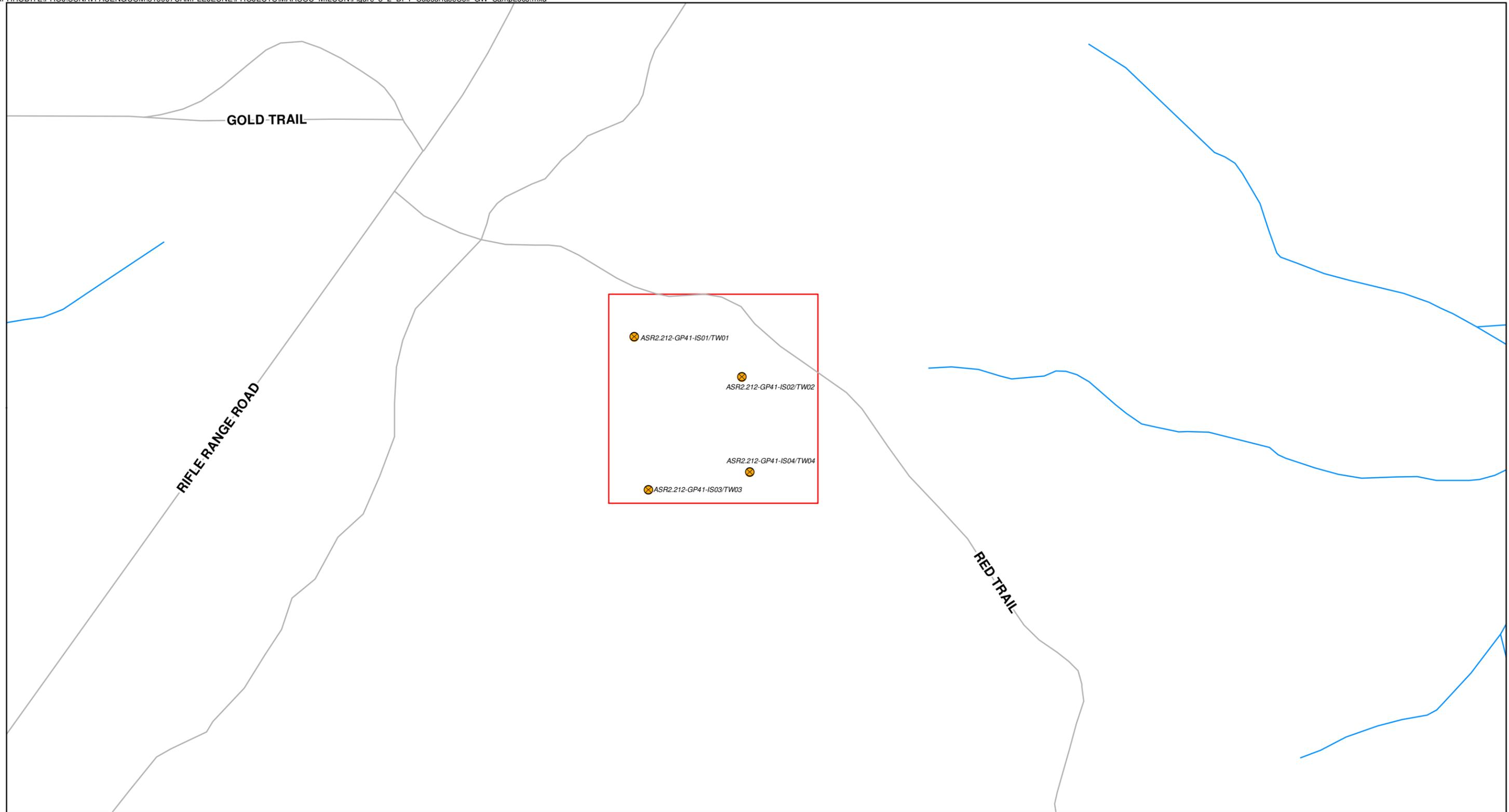


Figure 3-1
Surface Soil Sampling Locations
Former Gun Positions 41A & 41B
Proposed MARSOC MILCON Area
Camp Lejeune, North Carolina



- Legend**
- Subsurface Soil/Temporary Well Locations
 - Road Centerline
 - Surface Water Course Centerline
 - Former Gun Positions 41A & 41B

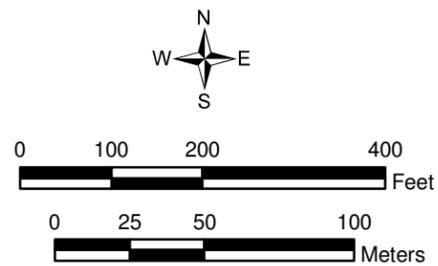
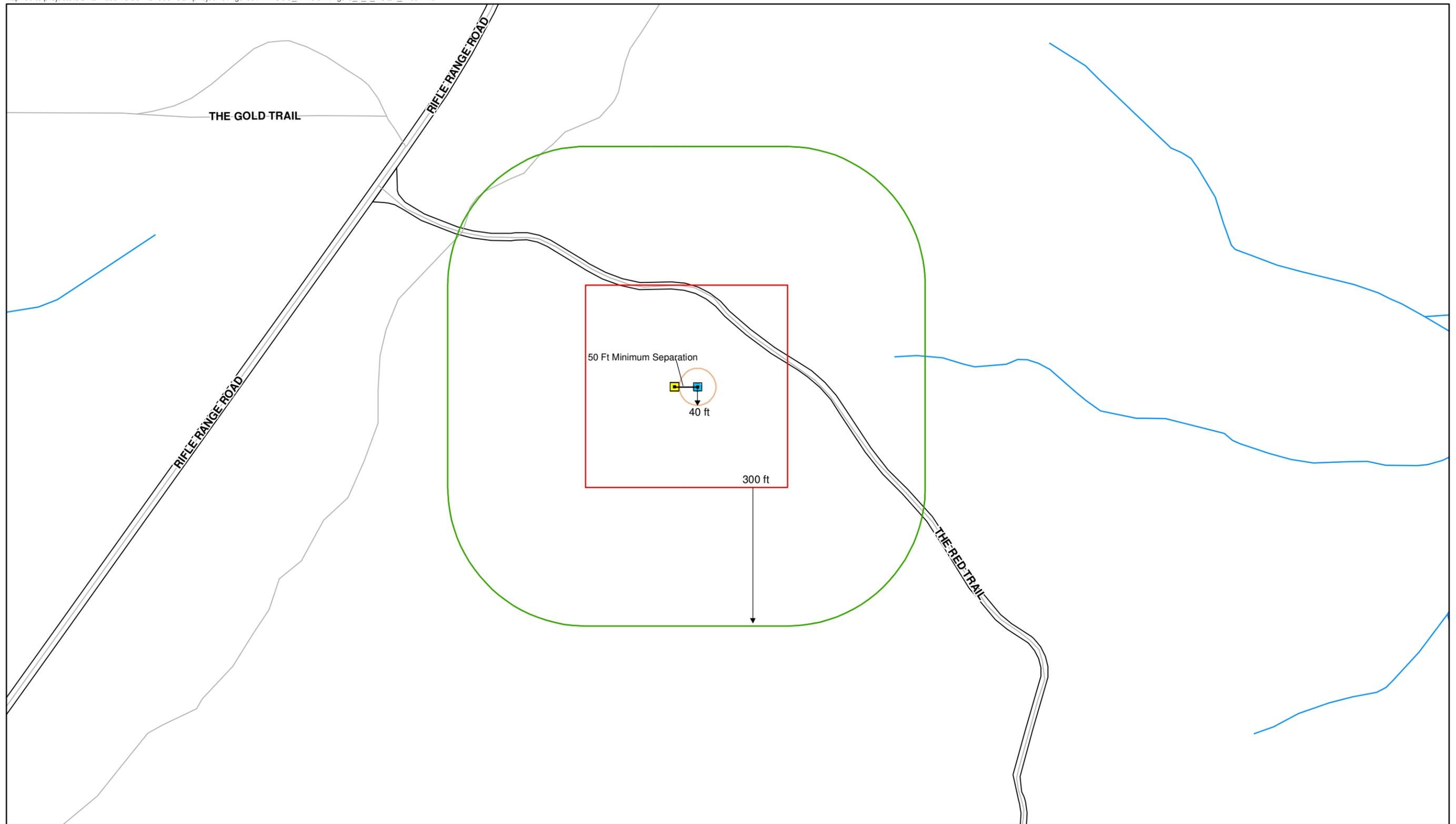


Figure 3-2
DPT Subsurface Soil and Groundwater Sampling Locations
Former Gun Positions 41A & 41B
Proposed MARSOC MILCON Area
Camp Lejeune, North Carolina



- Legend**
- MPPEH Safe Collection Point
 - Non-MPPEH Scrap Collection Point
 - EZ/TSD/Intentional Detonation = 300 ft
 - MPPEH Safe Collection Point IBD = 40 ft
 - Former Gun Positions 41A & 41B
 - Road Centerline
 - Road Area

TSD - Team Separation Distance
 IBD - Inhabited Building Distance
 EZ - Exclusion Zone

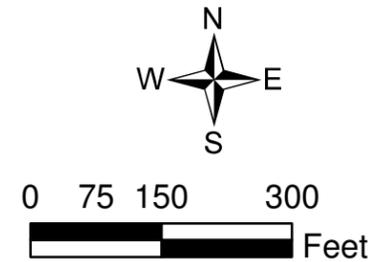
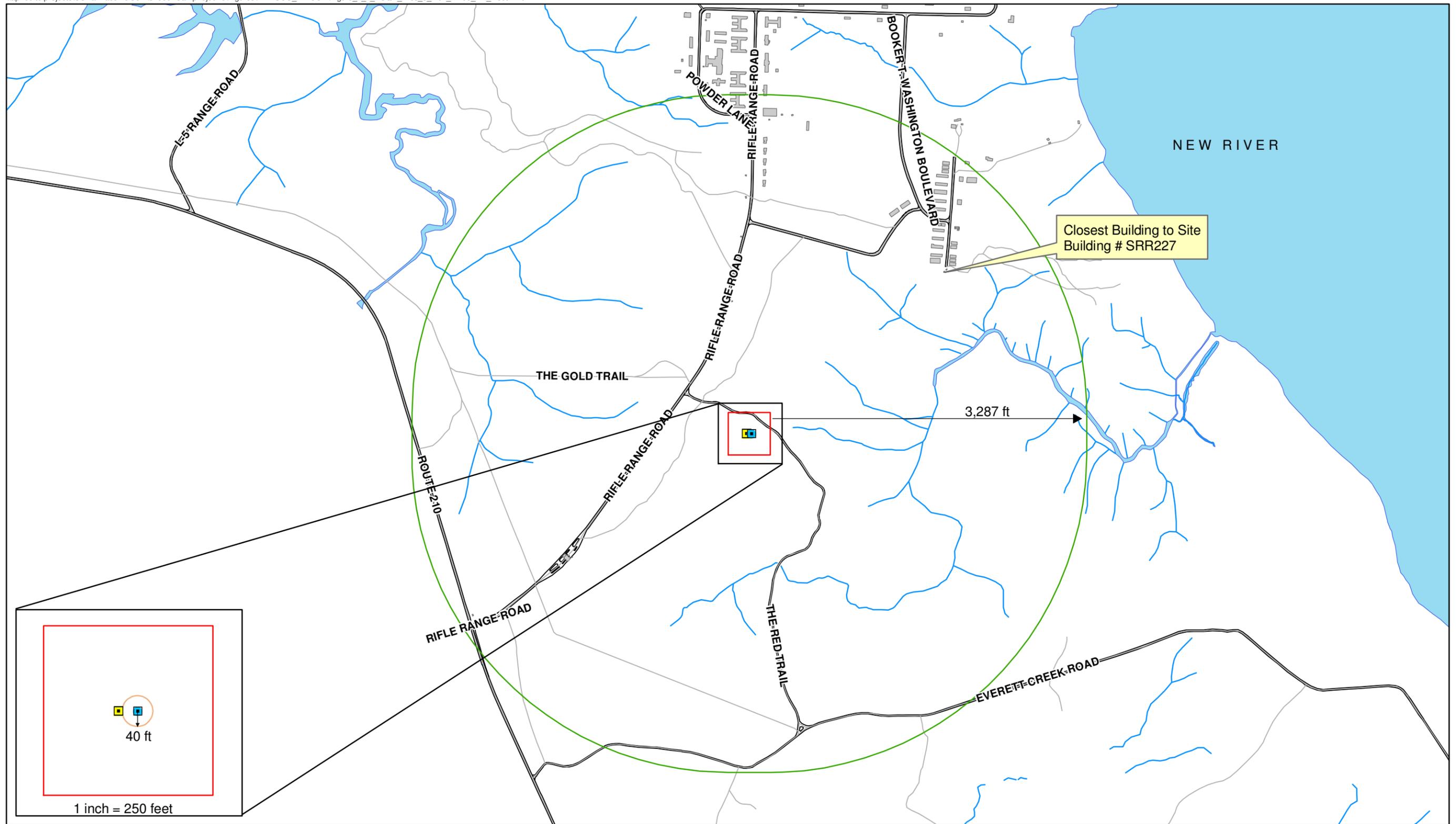


Figure 4-1
 Explosives Safety Quantity-Distance (ESQD) Arcs for Primary MGF (Fuze MTSQ)
 Former Gun Position 41A & 41B
 Proposed MARSOC MILCON Area
 MCB Camp Lejeune, North Carolina



- Legend**
- MPPEH Safe Collection Point
 - Non-MPPEH Scrap Collection Point
 - EZ for Intentional Detonation = 3,287 ft
 - MPPEH Safe Collection Point IBD = 40 ft
 - Road Centerline
 - Former Gun Positions 41A & 41B
 - Buildings
 - Road Area

IBD - Inhabited Building Distance
EZ - Exclusion Zone

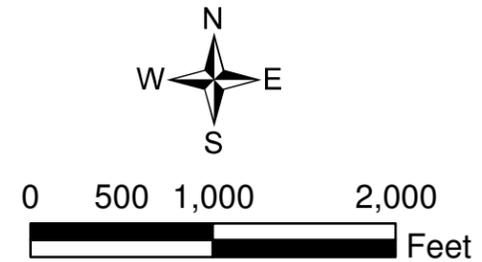


Figure 4-2
Explosives Safety Quantity-Distance (ESQD) Arcs for Contingency (8-inch M106 HE)
Former Gun Position 41A & 41B
Proposed MARSOC MILCON Area
MCB Camp Lejeune, North Carolina



Appendix A

Archival Research Report

Appendix A

Archival Records Search Report Former Gun Positions 41A & 41B

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Task Order 009

March 2008

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Atlantic

Under the

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Contract N62470-07-D-0501

Prepared by



CH2MHILL

Charlotte, North Carolina

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A-1	Gun Position 41, K-2 and G-10 Impact Areas
A-2	105 mm Howitzer
A-3	105 mm and 155mm Howitzer Projectiles

Attachment A	Resource Review Summary
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Acronyms and Abbreviations

°F	degrees Fahrenheit
asl	above sea level
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CTO	Contract Task Order
DGM	Digital Geophysical Mapping
HE	High-Explosive
MARSOC	Marine Special Operations Command
MC	Munitions Constituents
MCB	Marine Corps Base
MEC	Munitions and Explosives of Concern
MRP	Munitions Response Program
NARA	National Archives and Records Administration
PA/SI	Preliminary Assessment/ Site Inspection
UXO	Unexploded Ordnance
WWII	World War II

Introduction, Purpose, and Scope

Marine Corps Base (MCB) Camp Lejeune is planning a military construction (MILCON) project in an area encompassing the Former Gun Positions 41A & 41B (Gun Position 41). The military construction plan consists of a Marine Special Operations Command (MARSOC) facility, covering approximately 1244 acres of which four acres include the former location of Gun Position 41 (Figure 1-1). Due to the historical activities at Gun Position 41, potential impacts to soil and groundwater will be assessed within this portion of the proposed MILCON area under the munitions response program (MRP) before construction of the MARSOC facility.

The results of the environmental investigation will determine if any impacts to soil and groundwater have occurred at Gun Position 41 due to past range activities. To support site investigation effort, this archival records search report has been prepared to provide a narrative of the historical activities at Site MARSOC Gun Position that may have resulted in environmental contamination with Munitions and Explosives of Concern (MEC).

The archival records search report is an investigative review of existing information about the site and its surrounding area, with an emphasis on obtaining information from personnel and historical resources that might indicate a potentially hazardous release to the environment. The scope of the report includes:

- A review of existing information about the site (including MCB Camp Lejeune maps, drawings, and reports, and interviews with MCB Camp Lejeune personnel).
- Collection of additional information about the site.

A complete listing of resources identified and investigated for this report is provided in Attachment 1. Attachment 1 also includes details concerning the reviews of the historical information from the Marine Corps Library at Quantico, National Archives and Records Administration (NARA) map and text files, and MCB Camp Lejeune base files.

Site Information

A.2 Ownership and Operational History

A.2.1 MCB Camp Lejeune Ownership History

The history of the land now occupied by MCB Camp Lejeune is documented primarily through land records and maps. Following the start of World War II (WWII), the War Department began purchasing tracts of land in 1941 from local residents to meet the need for an East Coast amphibious training facility. Prior to the Marines occupation, the land had been occupied by white and African-American communities and farms since the Colonial era. The land contained plantation houses, cabins, farm buildings, tobacco barns, stores, and various cemeteries (Global Security Website, 2007).

The initial land transferred to the government was acquired in 14 different transactions between April and October 1941 and totaled 173.8 square miles or 111,155 acres, of which there were 85,155 land acres and about 26,000 acres under water (Loftfield, 1981, Louis Berger Group, 2002). The individual tracts of land were grouped into various 'Areas' for consolidation.

A.2.2 Gun Position 41

Gun Position 41, was identified in the Range Identification and Preliminary Range Assessment (USACE, 2001) as Archives Search Report (ASR) Site 2.212. The site is located on MCB Camp Lejeune, in the Stone Bay area east of Rifle Range Road (USACE, 2001).

An interview with the Base Safety specialist indicated that Gun Position 41 was established during the WWII and Korean War era as a training ground. A Howitzer, a type of artillery piece that is characterized by a relatively short barrel and the use of comparatively small explosive charges to propel projectiles at trajectories with a steep angle of descent, was positioned at Gun Position 41 and fired 105 mm and 155 mm ammunition into the K-2 and G-10 Impact Areas (see **Figure A-1 through A-3**). In addition, according to a former BSRO, other munitions including 4.2-inch mortars, 175 mm guns, 8-inch howitzers, and 120 mm mortars may have been fired at the Gun Position (Redmond, 2007). Live fire training ceased in the 1960s and then continued in the 1980s due to a change in training philosophy (Redmond, 2007). Presently, the site continues to be used as an official training ground, but no live fire training is conducted in this area. Training includes the use of blanks and pyrotechnics. As a result of the usage and type of training conducted at the site, there should be no ground UXO; although, ammunition packaging, range residue, barbwire, and buried garbage may be present (Richardson, 2007).

References

Global Security Website, "Camp Lejeune",
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Loftfield, Thomas C., 1981. Principal Investigator, University of North Carolina,
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C-4273, August 1981.

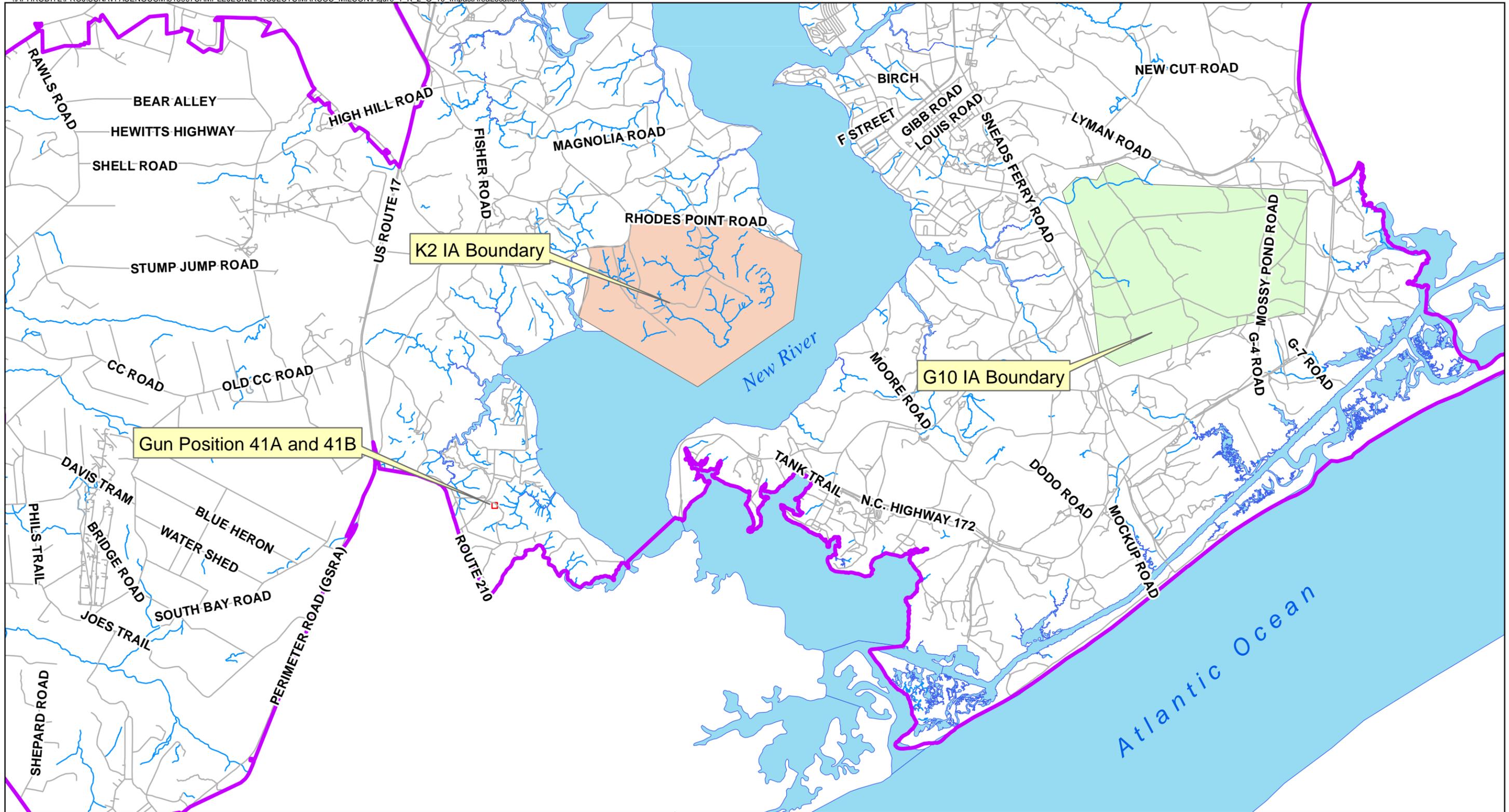
Louis Berger Group Inc., 2002. *Semper Fidelis: A Brief History of Onslow County, North
Carolina and MCB, Camp Lejeune, 2002, U.S.M.C.*, Lt. Col Lynn J. Kimball (USMC, Ret.),
consulting historian.

Redmond, B., 2007. Personal communication with Mr. Benjamin Redmond of CH2M HILL,
former Camp Lejeune officer, November 15, 2007.

Richardson, 2007. Personal Communication with Duane Richardson, Camp Lejeune Range
Safety Specialist. November 8, 2007.

US Army Corps of Engineers (USACE), 2001. St. Louis District. *Final Range Identification and
Preliminary Range Assessment*, Marine Corps Base Camp Lejeune, Onslow, North Carolina,
December 2001.

Figures



- Legend**
- Road Centerline
 - Surface Water Course Centerline
 - ▭ Base Boundary
 - ▭ G10 IA Boundary
 - ▭ K2 IA Boundary
 - ▭ Surface Water Course Area
 - ▭ Former Gun Position 41A & 41B

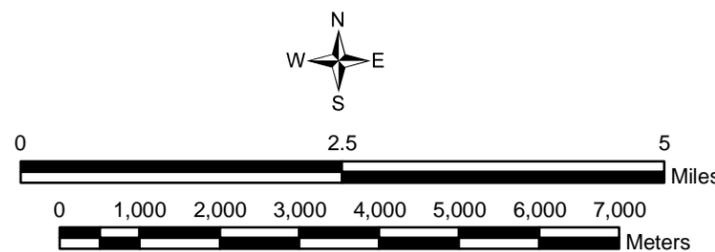


Figure A-1
 K-2 and G-10 Impact Area Locations
 Former Gun Position 41A & 41B
 Proposed MARSOC MILCON Area
 Camp Lejeune, North Carolina



Figure A-2
105 mm Howitzer
Former Gun Position 41A & 41B
Proposed MARSOC MILCON Area
Camp Lejeune, NC



155 mm



105 mm

Figure A-3
105 mm and 155mm Howitzer Projectiles
Former Gun Position 41A & 41B
Proposed MARSOC MILCON Area
Camp Lejeune, NC

Attachment A

Resource Review Summary

Resource Review Summary

The following table provides a summary of the specific references identified for review, interview, or contact for the archival report.

Resource	Actions Completed
Quantico, Virginia, Marine Corps Library Gray Research Center	Reviewed all available file folders related to Camp Lejeune – No relevant files to copy.
US National Archives (NARA II) Historical Files	Reviewed all available file photos related to Camp Lejeune – No relevant photos to copy.
Barry Zirby/National Archives Text File	Reviewed text and drawing files from Text Division. Made copies of relevant files.
Camp Lejeune Technical Records files	See US National Archives Files Review
	Reviewed and copied all relevant documents related to historical land use for each site.
Camp Lejeune Personnel	
Bob Lowder/Environmental	Contacted and interviewed
Linda Futrell/ Real Estate Expert	Contacted and interviewed
Anna Watts/ Technical Records	Contacted and interviewed
Carl Baker/ Technical Records	Contacted and interviewed
Duane Richardson/ Base Range Safety Officer	Contacted and interviewed

Marine Corp Library Review

Text Division

Contact: Annette Amerman

Site Visit: November 1, 2007

File review at Marine Corps Base, Quantico, Virginia, Gray Research Center, Marine Corps Archives and Special Collections.

No pertinent documents were obtained from the file review.

National Archives and Records Administration Review

Text Division

Contact: Mr. Barry Zirby, 301-713-7250 x285

Site visits on November 5 and 6, 2007

Reviewed 17 boxes of files associated with the Marine Corps, 1939-1950

- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 1275/70-800 (10/45-1/47) to 1275/70-727 (1/44-12/47), Box 218.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 1275/70-800 (10/44-1/45) to 1275/70-800 (7/45-9/45), Box 219.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-10 (1/48-12/48) to 2000-10 (5/24-12/36), Box 1201.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-10 (6/45-4/46) to 2000-10 (5/44), Box 1202.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20 (1/49-10/49) to 2000-10 (1/45-6/45), Box 1203.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20 (1/44-6/47) to 2000-20 (5/48-12/48), Box 1204.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20-5 (6/46-12/47) to 2000-20 (6/43), Box 1205.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20-10 (7/48-10/47) to 2000-20-5 (4/45-6/46), Box 1206.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20-10 (7/41-11/42) to 2000-20-10 (1/45-6/45), Box 1207.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20-10 (7/39-2/40) to 2000-20-10 (2/40-6/41), Box 1208.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20-20 (1/48-12/48) to 2000-20-15 (1/49-6/50), Box 1209.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20-20 (1/44-11/46) to 2000-20-20 (11/46-12/47), Box 1210.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2295-10 Brooklyn to 2285-10 Camp Lejuene, Box 1570.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2295-10 Camp Lejuene to 2285-10 Camp Lejuene, Box 1571.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2295-10 Camp Lejuene to 2285-10 Camp Lejuene, Box 1572.
- Record Group 127 (USMC), Quartermaster, General Correspondence, January 1940, 215-4 to 215-6, Box 145.
- Record Group 127 (USMC), Correspondence Files of the Office of the Commandant, Headquarters Support Division Central Files Section, 1950-1958, Box 172.

The boxes contained information primarily related to weapons test results, weapons cost distribution, weapons training classes, weapon specifications, and cleaning and maintenance. The material was not specific to Camp Lejeune and included information for several MC bases.

List of Documents Obtained from National Archives

No pertinent documents were obtained from the file review.

MCB Camp Lejeune Base Site Visit and Records Review

Base Contact: Mr. Bob Lowder, Environmental Management Division, 910-451-9607

File reviews of records in the base Technical Records office were conducted during the site visit. Additionally, interviews were conducted with Bob Lowder/Environmental Manager, Anna Watts/Technical Records, Carl Baker/Technical Records, and Duane Richardson/EOD Base Range Safety Officer.

List of Documents Obtained from Camp Lejeune

Base Real Estate Office

- "Proposed Borrow Sites, Vicinity Map", 1992. NAVFAC Drawing 14854, Sheet 1 of 4.
- "Proposed Borrow Area, Camp Geiger", 1992. NAVFAC Drawing 14855, Sheet 2 of 4.

Base Library

- Louis Berger Group, Inc. Under USCOE, Wilmington District Contract DACWS4-99-C-0004, *Semper Fidelis: A Brief History of Onslow County, North Carolina and MCB, Camp Lejeune, 2002*, United States Marine Corps, Lt. Col Lynn J. Kimball (USMC, Retired) Consulting Historian.
- Lotfield, Thomas, C. Principal Investigator. UNCW, August 1981. *Archeological and Historical Survey of USMC Base, Camp Lejeune; Naval Facilities Engineering Command Norfolk, Coastal Zone Resource Corp., Vol. II, Contract No. N62470-79-C-4273.*

Environmental Office

No pertinent documents were obtained from the file review.

Appendix B

Geophysical Prove-Out Plan

Appendix B
Geophysical Prove Out Work Plan
Focused Preliminary Assessment/Site Inspection
at
Former Gun Positions 41A & 41B

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Task Order 009

March 2008

Prepared for

Department of the Navy
Naval Facilities Engineering Command

Under the

Multi Media
Contract No. N62470-07-D-0501

Prepared by



Charlotte, North Carolina

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Tables

Table B-1 Geophysical Surveys to be Performed During GPO

Figures

Figure B-1 GPO Process

Geophysical Prove Out Work Plan

This Geophysical Prove Out (GPO) Work Plan (WP) is a supplement to the Master GPO WP from the MCB Camp Lejeune Munitions Response Master Project Plan (CH2M HILL, 2007) (herein referred to as MRP Master Project Plan) and provides additional site specific details related to GPO activities for digital geophysical mapping (DGM) surveys at the Former Gun Positions 41A & 41B (Gun Position 41), MCB Camp Lejeune, North Carolina. Only additional detail, modifications or additions to the information provided in the Master GPO WP from the MRP Master Project Plan (CH2M HILL, 2007) are discussed herein.

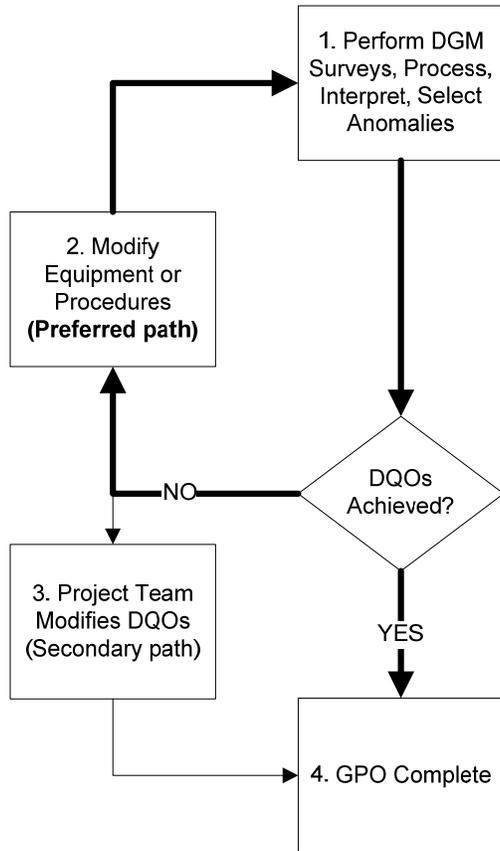
B.1 Project Data Quality Objectives

All data quality objectives (DQOs) from the Master GPO WP are applicable to the GPO for the subject site.

B.2 Procedures

Because an existing GPO plot is to be used (discussed in Section B.3.1) for the GPO activities, a modified Figure B-1 is presented in this section that illustrates the GPO process and the procedures to be employed (numbered in accordance with the steps shown in this section).

FIGURE B-1
GPO Process



1. DGM surveys will be performed by the DGM subcontractor using an EM61-MK2 time domain metal detector system. The system configurations to be tested are shown in Table B-1. The data will be processed and interpreted by the DGM subcontractor and anomaly selections made. Draft data will be provided to the CH2M HILL Project Geophysicist for evaluation within 4 hours of completing each GPO survey and final data packages within one working day of GPO completion.
2. If the initial DQOs have not been met, the CH2M HILL Project Geophysicist will meet with the DGM subcontractor to discuss whether modifications (e.g., sensor spacing) or procedures (e.g., lane spacing) can be made to the DGM system in order to meet the DQOs.
3. If the DQOs cannot be met by the DGM subcontractor, the CH2M HILL Project Manager and Project Geophysicist will meet with the NAVFAC Project Manager to discuss a resolution (i.e., modification of a DQO) prior to completing the GPO.
4. Once the surveys have been performed and at least one of the configurations has been determined capable of meeting the initial (or modified) DQOs, the GPO will be complete.

TABLE B-1
Geophysical Surveys to be Performed During GPO

Test	Instrument	Platform/Positioning System	Approximate Sensor Height Above Ground Surface (m)	Lane Width (m)	Data Collection Rate	Approximate Survey Speed (m/s)
1	EM61-MK2 Single Coil	Wheel mode/odometer positioning	0.4	1	Every 0.67 ft	1
2	EM61-MK2 Single Coil	Wheel mode/Fiducial (time based) positioning	0.4	1	10 or greater per second	1
3	EM61-MK2 Single Coil	Wheel mode/RTK GPS	0.4	1	10 or greater per second	1

Note: Some data elements are subject to evaluation and modification in the field.
ft = foot/feet; GPS = global positioning system; m = meter; m/s = meters per second; RTK = real-time kinematic

B.3 Additional GPO Considerations

Additional topics taken into consideration for the design of the GPO include plot location, size, and shape; quantities of seeded items; and geophysical and positioning instruments and technologies.

B.3.1 GPO Plot Location

The location of the GPO was determined on the basis that a plot already exists at Camp Lejeune in similar geologic conditions. Several surveys have been performed at Camp Lejeune using the EM61-MK2 technology and these systems have been demonstrated over this GPO plot, thus providing several data sets to validate the system to be used during the FGP 41 project.

B.3.2 Number and Types of Geophysical Instruments and Technologies Selected for Testing

Because of the type of targets to be detected at the site, a pre-field analysis of the two primary techniques used in the industry, magnetics and time domain electromagnetics (TDEM), CH2M HILL has selected the TDEM technique only for testing. This selection is based on experience at multiple other sites at Camp Lejeune at which the EM61-MK2 has proven successful at detection of items of interest. The geology at the site is not anticipated to be advantageous to either system.

A complete description of the EM61-MK2 is provided in the Master Geophysical Investigation Plan (GIP) as part of the MRP Master Project Plan (CH2M HILL, 2007).

B.3.3 Number and Types of Positioning Instruments and Technologies Selected for Testing

Because the area to be surveyed transects through wooded areas that may have large trees remaining as well as open areas (or areas that will be open after vegetation removal), the positioning systems to be tested during the GPO for positioning of the geophysical data include fiducial methods (wheel and time-based) and a Real-Time Kinematic (RTK) Global Positioning System (GPS). The RTK positioning method will be used in all areas where satellite communication is not obstructed by vegetation. A full description of the positioning methods is provided in the Master GIP as part of the MRP Master Project Plan (CH2M HILL, 2007).

B.4 Quality Control

B.4.1 DGM Instruments Quality Control

All systems will be field tested by the DGM subcontractor to ensure that they are operating properly. All quality control (QC) tests described in the Master GPO WP will be performed with the exception of the test designed for magnetometers only.

B.4.2 QC Seed Items

At least one QC seed item will be emplaced per acre to be surveyed with the DGM system for the subject site.

B.5 References

CH2M HILL, 2007. *Munitions Response Master Project Plan, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina*. July 2007.

Appendix C

Geophysical Investigation Plan

Appendix C
Geophysical Investigation Plan
Focused Preliminary Assessment/Site Inspection
at
Former Gun Positions 41A& 41B

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Task Order 009

March 2008

Prepared for
Department of the Navy
Naval Facilities Engineering Command

Under the
Multi Media
Contract No. N62470-07-D-0501

Prepared by



Charlotte, North Carolina

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Geophysical Investigation Plan

This Geophysical Investigation Plan (GIP) is a supplement to the MCB Camp Lejeune Master GIP (Appendix D) of the MCB Camp Lejeune MRP Project Plan (CH2M HILL, 2007) and provides additional site specific details related to the digital geophysical mapping (DGM) operations at the Former Gun Positions 41A & 41B (Gun Position 41), MCB Camp Lejeune, North Carolina. Only additional detail, modifications or additions to the information provided in the Master GIP from the MRP Master Project Plan (CH2M HILL, 2007) are discussed herein.

C.1 Areas to be Investigated

The investigation area covered in this GIP is discussed in the following subsections.

C.1.1 Gun Position 41/Proposed MARSOC MILCON Area

The Gun Position 41 investigation area is approximately four acres in size and is located east of Rifle Range Road (**Figure 1-1**). Based on a review of publicly available aerial photographs, the investigation area is approximately 70 percent heavily vegetated with trees and thick undergrowth. A portion of the area is cleared and a training trail, the Red Trail, crosses through the northeast portion of the site.

C.2 Anticipated MEC Types, Composition, Quantities and Depth

The types of munitions and explosives of concern (MEC) and munitions debris (MD) potentially present in the areas to be surveyed are 105mm Howitzer or 155mm Howitzer projectiles. The maximum depths at which these items might be found is unknown as the site was a firing location and not a target area, thus penetration depth calculations are not relevant. If remnants of firing activities are present at the site, it is not anticipated that they will be at great depths unless they were intentionally buried for disposal, in which case there should be a larger and more easily detectable accumulation of items.

C.3 Vegetation and Topography

The investigation area has a gently sloping terrain and portions of it are heavily vegetated with trees and thick undergrowth. Prior to commencement of DGM activities, the entire project area will have vegetation removal performed to include removing undergrowth and cutting trees three inches or less in diameter to a height of no more than six inches above ground surface.

C.4 Geologic Conditions

Based on investigations at other areas of Camp Lejeune, it is anticipated that shallow soils at the site consist of unconsolidated deposits of silty and clayey-sand, silt, and clay. These soils represent the Quaternary age “undifferentiated” formation which characterizes the shallow water table aquifer. Sands are likely to be fine to coarse-grained and contain varied amounts of silt (5 percent to 50 percent) and clay (5 percent to 20 percent). Results of the standard penetration tests (commonly referred to as “blow counts”, ASTM 1586) in other areas of Camp Lejeune indicate that the sands will likely have a relative density of loose to dense. Field observations in other areas of Camp Lejeune have classified the sands as SM and/or SC according to the Soil Conservation Survey (SCS). Clays were plastic to nonplastic, contain varied amounts of silt (some of which contained organic matter) and clay (5 percent to 25 percent), and classified as CL or CH. Standard penetration results for cohesive soils (silts and clays) indicated a relative density of medium dense to stiff.

The local geology (interlayered, unconsolidated sediment) is likely to be amenable to either magnetics or electromagnetic detection techniques. No geologic conditions that will impede geophysical operations at the site are known.

C.5 Shallow Groundwater Conditions

Groundwater is anticipated to be relatively shallow, within approximately 5 feet of ground surface. However, the MEC items, if present at Gun Position 41, are anticipated to be within a few feet of the ground surface.

C.6 Adverse Geophysical Conditions

No geophysical conditions, other than those discussed under Section C.7 and C.8, that might interfere with electromagnetic near-surface geophysical instrument operation are anticipated.

C.7 Site Utilities

The presence of underground utilities is unknown at the site. There are no above ground utilities evident.

C.8 Manmade Features Potentially Affecting Geophysical Operations

No manmade features, apart from the gravel road adjacent to the site, are anticipated at Gun Position 41 due to the lack of development and the remote location of the project area that might affect geophysical operations.

C.9 Site-Specific Dynamic Events

No site-specific dynamic events (e.g., unusually strong winds, harsh weather conditions) that might affect geophysical operations at the site are anticipated. Although it is possible that weather conditions may impede operations at some time during the project, no significant delays or effects on geophysical instruments resulting from abnormally severe weather are expected.

C.10 Overall Site Accessibility and Impediments

There are no known impediments that will limit access to the work areas at the site. Vegetation will be cleared to within six inches of ground surface within the work areas prior to commencement of geophysical operations.

C.11 Potential Worker Hazards

No potential worker hazards are apparent at the site other than those associated with conducting project fieldwork, which are addressed in the project Health and Safety Plan (refer to Appendix D in the Work Plan).

C.12 Geophysical Prove-out

A site-specific GPO will be used to finalize project Data Quality Objectives (DQOs) and validate the geophysical system selected for the DGM surveys at the subject site. The GPO Work Plan is provided as Appendix B in the Work Plan.

C.13 DGM Data Quality Objectives

The primary objective of the DGM activities at the subject site is to identify metallic anomalies that may be MEC or Material Potentially Presenting an Explosive Hazard (MPPEH). DQOs specific to the DGM survey at the site are identified in the GPO Work Plan (Appendix B in the Work Plan) and will carry through to the site survey.

C.14 Geophysical Instrumentation

A geophysical subcontractor will use a single coil EM61-MK2 to map geophysical anomalies that could potentially represent subsurface MEC within the subject site. The EM61-MK2 is described in the Master GIP.

C.15 DGM Systems Quality Control

The QC program described in the Master GIP will be followed. Supplemental information for those steps is provided in the following subsections.

C.15.1 DGM Instruments Quality Control

Because the EM61-MK2 will be used for the DGM surveys, the QC tests designed for magnetometer operations (discussed in the Master GIP) will not be performed.

C.15.2 QC Seed Items

At least one QC seed item (a pipe of similar size to a hand grenade) will be emplaced per acre to be surveyed with the DGM system at Gun Position 41.

C.16 References

CH2M HILL. 2007. *Munitions Response Master Project Plan, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina*. July.

Appendix D

Health Safety & Plan

CH2M HILL HEALTH AND SAFETY PLAN

This Health and Safety Plan (HASP) will be kept on the site during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the Standards of Practice (SOPs) in the CH2M HILL *Corporate Health and Safety Program, Program and Training Manual*, as appropriate. In addition, this plan adopts procedures in the project Work Plan. The Safety Coordinator- Haz Waste (SC-HW) is to be familiar with these SOPs and the contents of this plan. CH2M HILL's personnel and subcontractors must sign Attachment 1.

Project Information and Description

PROJECT NO: 363366

CLIENT: NAVFAC

PROJECT/SITE NAME: Multi-Media TO-009 / MCB Camp Lejeune, MRP MILCON Support, Former Gun Position 41A & 41B (Gun Position 41)

SITE ADDRESS: Jacksonville, North Carolina

CH2M HILL PROJECT MANAGER: Jessica Skeeane/ CLT

CH2M HILL OFFICE: Charlotte

DATE HEALTH AND SAFETY PLAN PREPARED: November 15, 2007

DATE(S) OF SITE WORK: February 2008 through May 2008

SITE ACCESS: Access to all sites is restricted. Sites may be accessed through the MCB Camp Lejeune Stone Bay Gate.

SITE SIZE: MCB, Camp Lejeune is approximately 236 square miles; Gun Position 41, subject of the MILCON support activities is located on approximately 4 acres of land.

SITE TOPOGRAPHY: The topography of MCB Camp Lejeune is relatively flat with ground surface elevations ranging from mean sea level (msl) to 72 feet above msl. Most of the MCB Camp Lejeune lies between 20 and 40 feet msl.

PREVAILING WEATHER: The climate at MCB, Camp Lejeune is characterized by mild winters and hot humid summers. Winters are usually short and mild with occasional and short duration cold periods. Summers are long, hot and humid. Average annual net precipitation is approximately 50 inches. Ambient air temperatures generally range from 33 to 53 degrees Fahrenheit (°F) in the winter months, and 71°F to 88°F during the summer months. Winds are generally south-southwesterly in the summer, and north-northwesterly in the winter (Water and Air Research, 1983). The hurricane season in the immediate area surrounding Camp Lejeune begins on June 1 and continues through November 30. Storms of non-tropical origins such as frontal passages, local thunderstorms, and tornadoes are more frequent and can occur year-round.

BASE HISTORY: Construction of MCB, Camp Lejeune began in 1941 with the objective of developing the "World's Most Complete Amphibious Training Base". Construction of the Base started at Hadnot Point where the major functions of the Base are centered. During World War II, MCB, Camp Lejeune was used as a training area to prepare Marines for combat. MCB, Camp Lejeune was again used for training during the Korean and Vietnam conflicts, and the Gulf War. MCB, Camp Lejeune is host to five Marine Corps commands and one Navy command. In addition, MCB Camp Lejeune provides support and training for the following tenet commands: Headquarters Nucleus; Second Marine Expeditionary Force; Second Marine Division; Second Marine Force Service Support Group; Second Marine Surveillance, Reconnaissance, and Intelligence Group;

Sixth Marine Expeditionary Brigade; the Naval Hospital; and the Naval Dental Clinic. All of the real estate and infrastructure are owned, operated, and maintained by the host command. The mission of Camp Lejeune is to maintain combat ready units for expeditionary deployment.

MCB, Camp Lejeune is bisected by the New River, which flows in a southeasterly direction and forms a large estuary before entering the Atlantic Ocean. The Atlantic Ocean forms the southeastern boundary of the facility. The western and northwestern boundaries are U.S. Route 17 and State Route 24, respectively. The City of Jacksonville, North Carolina is located immediately northwest of MCB, Camp Lejeune.

A majority of the land surrounding the facility is used for agriculture. Estuaries along the coast support commercial fishing and residential resort areas are located adjacent to MCB, Camp Lejeune along the Atlantic Ocean.

MCB Camp Lejeune is planning the construction of The military construction plan consists of an operations and housing complex, mess hall and extended parking area, covering approximately 100 acres, on the northeast corner of McHugh Blvd. and Birch Street.

SITE DESCRIPTION: Gun Position 41 is approximately 4 acres in size and is located in the Stone Bay area east of Rifle Range Road. (Figure 1-1). Based on a review of publicly available aerial photographs and site reconnaissance, approximately 70 percent of the investigation area is heavily vegetated with trees and thick undergrowth. Several 'fox holes' were identified during site reconnaissance along with ammunition packaging. A portion of the area is cleared and an access road, Red Trail, crosses through the northeast portion of the site.

DESCRIPTION OF SPECIFIC TASKS TO BE PERFORMED:

Due to the historical activities at Gun Position 41, impacts to soil and groundwater will be assessed within this portion of the proposed MILCON area under the munitions response program (MRP) before construction of the MARSOC facility. The following objectives will be accomplished during the MILCON support activities:

1. Identify historical activities at Gun Position 41 that may have resulted in environmental contamination with munitions and explosives of concern (MEC) or munitions constituents (MC) by researching archival records and interviewing current and previous installation personnel
2. Evaluate the presence and nature of MC contamination that may exist at Gun Position 41 by conducting an investigation of soil and groundwater
3. Conduct ecological and human health risk screenings using analytical data collected at Gun Position 41
4. Estimate the number and density of geophysical anomalies that may represent subsurface MEC by conducting digital geophysical mapping (DGM) within representative portions of the site
5. Perform an MEC intrusive investigation of selected geophysical anomalies, discovered during the aforementioned DGM activities, which may represent subsurface MEC. Based on the results of the MEC intrusive investigation, additional MEC activities may be required, including removal actions and/or construction support.

Site Map

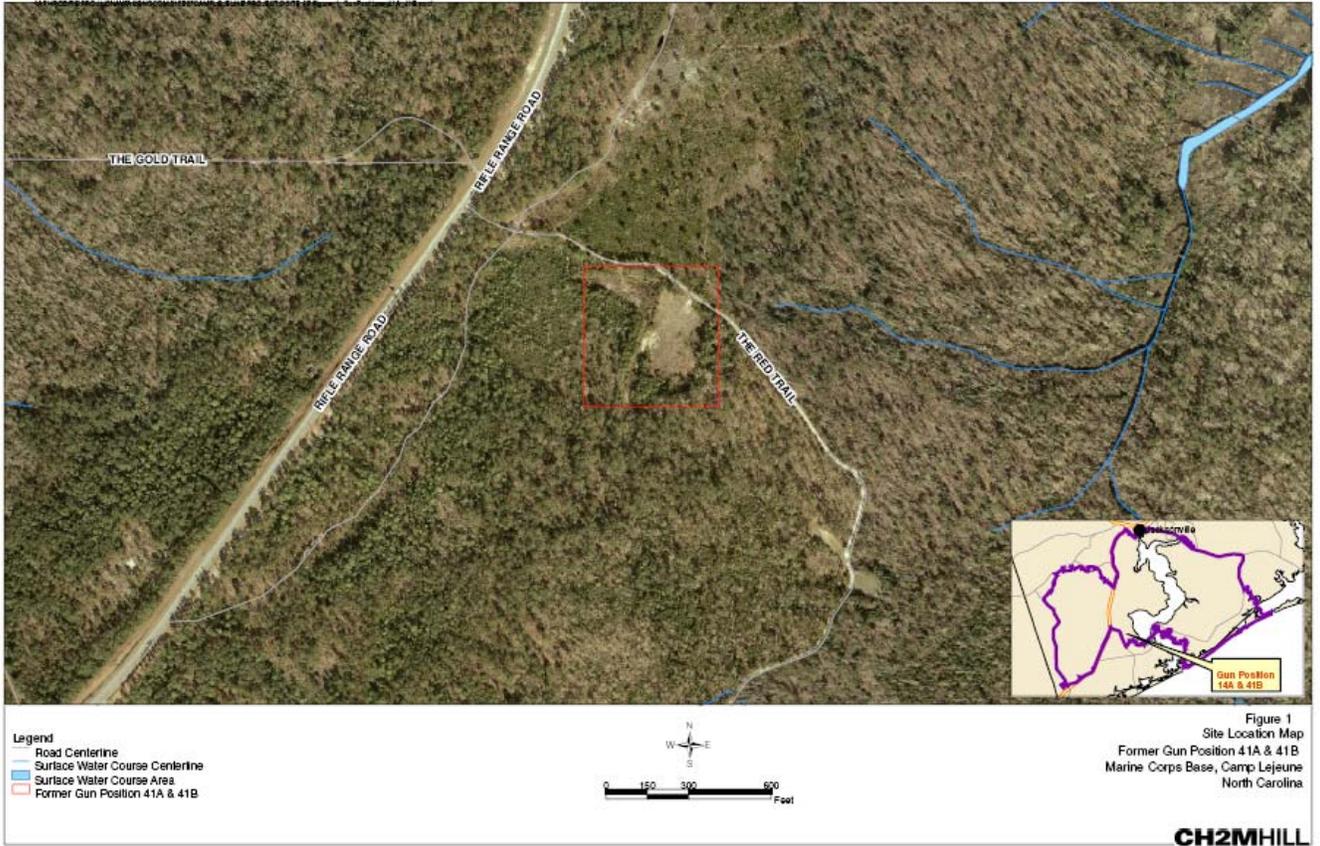


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1 Tasks to be performed under this Plan

1.1 Description of Tasks

(Reference Field Project Start-up Form)

Refer to project documents (i.e., Work Plan) for detailed task information. A health and safety risk analysis (Section 1.2) has been performed for each task and is incorporated in this plan through task-specific hazard controls and requirements for monitoring and protection. Tasks other than those listed below require an approved amendment or revision to this plan before tasks begin. Refer to Section 8.2 for procedures related to “clean” tasks that do not involve hazardous waste operations and emergency response (Hawwoper).

1.1.1 Hazwoper-Regulated Tasks

- Direct-push technology (DPT) soil boring
- Groundwater sampling
- Surface and subsurface soil sampling
- Geophysical mapping
- MEC Avoidance
- Vegetation Clearing
- MEC Intrusive Investigation
- MEC Removal (If MEC is discovered)

1.1.2 Non-HAZWOPER-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state HAZWOPER regulations are not applicable. It must be demonstrated that the tasks can be performed without the possibility of exposure in order to use non-HAZWOPER-trained personnel. **Prior approval from the Health and Safety Manager (HSM) is required before these tasks are conducted on regulated hazardous waste sites.**

1.2 Task Hazard Analysis

(Refer to Section 2 for hazard controls)

POTENTIAL HAZARDS	TASKS					
	DPT Soil Boring	Vegetation Clearing	MEC Intrusive Investigation/ Removal	Soil Sampling	Groundwater Sampling	Geophysical Mapping
Flying debris/objects	X	X	X			X
Noise > 85dBA	X	X	X			X
Electrical	X	X		X	X	X
Suspended loads	X		X			
Buried utilities, drums, tanks	X		X			X
Slip, trip, fall	X	X	X	X	X	X
Back injury	X			X	X	X
Confined space entry						
Trenches / excavations						
Visible lightning	X	X	X	X	X	X
Vehicle traffic	X		X	X	X	X
Elevated work areas/falls	X	X				
Fires	X	X	X			X
MEC	X	X	X	X	X	X
Entanglement	X	X	X			X
Drilling	X		X			
Heavy equipment	X	X	X			X
Working near water						
Working from boat						
IDW Drum Sampling	X			X	X	

2 Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the site or the particular hazard. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the SC-HW for clarification.

In addition to the controls specified in this section, Project-Activity Self-Assessment Checklists are contained in Attachment 6. These checklists are to be used to assess the adequacy of CH2M HILL and subcontractor site-specific safety requirements. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. Self-assessment checklists should be completed early in the project, when tasks or conditions change, or when otherwise specified by the HSM. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records, and be promptly submitted to the HSM.

Principles

Risk management is, and will continue to be, integrated into the planning, preparation, and execution of work on all operational sites during this project. Risk management is a dynamic process that continuously improves as personnel become familiar with site operations, the equipment, the environment, and such. Personnel are urged to continuously identify hazards and assess accident risks. Once identified, these hazards will be brought to the attention of the supervisor and/or the Project Manager (PM). Control measures will be developed and coordinated. All personnel are responsible for continuously assessing variable hazards and implementing risk controls.

Constraints

Risk management does not convey authority to violate the law or deliberately disobey local, state, or national laws. Neither does it justify bypassing risk controls required by the law, such as life safety and fire protection codes, physical security, and transport and disposal of hazardous material and waste.

Risk Management Process

The risk management process will be used by all personnel involved in the operations of the project. Every individual is responsible for the safety of operations and the identification of potential hazards. The SUXOS or UXOSO will cover all aspects of the appropriate AHA prior to that activity being conducted and ensure that all personnel understand the engineering controls being used and the personal protective equipment (PPE) that is issued. During operations, if any new hazards are identified or it is determined that the engineering controls or PPE are not appropriate, operations will cease and the following risk management process will be used to determine the appropriate course of action. The final actions or changes will be coordinated through the HSM and the PM. Prior to the changes being placed into effect, a written and approved change document will be in place.

The AHAs and the pre-task safety plans are key elements to this process. All personnel are required to read and understand each document. This shall be accomplished in the morning safety briefing and again at the daily debriefing to bring out any changes or discrepancies in the process.

Step 1 - Identify hazards.

Tasks, terrain and weather, biological hazards, chemical/explosive hazards, physical hazards, health hazards, lack of resources, physical and emotional health of personnel, long-term project, and lack of planning time.

Step 2 - Assess hazards to determine risks.

Hazard Probability: The possibility of any hazard that may be present having an effect on personnel H&S or the working environment.

Hazard Severity: The severity of the impact on personnel if they were exposed to the hazard without any engineering controls or PPE. The severity can range from negligible to severe, which could cause loss of life.

Step 3 - Develop controls and make risk decisions.

Engineering Controls - Engineering controls are the most effective means to eliminate a hazard. Through engineering controls, the unpredictable human element is removed from the equation. Engineering controls can include such measures as barriers and guards, substitution, distance, or other measures to separate personnel from existing hazards.

Personal Protective Equipment - Where engineering controls cannot eliminate the hazard, PPE will be used in conjunction with engineering controls to prevent the hazardous exposure from impacting personnel.

Administrative Controls - Administrative controls are used to supplement engineering controls and PPE to ensure that the controls in place are working as planned. Administrative controls include training and education of the workforce, monitoring, standard operating procedures, inspection program, and signs to warn individuals that a hazard exists. Oversight personnel responsible for locating specific hazards fall into this category.

Avoidance - Avoidance controls are applied when positive action is required to prevent contact with an identified hazard.

Criteria for controls - To be effective, each control developed must meet the following criteria:

Suitability - It must remove the hazard or mitigate (reduce) the residual risk to an acceptable level.

Feasibility - Personnel must have the capability to implement the control.

Acceptability - The benefit gained by implementing the control must justify the cost in resources and time.

Step 4 - Implement controls.

Controls are converted into clear, simple execution orders understood at all levels.

Personnel are trained to ensure understanding of controls.

Step 5 - Supervise and evaluate.

Supervisors ensure controls are followed.

Project-specific frequency for completing self-assessments: Bi-weekly or at the beginning of each project phase.

2.1 General Hazards

2.1.1 General Practices and Housekeeping

(Reference CH2M HILL SOP HS-209, *General Practices*)

- Site work should be performed during daylight hours whenever possible. Work conducted during hours of darkness requires enough illumination intensity to read a newspaper without difficulty.
- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel should be established and kept free from the accumulation of materials.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.

- Provide slip-resistant surfaces, ropes, and/or other devices to be used.
- Specific areas should be designated for the proper storage of materials.
- Tools, equipment, materials, and supplies shall be stored in an orderly manner.
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals.
- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.

2.1.2 Hazard Communication

(Reference CH2M HILL SOP HS-107, *Hazard Communication*)

The SSC is to perform the following:

- Complete an inventory of chemicals brought on site by CH2M HILL using Attachment 2.
- Confirm that an inventory of chemicals brought on site by CH2M HILL subcontractors is available.
- Request or confirm locations of Material Safety Data Sheets (MSDSs) from the client, contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed.
- Before or as the chemicals arrive on site, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.
- Give employees required chemical-specific HAZCOM training using Attachment 3.
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

2.1.3 Shipping and Transportation of Chemical Products

(Reference CH2M HILL's *Procedures for Shipping and Transporting Dangerous Goods*)

Chemicals brought to the site might be defined as hazardous materials by the U.S. Department of Transportation (DOT). All staff who ship the materials or transport them by road must receive CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the HSM or the Equipment Coordinator for additional information.

2.1.4 Lifting

(Reference CH2M HILL SOP HS-112, *Lifting*)

- Proper lifting techniques must be used when lifting any object.
 - Plan storage and staging to minimize lifting or carrying distances.
 - Split heavy loads into smaller loads.
 - Use mechanical lifting aids whenever possible.
 - Have someone assist with the lift -- especially for heavy or awkward loads.
 - Make sure the path of travel is clear prior to the lift.

2.1.5 Slips, Trips and Falls Hazards

Project sites may contain hazards that pose potential slip, trip and fall hazards to workers, such as:

- Holes, pits or ditches
- Slippery surfaces
- Steep grades
- Uneven ground
- Debris and sharp objects

Site personnel will be instructed to look for potential slip, trip and fall hazards. Take measures to correct the hazards, if possible, and notify the UXOSO and other team members if the hazards cannot be corrected.

2.1.6 Excavations Hazards

Excavation operations may be performed in support of intrusive anomaly investigations and MEC mechanical sifting and separation operations. Excavations for the MEC mechanical sifting and separation will be performed in no more than 2-foot increments until no anomalies are detected using the screening methods. Should excavations greater than 4 feet in depth be generated, the following hazard control measures will be implemented:

Sloping, benching, shoring, shielding, or other protective systems are required to protect personnel from cave-ins except when the excavation is made entirely in stable rock or is less than 5 feet (1.5 meters) deep and there is no indication of possible cave-in, as determined by the excavation competent person.

- Trenches greater than 4 feet deep shall have a ladder, stairway, or ramp positioned so that the maximum lateral travel distance is no more than 25 feet.

Excavations will not be entered unless necessary and only after the competent person has completed the daily inspection and has authorized entry.

2.1.7 Heavy Equipment Operational Hazards

Heavy equipment may be used during mobilization, vegetation removal, excavation of soil for mechanical sifting and separation, site restoration, and demobilization. Heavy equipment on site will be operated in compliance with the following general policies:

Only authorized, licensed drivers shall be permitted to operate equipment.

Operators shall wear seatbelts.

Equipment must be checked at the beginning of each shift to ensure the equipment is in safe operating condition and free of apparent damage. The check should include service brakes, parking brakes, emergency brakes, tires, horn, back-up alarm, steering mechanism, coupling devices, seat belts and operating controls.

Equipment shall not be used to lift personnel; loads shall not be lifted over the heads of personnel.

When equipment is unattended, the motor must be shut off, brakes set, blades/buckets landed, and shift lever in neutral position.

Equipment that is operating in reverse must have a reverse signal alarm distinguishable from the surrounding noise or a signal person when the operator's view is obstructed.

When not in operation, the blade/bucket must be blocked or grounded; the master clutch must be disengaged when the operator leaves the cab.

- Qualified UXO personnel will survey areas that require the removal of previously undisturbed soil or material before intrusive actions are performed.
- Operators of earth-moving equipment must be observant of MEC when performing operations in or around stockpiled materials from excavations or performing any intrusive operations on previously undisturbed areas. If MEC is suspected, operations will be halted until the items are investigated and the UXO qualified individual declares the area clear.

2.1.8 Hand and Power Tool Hazards

Hand and power tools may be used during tasks on the project. All hand and power tools will be used in compliance with the following basic policies:

Operate all tools according to the manufacturer's instructions and within design limitations.

- Maintain all hand and power tools in a safe condition.

- Inspect and test tools before use. If a tool is found to be defective, it is to be tagged “Do Not Use” and removed from service until repaired.
- Use PPE, such as gloves, safety glasses, earplugs, and face shields, when exposed to a hazard from the tool.
- Do not carry or lower power tools by the cord or hose.
- Disconnect tools from energy sources when not in use, before servicing and cleaning, and when changing accessories such as blades, bits, and cutters.
- Do not remove safety guards on tools while the tool is in use and promptly replace after repair or maintenance has been performed.
- When using a knife or blade tool, stroke or cut away from the body with a smooth motion, taking care not to use excessive force that could damage tool, material being cut, or unprotected hands.

2.1.9 Vehicle Operations Hazards

All vehicle operators will have a valid driver’s license and will operate the vehicles within the following guidelines:

- Vehicle operators will perform daily operational checks prior to operation.
- The principles of defensive driving shall be practiced at all times.
- Seat belts shall be installed and worn at all times while the vehicle is in operation.
- The operator shall have the vehicle under control at all times and able to bring the vehicle to a complete stop within a safe stopping distance.
- Vehicles may not be driven faster than the posted speed limit or for the terrain and weather conditions in which they are being operated.
- Vehicles will not be left unattended until the motor is shut off and the parking brake is set.
- Keys may be left in vehicles parked in the exclusion zone (EZ) to allow for emergency evacuation and use.
- A copy of the emergency evacuation routes and emergency telephone numbers will be in each vehicle used onsite.
- All vehicles in the EZ will have at least one fire extinguisher rated at a minimum of 10BC.
- Vehicles transporting explosives will comply with federal, state and local requirements for the transportation of hazardous materials.

2.1.10 Material Handling Equipment Hazards

Material handling equipment may be used at any time during a project as required. The following general guidelines will be enforced:

- Never approach operating equipment from the rear.
- Always make positive contact with the operator and confirm that the operator has stopped the motion of the equipment.
- Never approach the side of operating equipment; remain outside of the swing and turning radius.
- Maintain distance from pinch points of operating equipment.

- Never turn your back on any operating equipment.
- Never ride equipment unless it is designed to accommodate passengers and is equipped with firmly attached passenger seat.
- Never work or walk under a suspended load.
- Never use equipment as a personnel lift; do not ride excavator buckets or crane hooks.
- Always stay alert and maintain a safe distance from operating equipment, especially equipment on cross slopes and unstable terrain.

2.1.11 Fire Prevention

(Reference CH2M HILL SOP HS-208, *Fire Prevention*)

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet. When 5 gallons or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet. Extinguishers must:
 - be maintained in a fully charged and operable condition,
 - be visually inspected each month, and
 - undergo a maintenance check each year.
- The area in front of extinguishers must be kept clear.
- Post “Exit” signs over exiting doors, and post “Fire Extinguisher” signs over extinguisher locations.
- Combustible materials stored outside should be at least 10 feet from any building.
- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.
- Flammable/combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.

2.1.12 Electrical

(Reference CH2M HILL SOP HS-206 *Electrical Safety*)

- Only qualified personnel are permitted to work on unprotected energized electrical systems.
- Only authorized personnel are permitted to enter high-voltage areas.
- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented.
- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment, remove from service.
- All temporary wiring, including extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed.
- Extension cords must be:
 - equipped with third-wire grounding.
 - covered, elevated, or protected from damage when passing through work areas.
 - protected from pinching if routed through doorways.
 - not fastened with staples, hung from nails, or suspended with wire.
- Electrical power tools and equipment must be effectively grounded or double-insulated UL approved.
- Operate and maintain electric power tools and equipment according to manufacturers' instructions.
- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and grounded, or where insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet from overhead power lines for voltages of 50 kV or less, and 10 feet plus ½ inch for every 1 kV over 50 kV.
- Temporary lights shall not be suspended by their electric cord unless designed for suspension. Lights shall be protected from accidental contact or breakage.
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

2.1.13 Heat Stress

(Reference CH2M HILL SOP HS-211, *Heat and Cold Stress*)

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°F to 60°F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate yourself by slowly increasing workloads (e.g., do not begin with extremely demanding activities).
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shelter/shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. Persons who experience signs of heat syncope, heat rash, or heat cramps should consult the SSC/DSC to avoid progression of heat-related illness.

Monitoring Heat Stress

These procedures should be considered when the ambient air temperature exceeds 70°F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress.

The heart rate (HR) should be measured by the radial pulse for 30 seconds, as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 100 beats/minute, or 20 beats/minute above resting pulse. If the HR is higher, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the pulse rate still exceeds 100 beats/minute at the beginning of the next rest period, the work cycle should be further shortened by 33 percent. The procedure is continued until the rate is maintained below 100 beats/minute, or 20 beats/minute above resting pulse.

SYMPTOMS AND TREATMENT OF HEAT STRESS					
	Heat Syncope	Heat Rash	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature.
Treatment	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.	Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.	Remove to cooler area. Rest lying down. Increase fluid intake.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.	Cool rapidly by soaking in cool—but not cold—water. Call ambulance, and get medical attention immediately!

2.1.14 Cold Stress

(Reference CH2M HILL SOP HS-211, *Heat and Cold Stress*)

- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in cool weather.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council (NSC).
- Wind-Chill Index is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it should only be used as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.
- NSC Guidelines for Work and Warm-Up Schedules can be used with the wind-chill index to estimate work and warm-up schedules for fieldwork. The guidelines are not absolute; workers should be monitored for symptoms of cold-related illnesses. If symptoms are not observed, the work duration can be increased.
- Persons who experience initial signs of immersion foot, frostbite, hypothermia should consult the SSC/DSC to avoid progression of cold-related illness.
- Observe one another for initial signs of cold-related disorders.
- Obtain and review weather forecast – be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

SYMPTOMS AND TREATMENT OF COLD STRESS			
	Immersion (Trench) Foot	Frostbite	Hypothermia
Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Re-warm area quickly in warm—but not hot—water. Have victim drink warm fluids, but not coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but not coffee or alcohol. Get medical attention.

2.1.15 Procedures for Locating Buried Utilities

Do not begin subsurface construction activities (e.g., trenching, excavation, drilling, etc.) until a check for underground utilities and similar obstructions has been conducted. The use of as-built drawings and utility company searches must be supplemented with a geophysical or other survey by a qualified, independent survey contractor to identify additional and undiscovered buried utilities.

Examples of the type of geophysical technologies include:

- **Ground Penetrating Radar (GPR)**, which can detect pipes, including gas pipes, tanks, conduits, cables etc, both metallic and non-metallic at depths up to 30 feet depending on equipment. Sensitivity for both minimum object size and maximum depth detectable depends on equipment selected, soil conditions, etc.
- **Radio Frequency (RF)**, involves inducing an RF signal in the pipe or cable and using a receiver to trace it. Some electric and telephone lines emit RF naturally and can be detected without an induced signal. This method requires knowing where the conductive utility can be accessed to induce RF field if necessary.
- **Dual RF**, a modified version of RF detection using multiple frequencies to enhance sensitivity but with similar limitations to RF
- **Ferromagnetic Detectors**, are metal detectors that will detect ferrous and non-ferrous utilities. Sensitivity is limited, e.g. a 100 mm iron disk to a depth of about one meter or a 25 mm steel paper clip to a depth of about 20 cm.
- **Electronic markers**, are emerging technologies that impart a unique electronic signature to materials such as polyethylene pipe to facilitate location and tracing after installation. Promising for future installations but not of help for most existing utilities already in place.

Procedure

The following procedures shall be used to identify and mark underground utilities during subsurface construction activities on the project:

- The survey contractor shall determine the most appropriate geophysical technique or combinations of techniques to identify the buried utilities on the project, based on the survey contractor's experience and expertise, types of utilities anticipated to be present and specific site conditions.
- The survey contractor shall employ the same geophysical techniques used on the project to identify the buried utilities, to survey the proposed path of subsurface construction work to confirm no buried utilities are present.
- Identify customer specific permit and/or procedural requirements for excavation and drilling activities. For military installations contact the Base Civil Engineer and obtain the appropriate form to begin the clearance process.
- Contact utility companies or the state/regional utility protection service at least two (2) working days prior to excavation activities to advise of the proposed work, and ask them to establish the location of the utility underground installations prior to the start of actual excavation.
- Schedule the independent survey.
- Obtain utility clearances for subsurface work on both public and private property.
- Clearances are to be in writing, signed by the party conducting the clearance.
- Underground utility locations must be physically verified by hand digging using wood or fiberglass-handled tools when any adjacent subsurface construction activity (e.g. mechanical drilling, excavating) work is expected to come within 5 feet of the marked underground system. If subsurface construction

activity is within 5 feet and parallel to a marked existing utility, the utility location must be exposed and verified by hand digging every 100 feet.

- Protect and preserve the markings of approximate locations of facilities until the markings are no longer required for safe and proper excavations. If the markings of utility locations are destroyed or removed before excavation commences or is completed, the Project Manager must notify the utility company or utility protection service to inform them that the markings have been destroyed.
- Conduct a site briefing for employees regarding the hazards associated with working near the utilities and the means by which the operation will maintain a safe working environment. Detail the method used to isolate the utility and the hazards presented by breaching the isolation..
- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon during drilling or change in color, texture or density during excavation that could indicate the ground has been previously disturbed).

2.2 Biological Hazards and Controls

2.2.1 Snakes

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. **DO NOT** apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings.

2.2.2 Poison Ivy and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Become familiar with the identity of these plants. Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

2.2.3 Ticks

Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch in size. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray **only outside** of clothing with permethrin or permethrin and spray skin with only DEET; and check yourself frequently for ticks.

If bitten by a tick, grasp it at the point of attachment and carefully remove it. After removing the tick, wash your hands and disinfect and press the bite areas. Save the removed tick. Report the bite to human resources. Look for symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme: a rash might appear that looks like a bullseye with a small welt in the center. RMSF: a rash of red spots under the skin 3 to 10 days after the tick bite. In both cases, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, seek medical attention.

2.2.4 Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the SSC and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

2.2.5 Bloodborne Pathogens

(Reference CH2M HILL SOP HS-202, *Bloodborne Pathogens*)

Exposure to bloodborne pathogens may occur when rendering first aid or CPR, or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and personal protective equipment (PPE) are required as specified in CH2M HILL SOP HS-36, *Bloodborne Pathogens*. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

2.2.6 Mosquito Bites

Due to the recent detection of the West Nile Virus in the Southeastern United States it is recommended that **preventative measures** be taken to reduce the probability of being bitten by mosquitoes whenever possible. Mosquitoes are believed to be the primary source for exposure to the West Nile Virus as well as several other types of encephalitis. The following guidelines should be followed to reduce the risk of these concerns for working in areas where mosquitoes are prevalent.

- Stay indoors at dawn, dusk, and in the early evening.
- Wear long-sleeved shirts and long pants whenever you are outdoors.
- Spray clothing with repellents containing permethrin or DEET since mosquitoes may bite through thin clothing.
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35% DEET (N,N-diethyl-meta-toluamide). DEET in high concentrations (greater than 35%) provides no additional protection.
- Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands.
- Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's DIRECTIONS FOR USE, as printed on the product.

Note: Vitamin B and "ultrasonic" devices are NOT effective in preventing mosquito bites.

Symptoms of Exposure to the West Nile Virus

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.

The West Nile Virus incubation period is from 3-15 days.

If you have any questions or to report any suspicious symptoms, contact the project Health and Safety Manager.

2.2.7 Fire Ant Bites

Fire ants are common in the southern U.S. These insects typically build mounds on the land surface that are usually easy to identify. Avoid disturbing these mounds. A bite from a fire ant can be painful but rarely is life threatening. However, it is possible that the bite could cause an allergic reaction. If bitten, check for symptoms of an allergic reaction such as weakness, nausea, vomiting, dizziness, or shortness of breath. If symptoms appear, seek medical attention

2.3 Munitions and Explosives of Concern Hazards and Controls

2.3.1 Possible Munitions and Explosives of Concern

No documentation has been identified to indicate that MEC or material potentially presenting an explosive hazard (MPPEH) has ever been found at Gun Position 41.

An interview with the Base Safety specialist indicated that Gun Position 41 was established during the World War II as a training ground. A Howitzer was positioned at Gun Position 41 and fired 105 mm and 155 mm ammunition into the K-2 and G-10 Impact Areas. Presently, Gun Position 41 is used as an official training

ground; no live fire training is conducted however blanks and pyrotechnics are used. Based on the activities conducted at the site, there should be no UXO present. Items that may be present at the site include: ammunition packaging, range residue, barbed wire, and buried garbage.

2.3.2 Munitions with the Greatest Fragmentation Distance

The MGF used to determine safe working distances at Gun Position 41 is a net explosives weight (NEW) RDX 0.06025 pound (lb) Fuze Mechanical Time Super Quick (MTSQ).

The Explosives Safety Quantity-Distance (ESQD) information for the MGF is provided in Chapter 3 of the ESS for this project. During the course of this project, if MEC with a greater fragmentation range is encountered, the ESQD requirements will be adjusted.

2.3.3 Hazard Mitigation

According to Mr. James Gagnon of the Natural Resources Conservation Service (NRCS), Edenton Technical Services Office, frost upheaval in the coastal plain region of North Carolina is considered unlikely since the climate only allows frost action to occur to a maximum depth of approximately 6 inches. No other natural phenomena (e.g., drought, flooding, erosion, tidal changes) exist for this area. Therefore, migration of MEC (other than through human transport) is not considered likely.

2.3.4 Types of Explosives to be used on Site

No explosives are anticipated to be stored or used on the project site. During the course of this project, if MEC is encountered explosives storage and usage will be reassessed.

2.3.5 Explosives Storage, Transportation and Management

No explosives are anticipated to be stored or used on the project site. If MEC is encountered, explosives storage, transportation and management will be in compliance with the Explosives Siting Plan (ESP), the DDESB-approved Explosives Safety Submission (ESS) and the Explosives Management Plan (EMP) for the project.

2.3.6 MEC Avoidance Procedures

MEC avoidance operations will be required during sampling operations. Avoidance operations will consist of a team composed of one or more UXO Technicians. A single-person team will consist of a UXO Technician III. Additional personnel will be UXO Technician III or less. **Contact with MEC is prohibited.** The UXO Team will not destroy any MEC encountered. All MEC contacts and suspected MEC anomalies will be reported to the site manager who will in turn notify MCB Camp Lejeune personnel in accordance with contractual requirements.

- **Access routes to sampling locations**

-Prior to sampling, the UXO Technicians will conduct a reconnaissance of the sampling area. The reconnaissance will include locating the designated sampling or drilling location(s) and insuring that they are free of surface MEC. If surface MEC is detected the point will be relocated as directed. Once the designated point has been cleared, an access route for the sampling crew's vehicles and equipment will be cleared for surface MEC. The access route, at a minimum will be twice the width of the widest vehicle and the boundaries will be clearly marked to prevent personnel from straying into non cleared areas. If surface MEC is encountered, the UXO Team will mark and report the item and divert the approach path around the MEC.

- **Soil Sampling Sites**

The UXO Technicians will clear the surface area of the work site for soil samples and clearly mark the boundaries. The area will be large enough to accommodate the direct push equipment and provide a work area for the crews. As a minimum, the cleared area will be a square, with a side dimension equal to twice the length of the largest vehicle or piece of equipment for use on site. If a pre-selected area indicates magnetic anomalies, a new sampling / drill site will be chosen.

- **Borehole Sampling**

If surface samples are required they will be obtained prior to the start of boring. The borehole procedures will be completed using direct push technology (DPT) equipment. Prior to DPT sampling of the site, an UXO Technician will advance a borehole using a hand auger, and check the borehole with a down hole magnetometer a minimum of every one foot, to the deepest sampling depth or a maximum of 5 feet to ensure that smaller items of MEC, undetectable from the surface will be detected. The types of ammunition used included 105 mm and 155 mm howitzer projectiles. The maximum depths at which these items might be found is unknown as the site was a firing location and not a target area, thus penetration depth calculations are not relevant. Should any other MEC item other than the aforementioned items be identified during DPT sampling work will stop and the depth of down hole sampling will be re-evaluated.

2.4 Contaminants of Concern

(Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum ^a Concentration (ppm)	Exposure Limit ^b	IDLH ^c	Symptoms and Effects of Exposure	PIP ^d (eV)
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	GW: SB: SS:	NR	UN	Toxic by injection and ingestion.	NA
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	GW: SB: SS:	1.5 mg/m ³	50	Skin, eye, and mucous membrane irritant. Exposure can cause convulsions.	NA
1,3,5-Trinitrobenzene (1,3,5-TNB)	GW: SB: SS:	NR	UN	Toxic by injection and ingestion. Some mutagenic data reported.	NA
1,3-Dinitrobenzene (1,3-DNB)	GW: SB: SS:	1 mg/m ³	10	Toxic by skin contact. Liver and kidney damage. Damage to the central nervous system	NA
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	GW: SB: SS:	0.1 mg/m ³	5	Toxic by injection and ingestion. Some mutagenic and tetragenic data reported	NA
Nitrobenzene	GW: SB: SS:	1 ppm	25	Toxic by skin exposure. Skin, eye, and mucous membrane irritant. Respiratory disruption. Anemia	9.92
2,4,6-Trinitrotoluene (2,4,6-TNT)	GW: SB: SS:	0.5 mg/m ³	500	Toxic by skin exposure. Skin, eye, and mucous membrane irritant, Liver damage, jaundice. Cyanosis, dermal sensitization, sneezing, anemia, cardiac irregularity.	10.59
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	GW: SB: SS:	1.5 mg/m ³	50	Anoxia, cyanosis, anemia, jaundice, reproductive effects.	UN
2-Amino-4,6-dinitrotoluene (2-AM-DNT)	GW: SB: SS:	1.5 mg/m ³	50	Anoxia, cyanosis, anemia, jaundice, reproductive effects.	UN
2,4-Dinitrotoluene (2,4-DNT)	GW: SB: SS:	1.5 mg/m ³	50	Anoxia, cyanosis, anemia, jaundice, reproductive effects.	UN
2,6-Dinitrotoluene (2,6-DNT)	GW: SB: SS:	1.5 mg/m ³	50	Anoxia, cyanosis, anemia, jaundice, reproductive effects.	UN
2-Nitrotoluene (2-NT)	GW: SB: SS:	2 ppm	200	Anoxia, cyanosis, anemia, headache, lassitude, dizziness	9.45

2.4 Contaminants of Concern

(Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum ^a Concentration (ppm)	Exposure Limit ^b	IDLH ^c	Symptoms and Effects of Exposure	PIP ^d (eV)
3-Nitrotoluene (3-NT)	GW: SB: SS:	2 ppm	200	Anoxia, cyanosis, anemia, headache, lassitude, dizziness	9.45
4-Nitrotoluene (4-NT)	GW: SB: SS:	2 ppm	200	Anoxia, cyanosis, anemia, headache, lassitude, dizziness	9.45
Perchlorate	GW: SB: SS:	UK	UK	Irritants to skin, eyes, and mucous membranes.	NA
Arsenic	GW: SB: SS:	0.01 mg/m ³	5 Ca	Ulceration of nasal septum, respiratory irritation, dermatitis, gastrointestinal disturbances, peripheral neuropathy, hyperpigmentation	NA
Barium	GW: SB: SS:	0.5 mg/m ³	50	Skin and eye irritation, slowed pulse, skin burns, gastroenteritis	NA
Cadmium	GW: SB: SS:	0.005 mg/m ³	9 Ca	Pulmonary edema, coughing, chest tightness/pain, headache, chills, muscle aches, nausea, vomiting, diarrhea, difficulty breathing, loss of sense of smell, emphysema, mild anemia	NA
Chromium	GW: SB: SS:	0.5 mg/m ³	25	Irritated eyes, sensitization dermatitis, histologic fibrosis of lungs	NA
Lead	GW: SB: SS:	0.05 mg/m ³	100	Weakness lassitude, facial pallor, pal eye, weight loss, malnutrition, abdominal pain, constipation, anemia, gingival lead line, tremors, paralysis of wrist and ankles, encephalopathy, kidney disease, irritated eyes, hypertension	NA
Mercury	GW: SB: SS:	0.05 mg/m ³	10	Skin and eye irritation, cough, chest pain, difficult breathing, bronchitis, pneumonitis, tremors, insomnia, irritability, indecision, headache, fatigue, weakness, GI disturbance	NA
Selenium	GW: SB: SS:	0.2 mg/m ³	1	Skin and eye irritation, visual disturbance, metallic taste in the mouth, skin burns, dermatitis, chills.	NA
Silver	GW: SB: SS:	0.01 mg/m ³	10	Argyrosis, discoloration of skin and nail beds, cyanosis.	NA

2.4 Contaminants of Concern

(Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum ^a Concentration (ppm)	Exposure Limit ^b	IDLH ^c	Symptoms and Effects of Exposure	PIP ^d (eV)
Footnotes: ^a Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), S (Surface Soil), SL (Sludge), SW (Surface Water). ^b Appropriate value of PEL, REL, or TLV listed. ^c IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen. ^d PIP = photoionization potential; NA = Not applicable; UK = Unknown. NR = Not Regulated					UK
2.6 Potential Routes of Exposure					
Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 4.					

3 Project Organization and Personnel

3.1 CH2M HILL Employee Medical Surveillance and Training

(Reference CH2M HILL SOPs HS-113, *Medical Surveillance*, and HS-110, *Training*)

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated “SC-HW” have completed a 12-hour site safety coordinator course, and have documented requisite field experience. An SC-HW with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones. Employees designated “FA-CPR” are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least two FA-CPR designated employees must be present during all tasks performed in exclusion or decontamination zones. The employees listed below are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

Employee Name	Office	Responsibility	SC-HW/FA-CPR
Jessica Skeean	CLT	PM	Level D SC-HW: FA-CPR
Dan Tomczak	RDU	Task Manager	Level D SC-HW: FA-CPR
TBD	TBD	FTL	Level D SC-HW: FA-CPR

3.2 Field Team Chain of Command and Communication Procedures

3.2.1 Client

Client Contact

Bryan Beck
 NAVFAC Mid-Atlantic
 Code: OPCEV
 6506 Hampton Blvd
 Norfolk, Virginia 23508-1278
 Direct: (757) 322-4734
 Fax: (757) 322-4805
bryan.k.beck@navy.mil

Base Contact

Robert Lowder
 Camp Lejeune - EMD
 Building 12
 Marine Corps Base Camp Lejeune, NC 28542-0004
 Direct (910) 451-9607
 Fax: (910) 451-5997
robert.a.lowder@usmc.mil

3.2.2 CH2M HILL

Project Manager: Jessica Skeean/CLT
 ESBG Munitions Response Safety Officer: Dan Young/NVR

Health and Safety Manager: Michael Goldman/ATL
 Munitions Response Senior Advisor: Tom Roth/ATL
 Field Team Leader: TBD
 Safety Coordinator- Hazardous Waste (SC-HW): TBD
 UXO Safety Officer (UXOSO): TBD

The SC-HW is responsible for contacting the Field Team Leader and Project Manager. In general, the Project Manager will contact the client. The Health and Safety Manager should be contacted as appropriate.

UXO TECHNICIAN III

The UXO Technician III will report directly to the Project Manager on issues pertaining to the operations at Gun Position 41. The UXO Technician III will have the following safety and health related responsibilities:

- Reports directly to the CH2M HILL Project Manager;
- Managing the funding, manpower and equipment necessary to safely conduct site operations;
- Reviewing and becoming familiar with the site Work Plan (WP) and HSP;
- Provide copies of the WP and site specific HSP to site and subcontract personnel;
- Review the scope of work (SOW) and ensure that the required safety and health elements are addressed in the site specific HSP and/or WP;
- Coordinating the assignment of personnel and ensuring that the personnel and equipment provided meet the requirements of the WP and site specific HSP;
- Ensuring implementation of project quality, safety and health procedures;
- Early detection and identification of potential problem areas, including safety & health matters, and instituting corrective measures;
- Directly interfacing with the Project manager and advising him of safety and health matters related to conduct of the site operations.
- Acts as the On-Scene-Incident-Commander (OSIC) in the event of an MEC emergency, notifying and coordinating with off site emergency and medical response agencies.

UXO TECHNICIANS

All UXO Technicians are required to comply with the provisions of this Avoidance Plan, the site specific HSP, the WP and all applicable Federal, State and local regulations. They will report to the UXO Technician III.

3.2.3 CH2M HILL Subcontractors

(Reference CH2M HILL SOP HS-215, *Contracts, Subcontracts, and HSE&Q Management Practices*)

Subcontractor: To be determined

Subcontractor Contact Name:

Telephone:

The subcontractors listed above are covered by this HSP and must be provided a copy of this plan. However, this plan does not address hazards associated with the tasks and equipment that the subcontractor has expertise in (e.g., drilling, excavation work, electrical). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to these procedures submit (SOP & AHA, etc.) to CH2M HILL for review before the start of field work. Subcontractors must comply with the established health and safety plan(s). The CH2M HILL SC-HW should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s). CH2M HILL's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

CH2M HILL should continuously endeavor to observe subcontractors' safety performance. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. In addition to this level of observation, the SC-HW is responsible for confirming CH2M HILL subcontractor performance against both the subcontractor's safety plan and applicable self-assessment checklists. Self-assessment checklists contained in Attachment 6 are to be used by the SC-HW to review subcontractor performance.

Health and safety related communications with CH2M HILL subcontractors should be conducted as follows:

- Brief subcontractors on the provisions of this plan, and require them to sign the Employee Signoff Form included in Attachment 1.
- Request subcontractor(s) to brief the project team on the hazards and precautions related to their work.
- When apparent non-compliance/unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action – the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When repeat non-compliance/unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, and stop affected work until adequate corrective measures are implemented. Notify the Project Manager and HSM as appropriate.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

3.2.4 Contractors

(Reference CH2M HILL SOP HS-215, *Contracts, Subcontracts, and HSE&Q Management Practices*)

Contractor: To be determined

Contractor Contact Name:

Telephone:

This plan does not cover contractors that are contracted directly to the client or the owner. CH2M HILL is not responsible for the health and safety or means and methods of the contractor's work, and we must never assume such responsibility through our actions (e.g., advising on H&S issues). In addition to this plan, CH2M HILL staff should review contractor safety plans so that we remain aware of appropriate precautions that apply to us. Except in unusual situations when conducted by the HSM, CH2M HILL must never comment on or approve contractor safety procedures. Self-assessment checklists contained in Attachment 6 are to be used by the SC-HW to review the contractor's performance ONLY as it pertains to evaluating our exposure and safety.

Health and safety related communications with contractors should be conducted as follows:

- Request the contractor to brief CH2M HILL employees and subcontractors on the precautions related to the contractor's work.
- When an apparent contractor non-compliance/unsafe condition or practice poses a risk to CH2M HILL employees or subcontractors:
 - Notify the contractor safety representative
 - Request that the contractor determine and implement corrective actions
 - If needed, stop affected CH2M HILL work until contractor corrects the condition or practice. Notify the client, Project Manager, and HSM as appropriate.
- If apparent contractor non-compliance/unsafe conditions or practices are observed, inform the contractor safety representative. Our obligation is limited strictly to informing the contractor of our observation – the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- If an apparent imminent danger is observed, immediately warn the contractor employee(s) in danger and notify the contractor safety representative. Our obligation is limited strictly to immediately warning the affected individual(s) and informing the contractor of our observation – the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

4 Personal Protective Equipment (PPE)

(Reference CH2M HILL SOP HS-117, *Personal Protective Equipment*, HS-121, *Respiratory Protection*)

PPE Specifications ^a

Task	Level	Body	Head	Respirator ^b
General site entry Surveying Surface Soil Sampling Geophysical Surveying	D	Work clothes; steel-toe, leather work boots; work glove.	Hardhat ^c Safety glasses Ear protection ^d	None required
Geoprobe boring	Modified D	Work clothes or cotton coveralls Boots: Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers Gloves: Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat ^c Safety glasses Ear protection ^d	None required
Groundwater sampling Soil boring Investigation-derived waste (drum) sampling and disposal	Modified D	Boots: Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers Gloves: Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat ^c Safety glasses Ear protection ^d	None required.
Tasks requiring upgrade	C	Coveralls: Uncoated Tyvek® Boots: Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers Gloves: Inner surgical-style nitrile & outer chemical-resistant nitrile gloves	Hardhat ^c Splash Shield ^e Safety glasses Ear protection ^d	Full face air purifying respirator fitted with organic vapor cartridges.

Reasons for Upgrading or Downgrading Level of Protection

Upgrade ^f	Downgrade
<ul style="list-style-type: none"> Request from individual performing tasks. Change in work tasks that will increase contact or potential contact with hazardous materials. Occurrence or likely occurrence of gas or vapor emission. Known or suspected presence of dermal hazards. Instrument action levels (Section 5) exceeded. 	<ul style="list-style-type: none"> New information indicating that situation is less hazardous than originally thought. Change in site conditions that decreases the hazard. Change in work task that will reduce contact with hazardous materials.

^a Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.

^b No facial hair that would interfere with respirator fit is permitted.

^c Hardhat and splash-shield areas are to be determined by the SC-HW.

^d Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.

^e Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is > 85%, or if organic vapor measurements are > midpoint of Level C range (refer to Section 5)--then at least every 4 hours. If encountered conditions are different than those anticipated in this HSP, contact the HSM.

^f Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM, and an SC-HW qualified at that level is present.

5 Air Monitoring/Sampling

(Reference CH2M HILL SOP HS-207 - *Exposure Monitoring*)

5.1 Air Monitoring Specifications

Instrument	Tasks	Action Levels ^a		Frequency ^b	Calibration
FID: OVA model 128 or equivalent	Soil sampling, drilling and other intrusive work.	<1 ppm 1 to 10 ppm > 10 ppm	Level D Level C Evacuate work area and contact HSM	Initially and periodically during task	Daily
PID: OVM with 10.6eV lamp or equivalent	Soil sampling, drilling and other intrusive work.	<1 ppm 1 to 10 ppm > 10 ppm	Level D Level C Evacuate work area and contact HSM	Initially and periodically during task	Daily
CGI: MSA model 260 or 261 or equivalent	Soil sampling, drilling and other intrusive work.	0-10% : 10-25% LEL: >25% LEL:	No explosion hazard Potential explosion hazard Explosion hazard; evacuate or vent	Continuous during advancement of boring or trench	Daily
O₂Meter: MSA model 260 or 261 or equivalent	Soil sampling, drilling and other intrusive work.	>25% ^c O ₂ : 20.9% ^c O ₂ : <19.5% ^c O ₂ :	Explosion hazard; evacuate or vent Normal O ₂ O ₂ deficient; vent or use SCBA	Continuous during advancement of boring or trench	Daily
Visual Dust Monitoring	Soil sampling, drilling and other intrusive work.	Visual clouds of dust present	Evacuate work area and contact HSM	Initially and periodically during task	NA

^a Action levels apply to sustained breathing-zone measurements above background.

^b The exact frequency of monitoring depends on field conditions and is to be determined by the SC-HW; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place/location where measurement is taken (e.g., "Breathing Zone/MW-3", "at surface/SB-2", etc.).

^c If the measured percent of O₂ is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O₂ action levels apply only to ambient working atmospheres, and not to confined-space entry. More-stringent percent LEL and O₂ action levels are required for confined-space entry (refer to Section 2).

^d Refer to SOP HS-10 for instructions and documentation on radiation monitoring and screening.

^e Noise monitoring and audiometric testing also required.

5.2 Calibration Specifications

(Refer to the respective manufacturer's instructions for proper instrument-maintenance procedures)

Instrument	Gas	Span	Reading	Method
PID: OVM, 10.6 or 11.8 eV bulb	100 ppm isobutylene	RF = 1.0	100 ppm	1.5 lpm reg T-tubing
PID: MiniRAE, 10.6 eV bulb	100 ppm isobutylene	CF = 100	100 ppm	1.5 lpm reg T-tubing
PID: TVA 1000	100 ppm isobutylene	CF = 1.0	100 ppm	1.5 lpm reg T-tubing
FID: OVA	100 ppm methane	3.0 ± 1.5	100 ppm	1.5 lpm reg T-tubing
FID: TVA 1000	100 ppm methane	NA	100 ppm	2.5 lpm reg T-tubing
Dust Monitor: Miniram-PDM3	Dust-free air	Not applicable	0.00 mg/m ³ in "Measure" mode	Dust-free area OR Z-bag with HEPA filter
CGI: MSA 260, 261, 360, or 361	0.75% pentane	N/A	50% LEL \pm 5% LEL	1.5 lpm reg direct tubing

5.3 Air Sampling

Sampling, in addition to real-time monitoring, may be required by other OSHA regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, and certain volatile organic compounds. Contact the HSM immediately if these contaminants are encountered.

Method Description

None anticipated.

Personnel and Areas

Results must be sent immediately to the HSM. Regulations may require reporting to monitored personnel. Results reported to:

HSM: Michael Goldman/ATL
MRSO: Dan Young/NVR

6 Decontamination

(Reference CH2M HILL SOP HS-506, *Decontamination*)

The SC-HW must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SC-HW. The SC-HW must ensure that procedures are established for disposing of materials generated on the site.

6.1 Decontamination Specifications

Personnel	Sample Equipment	Heavy Equipment
<ul style="list-style-type: none"> • Boot wash/rinse • Glove wash/rinse • Outer-glove removal • Body-suit removal • Inner-glove removal • Respirator removal • Hand wash/rinse • Face wash/rinse • Shower ASAP • Dispose of PPE in municipal trash, or contain for disposal • Dispose of personnel rinse water to facility or sanitary sewer, or contain for offsite disposal 	<ul style="list-style-type: none"> • Wash/rinse equipment • Solvent-rinse equipment • Contain solvent waste for offsite disposal 	<ul style="list-style-type: none"> • Power wash • Steam clean • Dispose of equipment rinse water to facility or sanitary sewer, or contain for offsite disposal

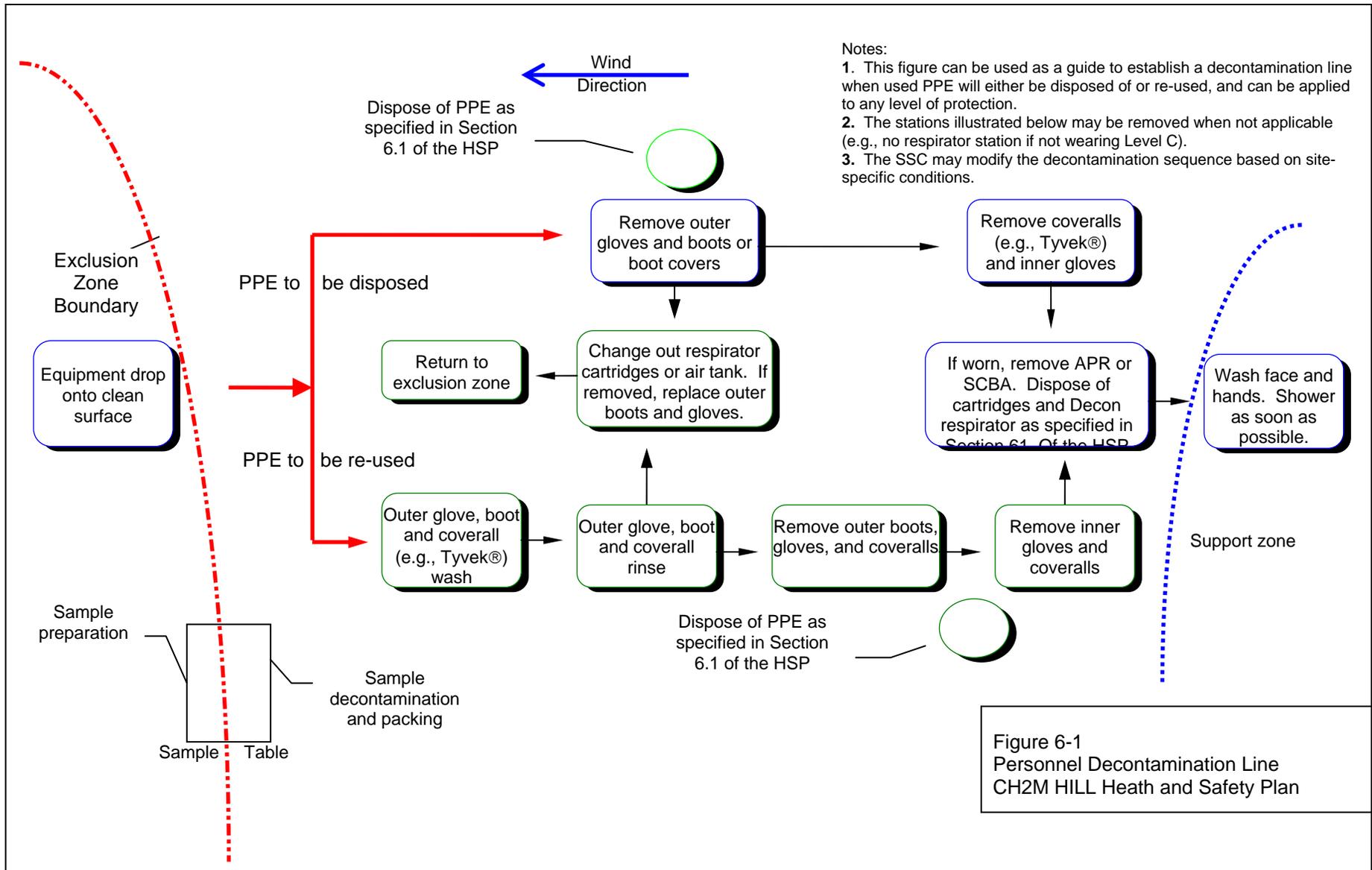
6.2 Diagram of Personnel-Decontamination Line

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SC-HW should establish areas for eating, drinking, and smoking. Contact lenses are not permitted in exclusion or decontamination zones.

Figure 6-1 illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the SC-HW to accommodate task-specific requirements.

7 Spill-Containment Procedures

Sorbent material will be maintained in the support zone. Incidental spills will be contained with sorbent and disposed of properly.



8 Site-Control Plan

8.1 Site-Control Procedures

(Reference CH2M HILL SOP HS-510, *Site Control*)

- The SC-HW will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.
- Topics for briefing on site safety: general discussion of Health and Safety Plan, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, emergencies.
- The SC-HW records attendance at safety briefings in a logbook and documents the topics discussed.
- Post the OSHA job-site poster in a central and conspicuous location in accordance with CH2M HILL SOP HS-116, *OSHA Postings*.
- Establish support, decontamination, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
 - Line-of-sight and hand signals
 - Air horn
 - Two-way radio or cellular telephone if available
- Establish offsite communication.
- Establish and maintain the “buddy system.”
- Initial air monitoring is conducted by the SSC in appropriate level of protection.
- The SC-HW is to conduct periodic inspections of work practices to determine the effectiveness of this plan – refer to Sections 2 and 3. Deficiencies are to be noted, reported to the HSM, and corrected.

8.2 UXO Site Control

The UXO Technician III coordinates access control and security on site. Strict MEC avoidance procedures will be practiced during field investigation activities. An instrument-assisted visual site survey will be completed prior to commencing field sampling activities. Due to the hazardous nature of MEC work, only authorized personnel will be allowed within 200 ft of work operations. Authorized personnel are those that have completed the required training, meet medical requirements and are essential to the ongoing operation. This 200 ft buffer is an area large enough to prevent personnel injuries from fragmentation and overpressure resulting from either an unintentional or intentional detonation of MEC.

During duty hours, personnel will provide security at the site. All work will stop if any unauthorized personnel approach within 200 feet of work operations. This will ensure the field team’s safety and the safety of those approaching the work site. Equipment will be returned to a designated area and secured at the end of each work day. Future site control measures to ensure safety are as follows;

- Eating, drinking and smoking are prohibited except in designated areas;
- MEC operations will cease if non-UXO trained or non-essential personnel are present;
- The UXO Technician III will escort all authorized visitors to the site;
- The UXO Technician III will maintain the site entry control log to ensure accurate accountability of personnel;
- The UXO Technician III will brief this UXO Avoidance Plan to all personnel entering the site to inform them of the potential site hazards. All personnel will acknowledge this briefing by signing the briefing log;
- In case of an emergency, personnel will exit the site and move to the designated safe area. The UXO Technician II will assist in determining the severity of the emergency. If the emergency warrants evacuation, the UXO Technician III will notify the Project Manager.

8.2 Hazwoper Compliance Plan

(Reference CH2M HILL SOP HS-220, *Site-Specific Written Safety Plans*)

Certain parts of the site work are covered by state or federal Hazwoper standards and therefore require training and medical monitoring. Anticipated Hazwoper tasks (Section 1.1.1) might occur consecutively or concurrently with respect to non-Hazwoper tasks. This section outlines procedures to be followed when approved activities specified in Section 1.1.2 do not require 24- or 40-hour training. Non-Hazwoper-trained personnel also must be trained in accordance with all other state and federal OSHA requirements.

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors before non-Hazwoper-trained personnel are allowed on the site, or while non-Hazwoper-trained staff are working in proximity to Hazwoper activities. Other data (e.g., soil) also must document that there is no potential for exposure. The HSM must approve the interpretation of these data. Refer to subsections 2.5 and 5.3 for contaminant data and air sampling requirements, respectively.
- When non-Hazwoper-trained personnel are at risk of exposure, the SSC must post the exclusion zone and inform non-Hazwoper-trained personnel of the:
 - nature of the existing contamination and its locations
 - limitations of their access
 - emergency action plan for the site
- Periodic air monitoring with direct-reading instruments conducted during regulated tasks also should be used to ensure that non-Hazwoper-trained personnel (e.g., in an adjacent area) are not exposed to airborne contaminants.
- When exposure is possible, non-Hazwoper-trained personnel must be removed from the site until it can be demonstrated that there is no longer a potential for exposure to health and safety hazards.
- Remediation treatment system start-ups: Once a treatment system begins to pump and treat contaminated media, the site is, for the purposes of applying the Hazwoper standard, considered a treatment, storage, and disposal facility (TSDF). Therefore, once the system begins operation, only Hazwoper-trained personnel (minimum of 24 hour of training) will be permitted to enter the site. All non-Hazwoper-trained personnel must not enter the TSDF area of the site.

9 Emergency Response Plan

(Reference CH2M HILL, SOP HS-106, *Emergency Planning*)

9.1 Pre-Emergency Planning

The SC-HW performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency-service providers as appropriate.

- Review the facility emergency and contingency plans where applicable.
- Determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Determine what offsite communication equipment is needed (e.g., nearest telephone, cell phone).
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Field Trailers: Post “Exit” signs above exit doors, and post “Fire Extinguisher” signs above locations of extinguishers. Keep areas near exits and extinguishers clear.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin, including driving route to hospital.
- Brief new workers on the emergency response plan.

The SC-HW will evaluate emergency response actions and initiate appropriate follow-up actions.

9.2 Emergency Equipment and Supplies

The SC-HW should mark the locations of emergency equipment on the site map and post the map.

Emergency Equipment and Supplies	Location
20 LB (or two 10-lb) fire extinguisher (A, B, and C classes)	Support Zone/Heavy Equipment
First aid kit	Support Zone/Field Vehicle
Eye Wash	Support & Decon Zone/Field Vehicle
Potable water	Support & Decon Zone/Field Vehicle
Bloodborne-pathogen kit	Support Zone/Field Vehicle
Additional equipment (specify):	

9.3 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Shut down CH2M HILL operations and evacuate the immediate work area.
- Notify appropriate response personnel.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.

Instead of implementing a work-area evacuation, note that small fires or spills posing minimal safety or health hazards may be controlled.

9.4 Emergency Medical Treatment

The procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to Human Resources. If there is doubt about whether medical treatment is necessary, or if the injured person is reluctant to accept medical treatment, contact the CH2M HILL medical consultant. During non-emergencies, follow these procedures as appropriate.

- Notify appropriate emergency response authorities listed in Section 9.8 (e.g., 911).
- The SC-HW will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR where feasible.
- Get medical attention immediately.
- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.
- Make certain that the injured person is accompanied to the emergency room.
- When contacting the medical consultant, state that the situation is a CH2M HILL matter, and give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.
- Report incident as outlined in Section 9.7.

9.5 Evacuation

- Evacuation route(s) and assembly area(s) will be designated by the SC-HW before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The SC-HW and a “buddy” will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The SC-HW will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The SC-HW will write up the incident as soon as possible after it occurs and submit a report to the Corporate Director of Health and Safety.

9.6 Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy’s wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

9.7 Incident Notification and Reporting

- Upon any project incident (fire, spill, injury, near miss, death, etc.), immediately notify the PM and HSM. Call emergency beeper number if HSM is unavailable.
- For CH2M HILL work-related injuries or illnesses, contact and help Human Resources administrator complete an Incident Report Form (IRF). IRF must be completed within 24 hours of incident.
- For CH2M HILL subcontractor incidents, complete the Subcontractor Accident/Illness Report Form and submit to the HSM.
- Notify and submit reports to client as required in contract.

9.8 Emergency Contacts

EMERGENCY CONTACTS

If an injury occurs, notify the injured person's personnel office as soon as possible after obtaining medical attention for the injured person. Notification MUST be made within 24 hours of the injury.

24-hour CH2M HILL Emergency Contact – 800/756-1130

Medical Emergency – 911 or

Hospital ER (On-Base) #: (910) 451-4840
(910) 451-4841
(910) 451-4842
Onslow County ER (Off-Base) #: (910) 577-2240
Ambulance (On-Base) #: (910) 451-3004
(910) 451-3005
Ambulance (Public) #: (910) 451-9111
LEPC (Poison Control)#: (800) 222-1222

CH2M HILL Medical Consultant

Occupational Health Nurse
1-800-756-1130
(notify the PM before contacting)

Fire/Spill Emergency – 911 or

Base Fire Response #: (910) 451-9111

Local Occupational Physician

Occupational Medicine Specialists
4815 Oleander Dr.
Wilmington, NC 28403
910 452-1111

Security & Police – 911 or

Base Security #: (910) 451-2555

Corporate Director Health and Safety

Name: Keith Christopher
Phone: 703/356-1113

On-Scene Coordinator

Name: Fire Chief
Phone: (910) 451-5815

Environmental Management Division (EMD)

Names: Bob Lowder
Phone: (910) 451-9607

Utilities Emergency

Water: Contact PM
Gas: Contact Base EMD
Electric: Contact PM

Health and Safety Manager (HSM)

Name: Michael Goldman/ATL
Phone: (770) 604-9182 x 54133

Designated Safety Coordinator (DSC)

Name: TBD
Phone:

Regional Human Resources Department

Name: Mary Jo Jordan/GNV
Phone: 352/355-5877 x 52231

Project Manager

Name: Jessica Skeean/CLT
Phone: 704-329-0073 x251

Corporate Human Resources Department

Name: Monica Romero/DEN
Phone: (720) 286-3059 ext: 63059

MR Senior Consultant

Name: Thomas M. Roth/ATL
Phone: 404-474-7640 (office)
404-259-6674 (cell)

Corporate MEC H&S Manager

Name: Dan Young
Phone: 251-962-2963 (home office)
251-752-0148 (cell)

Federal Express Dangerous Goods Shipping

Phone: 800/238-5355

CH2M HILL Emergency Number for Shipping Dangerous Goods

Phone: 800/255-3924

Worker's Compensation and Auto Claims

Sterling Administration Services
Phone: 800/420-8926 After hours: 800/497-4566

Report fatalities AND report vehicular accidents involving pedestrians, motorcycles, or more than two cars.

EMERGENCY CONTACTS

Contact the Project Manager. Generally, the Project Manager will contact relevant government agencies.

Facility Alarms: TBD

Evacuation Assembly Area(s): TBD by the SC-HW; will probably be the local hotel where the field team is staying

Facility/Site Evacuation Route(s): follow main roads towards access gates and off the Base

10 Approval

This site-specific Health and Safety Plan has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

10.1 Original Plan

Written By: David Seed/RDU **Date:** November 15, 2007

Approved By: Michael Goldman **Date:** November 16, 2007

Approved By: **Date:**

10.2 Revisions

Revisions Made By: **Date:**

Revisions to Plan:

Revisions Approved By: **Date:**

11 Attachments

Attachment 1: Employee Signoff Form – Field Safety Instructions
Attachment 2: Project-Specific Chemical Product Hazard Communication Form
Attachment 3: Chemical-Specific Training Form
Attachment 4: Emergency Contacts
Attachment 5: Project H&S Forms/Permits
Attachment 6: Project Activity Self-Assessment Checklists
Attachment 7: Applicable Material Safety Data Sheets



CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project #:
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

- Physical and health hazards
- Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)
- Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL’s written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

Route to Hospital: (Depends on location within base area)

Nearest On-Base hospital:

Base Naval Hospital (only to be used in extreme emergency)
Building NH100
100 Brewster Blvd.
Camp Lejeune, NC 28547
Phone: (910) 451-4840, (910) 451-4841, (910) 451-4842

Local hospital:

Onslow County Memorial Hospital
317 Western Boulevard
Jacksonville, NC 28546
Phone: (910) 577-2240

Local ambulance service:

Base Ambulance: (910) 451-3004, (910) 451-3005
Public Ambulance: (910) 451-9111

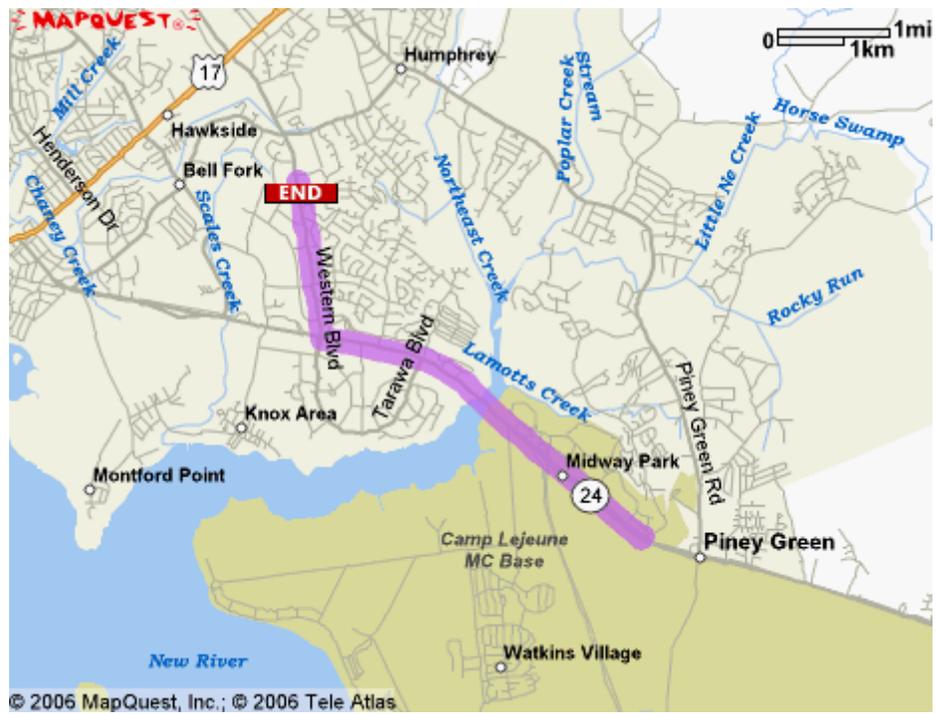
From MCB Camp Lejeune

Directions to the Base Naval Hospital (Building NH100)
(nearest hospital; only to be used in an extreme emergency)

1. Proceed north to Holcomb Boulevard (towards Highway 24).
2. Turn left onto Brewster Boulevard (heading west)
3. Continue on Brewster Boulevard until intersection with the driveway to the Naval Hospital.
4. Turn onto Hospital driveway, and proceed to emergency room.

Directions to Onslow County Memorial Hospital:

1. From Holcomb Boulevard, exit Base through main gate.
2. Follow Highway 24 west until intersecting with Western Boulevard.
3. Turn right onto Western Boulevard.
4. The Onslow County Memorial Hospital is on the left, approximately 2 miles (fifth stop light) from Highway 24.
5. Follow the signs to the emergency room.



CH2M HILL HEALTH AND SAFETY PLAN

Attachment 5

Project H&S Forms and Permits

To be completed as needed for task specific operations.

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 6

Project Activity Self-Assessment Checklists

HS&E Self-Assessment Checklist - DRILLING

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project’s written safety plan.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to drilling hazards, 2) CH2M HILL staff are providing support function related to drilling activities, and/or 3) CH2M HILL oversight of a drilling subcontractor is required.

Safety Coordinator may consult with drilling subcontractors when completing this checklist, but shall not direct the means and methods of drilling operations nor direct the details of corrective actions. Drilling subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately, or all exposed personnel shall be removed from the hazard until corrected.

Project Name: _____ Project No.: _____
 Location: _____ PM: _____
 Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

- Evaluate CH2M HILL employee exposures to drilling hazards (complete Section 1).
- Evaluate CH2M HILL support functions related to drilling activities (complete Section 2)
- Evaluate a CH2M HILL subcontractor’s compliance with drilling safety requirements (complete entire checklist).
 Subcontractors Name: _____

- Check “Yes” if an assessment item is complete/correct.
- Check “No” if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the drilling subcontractor. Section 3 must be completed for all items checked “No.”
- Check “N/A” if an item is not applicable.
- Check “N/O” if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in SOP HSE-35.

SECTION 1 - SAFE WORK PRACTICES (4.1)

	Yes	No	N/A	N/O
1. Personnel cleared during rig startup	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Personnel clear of rotating parts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Personnel not positioned under hoisted loads	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Loose clothing and jewelry removed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Smoking is prohibited around drilling operation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Personnel wearing appropriate personal protective equipment (PPE), per written plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Personnel instructed not to approach equipment that has become electrically energized	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION 2 - SUPPORT FUNCTIONS (4.2)

FORMS/PERMITS (4.2.1)

8. Driller license/certification obtained	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Well development/abandonment notifications and logs submitted and in project files	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Water withdrawal permit obtained, where required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Dig permit obtained, where required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

UTILITY LOCATING (4.2.2)

12. Location of underground utilities and structures identified	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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SECTION 2 (Continued)				
WASTE MANAGEMENT (4.2.3)	Yes	No	N/A	N/O
13. Drill cuttings and purge water managed and disposed properly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILLING AT HAZARDOUS WASTE SITES (4.2.4)				
14. Waste disposed of according to project's written safety plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Appropriate decontamination procedures being followed, per project's written safety plan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILLING AT MUNITIONS RESPONSE SITES (4.2.5)				
16. OE plan prepared and approved	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. OE/UXO avoidance provided, routes and boundaries cleared and marked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Initial pilot hole established by UXO technician with hand auger	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Personnel remain inside cleared areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SECTION 3 - DRILLING SAFETY REQUIREMENTS (4.3)				
GENERAL (4.3.1)				
20. Only authorized personnel operating drill rigs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Daily safety briefing/meeting conducted with crew	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Daily inspection of drill rig and equipment conducted before use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILL RIG PLACEMENT (4.3.2)				
23. Location of underground utilities and structures identified	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Safe clearance distance maintained from overhead power lines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Drilling pad established, when necessary	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Drill rig leveled and stabilized	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. Additional precautions taken when drilling in confined areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILL RIG TRAVEL (4.3.3)				
28. Rig shut down and mast lowered and secured prior to rig movement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Tools and equipment secured prior to rig movement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. Only personnel seated in cab are riding on rig during movement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Safe clearance distance maintained while traveling under overhead power lines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. Backup alarm or spotter used when backing rig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILL RIG OPERATION (4.3.4)				
33. Kill switch clearly identified and operational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. All machine guards are in place	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35. Rig ropes not wrapped around body parts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36. Pressurized lines and hoses secured from whipping hazards	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37. Drill operation stopped during inclement weather	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. Air monitoring conducted per written safety plan for hazardous atmospheres	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. Rig placed in neutral when operator not at controls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILL RIG SITE CLOSURE (4.3.5)				
40. Ground openings/holes filled or barricaded	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41. Equipment and tools properly stored	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42. All vehicles locked and keys removed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILL RIG MAINTENANCE (4.3.6)				
28. Defective components repaired immediately	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Lockout/tagout procedures used prior to maintenance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. Cathead in clean, sound condition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Drill rig ropes in clean, sound condition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. Fall protection used for fall exposures of 6 feet (U.S.) 1.5 meters (Australia) or greater	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. Rig in neutral and augers stopped rotating before cleaning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. Good housekeeping maintained on and around rig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 7

Applicable Material Safety Data Sheets

**CH2M HILL HEALTH AND SAFETY PLAN
ATTACHMENT 8**

USACE Incident Report Form 3394

**CH2M HILL HEALTH AND SAFETY PLAN
ATTACHMENT 9**

Project Standard SOP(s)

Appendix E

MEC Removal Standard Operating Procedures

**STANDARD OPERATING PROCEDURE – OPS-14
MEC ANALOG DETECTION AND REMOVAL ACTIONS****1.0 PURPOSE**

The purpose of this Standard Operating Procedure (SOP) is to provide all USA Environmental, Inc. (USAE) employees and subcontractors with the minimum procedures and safety and health requirements applicable to the conduct of analog detection and removal actions (mag and dig) at sites potentially containing unexploded ordnance (UXO) and/or munitions and explosives of concern (MEC).

2.0 SCOPE

This SOP applies to all USAE site personnel, including contractor and subcontractor personnel, involved in the conduct of analog detection and removal actions (mag and dig) on a UXO/MEC contaminated site. The following USAE policies and procedures are not all inclusive nor are they applicable in all situations. This SOP is not a stand-alone document and is to be used together with Work Plans, other USAE SOPs, the USAE Site Safety and Health Plan (SSHP), applicable Federal, State, and local regulations, and contract restrictions and guidance. Consult the documents listed in Section 7.0 of this SOP for additional compliance issues.

3.0 RESPONSIBILITIES**3.1 PROJECT MANAGER**

The Project Manager is responsible for ensuring availability of resources to safely and effectively implement this SOP.

3.2 SITE MANAGER

The Site Manager is responsible for incorporating this SOP in plans, procedures, and training. In addition, he is responsible for oversight and supervision of field personnel, and ensuring compliance with this SOP.

3.3 UXO SAFETY OFFICER

The UXO Safety Officer (UXOSO) ensures that all mag and dig activities are conducted in a safe manner, in accordance with the approved Work Plan, the SSHP, this SOP, and all applicable regulatory guidance. The UXOSO's duties shall include, but are not limited to: analyzing UXO explosives operational risk, hazards, and safety requirements; establishing and ensuring compliance with all site-specific safety requirements for UXO and explosives operations; enforcing personnel limits and safety exclusion zones (EZ) for UXO clearance operations; and all activities associated with UXO and explosives transportation, storage, and destruction.

3.4 UXO QUALITY CONTROL SPECIALIST

The UXO Quality Control Specialist (UXOQCS) ensures compliance with the project Quality Control (QC) Plan and performs analog QC checks of completed grids in accordance with the Work Plan.

4.0 OPERATIONS**4.1 ANALOG DETECTION AND REMOVAL ACTIONS**

All analog detection and removal (mag and dig) activities at MEC sites will be under the supervision of UXO qualified personnel. Non-UXO qualified personnel will not be allowed in the EZ during intrusive operations. If access is required by non-UXO qualified personnel, all work will stop while they are in the EZ. During operations, USAE personnel will strictly adhere to the SSHP and the following general safety practices:

-
- Operations will be conducted during daylight hours only.
 - Access to operating areas will be limited to only those personnel necessary to accomplish the specific operation.
 - UXO will only be handled by qualified UXO Technicians.
 - During UXO operations the minimum separation distance (MSD) between UXO and non-UXO operations is fragmentation distance of the munition with the greatest fragmentation distance (MGFD), as stated in the Work Plan.
 - During demolition operations personnel remaining on site will be limited to those personnel needed to safely and efficiently prepare the item/s for destruction.).
 - All personnel will attend the daily safety briefing (tailgate safety briefing) prior to entering the operating area.
 - Anyone can stop operations for an unsafe act or situation.
 - Safety violations and/or unsafe acts will be immediately reported to the UXOSO.
 - Failure to comply with safety rules/procedures may result in termination of employment.

4.2 GRID LAYOUT

A registered land surveyor will survey each of the clearance areas, accompanied by a UXO escort. Surveying activities will consist of locating clearance area boundaries, establishing permanent survey monuments, and establishing grids for geophysical investigation activities within the clearance areas.

Depending on the method selected and approved by the customer, the site layout and search grids will be established using a Global Positioning System (GPS), licensed surveyor, or compass and measuring tape. Survey crews will be escorted in the field by a UXO Technician II or above who will provide UXO avoidance including checking the intended survey stake locations with a magnetometer prior to driving stakes into the ground. This will prevent driving stakes into buried MEC.

4.3 ANALOG SWEEP PROCEDURES

Intrusive investigation team(s) will consist of a Team Leader (UXO Technician III) and UXO Technicians II/I. During intrusive operations UXO Technicians I will operate under the supervision of UXO Technicians II or III. UXO operations will only be performed by qualified UXO Technicians, which are defined as:

- MEC identification
- Access procedures such as excavation, either by hand or using heavy equipment
- Handling of MEC/UXO, explosives, or explosive items
- Disposal, including movement, transportation, and final disposal of MEC

Analog detector sweeps (i.e., mag and dig) are particularly effective in areas where vegetation and terrain limit the use of larger digital systems. Also, mag and dig approaches should be used when there is insufficient difference between UXO at the site and other metallic fragments and debris, such that digital discrimination is ineffective or cost prohibitive.

Initially, individual search lanes will be established approximately 5 feet (ft) wide. Each lane will be surveyed using a Schonstedt GA-52CX and/or White's XLT magnetometer. The operation will begin at one end of each lane and move in a forward direction toward the opposing baseline. During the forward movement the technician moves the magnetometer back and forth from one side of the lane to the other. Both forward movement and the swing of the magnetometer are performed at a pace that ensures the entire lane is searched and that the instrument is able to appropriately respond to subsurface anomalies. When a subsurface anomaly or metallic surface object is encountered, the UXO Technician halts and investigates the anomaly at that time. Throughout this operation the team leader closely monitors the team's individual performance to ensure these procedures are being performed correctly.

4.4 SURFACE UXO

Upon encountering a surface MEC it will be identified by two UXO Technicians and marked in accordance with the approved Work Plan for future disposition. If detonation cannot be arranged the same day as the MEC is identified, a guard will be posted during the non-working hours to ensure the item is not disturbed.

4.5 SUBSURFACE ANOMALIES

4.5.1 MANUAL EXCAVATIONS

Subsurface anomalies will be investigated by UXO-qualified personnel as they are identified during the sweep. All identified anomalies within the grid will be intrusively investigated. Excavations for individual anomalies will be conducted using the Schonstedt GA-52CX and/or White's XLT magnetometers to assist the team in determining the location and orientation of the target item. The UXO Technicians excavating anomalies shall initially remove no more than a 6-inch layer of soil along side the location of the anomaly, being careful not to impact the anomalous feature. The UXO Technician will conduct a visual and electronic search of the excavation to further pin point the anomaly source as needed. This process shall be repeated until the audible signal from the magnetometer indicates the object is close to the surface. Once this determination has been made, soil will be removed by hand until the source of the anomaly is located. Excavations on individual anomalies greater than 4 ft below the ground surface (bgs) will not be made without prior approval of the U.S. Army Corps of Engineers (USACE) OE Safety Specialist.

4.5.2 MECHANICAL HANDLING EQUIPMENT

Mechanical Handling Equipment (MHE) may be used to excavate large anomalies (e.g., pits) or those deeper than 4 ft bgs if required (e.g., to confirm the anomaly is not a MEC). Any decision to use MHE to excavate these anomalies will be made by the SUXOS and the USACE OE Safety Specialist (see SOP OPS-06, Excavation and Trenching for detailed MHE procedures). The excavation will proceed slowly to ensure the item is not broached by the MHE. If the excavated material is considered to be a MEC, it shall be uncovered sufficiently by hand to obtain a positive identification of the item. If the item is identified as UXO/MEC, a determination will subsequently be made as to whether it is fused or not.

While excavating with MHE, a UXO Technician will be stationed in a position that is out of the reach of the excavation equipment but affords a view of the excavation site. This observer will ensure that the next lift is visually free of UXO. The excavated material will be placed onto the ground within a screening area that has been surface swept and the boundaries recorded. The soil spoils will be spread across the screening area using the excavator bucket. The excavated material will be screened for range related debris, munitions debris, and UXO/MEC items. UXO technicians will recover all pieces of munitions debris or range related debris and any ordnance items. After screening, the soil spoils will be stockpiled to the side of the screening area.

5.0 RECORD KEEPING

The team leader will maintain a field logbook, which at a minimum will contain a record of the following:

-
- Weather
 - Instrument details and serial number
 - Team Personnel
 - Grids worked
 - Start and stop times
 - MEC/UXO items encountered

The data to be recorded for each item discovered during anomaly excavation will include the following (as applicable):

- Type (e.g., MD, MPPEH, UXO, and non-MEC Scrap)
- Description (e.g., "projo, 20-mm, practice, MK105" and "base, coupling, firing device")
- Initial Condition (e.g., expended, inert, live, and to be determined [TBD])
- Approximate length
- Approximate width
- Depth
- Approximate weight
- Found in a pit?
- Piece of frag?
- Initial disposition (e.g., left in place and removed to scrap pile)
- Requires demolition?

All data will be turned into the Site Geophysicist at the end of the day.

6.0 DISPOSAL OPERATIONS

Fuzed UXO/MEC items will be blown in place (BIP), and un-fuzed UXO/MEC items will be consolidated whenever possible in accordance with USACE Engineer Pamphlet 1110-1-17, Establishing a Temporary Open Burn and Open Detonation Site for Conventional Ordnance and Explosives Projects, dated 16 July 1999, Appendix D. In no case shall the SUXOS authorize or undertake destruction of UXO/MEC when there is sufficient reason to believe that the disposal action will result in personnel casualties or property damage. The USACE OE Safety Specialist will be consulted for guidance in the event that there is sufficient reason to believe that the disposal action will result in personnel casualties or property damage.

7.0 REFERENCES

- USACE Safety Considerations for UXO

- USAE Corporate Safety and Health Program (CSHP)
- OSHA, 29 CFR 1910, Occupational Safety and Health Standards
- OSHA, 29 CFR 1926, Construction Standards
- Applicable sections of EPA, 40 CFR Parts 260 to 299, Protection of Environment
- Applicable sections of DOT, 49 CFR Parts 100 to 199, Transportation
- USACE EM 385-1-1, Safety and Health Requirements Manual
- USACE ER 385-1-92, Safety and Occupational Health Document Requirements for Hazardous Waste Remedial Actions
- DOD 4145.26-M, Contractors' Safety Manual for Ammunition and Explosives
- DOD 6055.9-STD, DOD Ammunition and Explosives Safety Standards
- DOD 4160.21-M, Defense Reutilization and Marketing Manual
- DA PAM 385-64, Ammunition and Explosives Safety Standards
- AR 385-64, Ammunition and Explosives Safety Standards
- AR 200-1, Environmental Protection and Enhancement
- AR 385-10, The Army Safety Program
- AR 385-16, System Safety Engineering and Management
- AR 385-40 w/USACE supplement, Accident Reporting and Records
- TM 9-1300-200, Ammunition General
- TM 9-1300-214, Military Explosives
- TM 60 Series Publications