

Final

**Site Specific Work Plan Addendum  
for Preliminary Assessment/Site Inspection  
Site UXO-12 New River 1,000-inch Range (ASR #2.5) and  
UXO-18 50-foot Small Bore Range (ASR #2.44)**

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

**Contract Task Order 040**

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Under the

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Prepared by



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# Contents

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<b>Acronyms and Abbreviations .....</b>	<b>v</b>
<b>1 Introduction .....</b>	<b>1-1</b>
1.1 Background and Project Objectives.....	1-1
1.2 Purpose.....	1-1
1.3 Work Plan Scope and Organization .....	1-2
1.4 Site Location and Description .....	1-3
1.5 Site History .....	1-4
1.5.1 UXO-12/UXO-18 .....	1-4
1.5.2 UXO-05 Range .....	1-4
1.6 Climate .....	1-5
1.7 Geology and Hydrogeology .....	1-5
<b>2 Technical Management Plan .....</b>	<b>2-1</b>
2.1 Project Personnel, Organization, and Schedule.....	2-1
2.1.1 Project Organization .....	2-1
2.1.2 Project Personnel.....	2-1
2.1.3 Project Schedule .....	2-1
2.2 Technical Approach.....	2-1
2.2.1 Planning .....	2-1
2.2.2 Work Plan Preparation.....	2-1
2.2.3 Site Investigation.....	2-2
2.2.4 Geographical Information System.....	2-2
2.2.5 Focused PA/SI Report .....	2-2
<b>3 Field Investigation Plan.....</b>	<b>3-1</b>
3.1 Overall Approach .....	3-1
3.2 Site Preparation and Restoration .....	3-2
3.2.1 Mobilization.....	3-2
3.2.2 Site Survey .....	3-2
3.2.3 Vegetation Clearing .....	3-3
3.2.4 Buried Utility Clearance.....	3-3
3.2.5 Site Restoration and Demobilization.....	3-3
3.3 Geospatial Information and Electronic Submittals .....	3-3
3.4 Field Sampling Plan.....	3-4
3.4.1 Field Operations.....	3-4
3.4.2 Analytical Requirements and Sample Handling.....	3-6
3.4.3 Investigation-derived Waste Management .....	3-8
3.5 Health and Safety Plan.....	3-8
3.6 Data Management.....	3-8
3.7 Project File Requirements .....	3-9
<b>4 Quality Control Plan .....</b>	<b>4-1</b>

<b>5</b>	<b>Environmental Protection Plan.....</b>	<b>5-1</b>
5.1	Regional Ecological Summary .....	5-1
5.2	Endangered/Threatened Species within the Project Site .....	5-1
5.3	Wetlands within the Project Site .....	5-2
5.4	Cultural and Archaeological Resources within the Project Site .....	5-3
5.5	Water Resources within the Project Site.....	5-3
5.6	Coastal Zones within the Project Site .....	5-3
5.7	Vegetation to be removed within the Project Site.....	5-4
5.8	Existing Waste Disposal Sites within the Project Site.....	5-4
5.9	Compliance with Applicable or Relevant and Appropriate Requirements.....	5-4
5.10	Detailed Procedures and Methods to Protect and/or Mitigate the Resources/Sites Identified .....	5-4
<b>6</b>	<b>References.....</b>	<b>6-1</b>

### Appendices

- A Archival Records Search Report
- B Health and Safety Plan
- C UFP-SAP Cross-Walk Table and QAPP

### Tables

- 2-1 Project Personnel Contact Information
- 3-1 Summary of Sampling Program
- 3-2 Analyses, Bottleneck, Preservation, and Holding Time Requirements
- 3-3 Required QA/QC Samples
- 3-4 Sample Collection Frequencies
- 4-1 Definable Features of Work Auditing Procedures
- 5-1 Species Potentially Occurring on or Adjacent to Camp Lejeune Listed as Threatened, Endangered, or of Special Concern by the USFWS

### Figures

- 1-1 UXO-12/UXO-18 Location Map
- 1-2 Historical Range Fan Boundaries
- 2-1 Project Schedule
- 3-1 Proposed XRF Screening Locations
- 3-2 Proposed Sampling Locations

# Acronyms and Abbreviations

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AHA	Activity Hazard Analysis
ASR	Archive Search Report
bgs	below ground surface
BMP	Best Management Practice
CAMA	Coastal Area Management Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-term Environmental Action – Navy
COC	Chain-of-Custody
CTO	Contract Task Order
DCM	Division of Coastal Management
DFOW	Definable Features of Work
DPT	Direct Push Technology
EOD	Explosives Ordnance Disposal
ERS	Ecological Risk Screenings
ESV	Ecological Screening Value
FID	Flame Ionization Detector
FTL	Field Team Leader
GIS	Geographical Information System
HSP	Health and Safety Plan
HWS	Hazardous Waste Section
ID	Inner Diameter
IDW	Investigation-derived Waste
INRMP	Integrated Natural Resource Management Plan
m	meter
MC	Munitions Constituents
MCB	Marine Corps Base
MCL	Maximum Contaminant Level
MEC	Munitions and Explosives of Concern
MG	Machine Gun
MILCON	Military Construction
MRP	Munitions Response Program
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NAVFAC	Naval Facilities Engineering Command
NCDENR	North Carolina Department of Environment and Natural Resources

NCGWQS	North Carolina Groundwater Quality Standards
NEPA	National Environmental Policy Act
NRHP	National Register of Historic Places
PA	Preliminary Assessment
PM	Project Manager
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCP	Quality Control Plan
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan
SI	Site Inspection
SLERA	Screening-level Ecological Risk Assessment
SOP	Standard Operating Procedure
SSL	Soil Screening Level
UFP	Uniform Federal Policy
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound
WP	Work Plan
XRF	X-ray Fluorescence

# Introduction

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## 1.1 Background and Project Objectives

The United States Marine Corps and Naval Facilities Engineering Command (NAVFAC) are in the process of investigating closed ranges at Marine Corps Base (MCB) Camp Lejeune following the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. Due to historical activities at Site Unexploded Ordnance (UXO)-12 New River 1,000-inch Range ([Archive Search Report (ASR)] #2.5) and the UXO-18 50-foot Small Bore Range (ASR #2.44) (herein referred to as UXO-12/UXO-18), a munitions response program (MRP) Preliminary Assessment/Site Inspection (PA/SI) is being conducted to accomplish the following objectives:

- Identify historical activities that may have resulted in environmental contamination with munitions and explosives of concern (MEC) or munitions constituents (MC).
- Evaluate the presence and nature of MC contamination that may exist at UXO-12/UXO-18.
- Conduct ecological and human health risk screenings using analytical data collected at UXO-12/UXO-18.

This Work Plan (WP) Addendum has been developed to facilitate the implementation of a PA/SI for the UXO-12/UXO-18 investigation area. This PA/SI includes UXO-12 and the portions of UXO-18 that have been selected for closure. The remainder of the UXO-18 site overlaps active range area and will not be addressed during this effort. The UXO-12/UXO-18 investigation area is located in the northwest corner of MCB Camp Lejeune just south of Foster Boulevard, mostly north of Curtis Road, and west of Church Street (**Figure 1-1**). The UXO-12/UXO-18 investigation area encompasses approximately 176 acres.

This PA/SI is being conducted by CH2M HILL under the NAVFAC Mid-Atlantic, Comprehensive Long-Term Environmental Action – Navy (CLEAN) Program, Contract N62470-08-D-1000, Contract Task Order (CTO) 40.

## 1.2 Purpose

The purpose of a PA is to evaluate whether a site poses a potential risk to human health and the environment, and if further investigation may be warranted. PA investigations collect readily available information about a site and its surrounding area. The PA is designed to distinguish, based on limited data, between sites that present little or no risk to human health and the environment and sites that may pose a risk and require further investigation. The PA also identifies sites requiring assessment for possible emergency response actions. If the PA results in a recommendation for further investigation, a Site Inspection (SI) is performed.

SIs typically involve the collection of environmental and waste samples to determine whether hazardous substances are present at a site; to determine if these substances are being released to the environment; and to assess if the substances have reached nearby receptors.

## 1.3 Work Plan Scope and Organization

This WP Addendum is designed to describe site specific activities not described in the MCB Camp Lejeune MRP Master Project Plans, referred to herein as the MRP Master Project Plans (CH2M HILL, 2008). The following PA/SI activities will be performed in accordance with the MRP Master Project Plans to accomplish the objectives described in Section 1.1:

- Conduct a detailed archive search for documents pertaining to the historical uses of the UXO-12/UXO-18 investigation area that may have resulted in environmental contamination with MC. 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.
- Clear vegetation in designated areas to facilitate access for environmental sampling activities.
- Field screen surface soil samples using portable a X-ray fluorescence (XRF) instrument.
- Perform laboratory analysis of surface and subsurface soil, surface water, sediment, and groundwater samples for metals.
- Manage investigation-derived waste (IDW).
- Survey environmental sampling locations.
- Validate laboratory data.
- Conduct ecological and human health risk screenings using analytical data collected at the UXO-12/UXO-18 investigation area.
- Prepare a Focused PA/SI Report.

This 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 the UXO-12/UXO-18 investigation area, 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, and sampling of environmental media.
- **Section 4, Quality Control Plan (QCP)**, provides details of the approach, methods, and operational procedures to be employed for quality control (QC) during the focused PA/SI project.
- **Section 5, Environmental Protection Plan**, describes the approach, methods, and operational procedures to be employed to protect the natural environment during the performance of all tasks for the Focused PA/SI.
- **Section 6, 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, Health and Safety Plan (HSP)**, provides an interface with CH2M HILL's overall health and safety program.
- **Appendix C, Uniform Federal Policy (UFP)/Sampling and Analysis Plan (SAP) Cross-Walk Table, Quality Assurance Project Plan (QAPP)**, references project management/project planning aspects, measurement data acquisition, assessment oversight, and data review processes used to carryout tasks associated with this WP.

## 1.4 Site Location and Description

The UXO-12/UXO-18 investigation area encompasses approximately 176 acres of predominantly wooded land located in the northwest corner of MCB Camp Lejeune, south of Foster Boulevard and west of Church Street (**Figure 1-2**). The site topography is relatively level, sloping gently eastward towards an unnamed creek and wetlands.

**Figure 1-2** illustrates the UXO-12/UXO-18 investigation area, which consists of the entirety of two former ranges,

- UXO-18 B-6 1,000-inch range (ASR #2.44, Plate 8)
- UXO-12 New River 1,000-inch range (ASR # 2.5, Plate 4)

and portions of three former ranges:

- UXO-05 Former Miniature Anti-tank range (ASR #2.7a, Plates 3 and 4)
- UXO-18 B-6 50-foot small arms range (ASR #2.44, Plate 5)
- UXO-18 B-6 50-foot small arms range (ASR #2.44, Plate 6)

Access to the northern portion of the site is by means of Sixth Street, while the southern portion of the site is accessible directly from Curtis Road. There is an aboveground electrical utility line that runs across the southern portion of the UXO-12/UXO-18 investigation area, running parallel to Curtis Road.

## 1.5 Site History

### 1.5.1 UXO-12/UXO-18

In November 2008, CH2M HILL completed a detailed investigative review of information relating to the UXO-12/UXO-18 investigation area, with specific emphasis on historical activities that may have resulted in environmental contamination of the site. Information obtained from this review is presented in the Archival Records Search Report (**Appendix A**) and summarized below.

Historical mapping from 1927 to the early 1940s indicates that the subject site was undeveloped during this timeframe, although the area immediately to the east was apparently used during the early 1940s as an infantry encampment, known as Camp Geiger. Camp Geiger is now a fully developed cantonment area.

Over the years, the ranges associated with the UXO-12/UXO-18 investigation area have been referred to by various names (USACE, 2001), including:

- B-6, 50-foot Small Arms Range (UXO-18)
- B-6, 50-foot, .22 Caliber Range (UXO-18)
- B-6, 1,000-inch Range [machine gun (MG) and .22 Caliber] (UXO-18)
- New River 50-foot Small Bore Range
- New River 1,000-inch Range (UXO-12)

According to the United States Corps of Engineers (USACE) *Range Identification and Preliminary Range Assessment* (USACE, 2001), the ranges associated with B-6 (ASR #2.44) were used between 1950 and 1961. A total of 25 target stations were reportedly used for .22 caliber (rifle and pistol) ammunition, and 10 target stations were used for .32, .38, and .45 caliber (pistol) ammunition (USACE, 2001).

The New River 1,000-inch Range (ASR #2.5) was used from 1942 to 1945. Camp Training Order Number 5-1946, dated 18 March 1946 stated that the range was used for .30 Caliber weapons firing and as of the date of the order the range was disestablished (USACE, 2001). Historical aerial photos from 1948 and 1951 show the UXO-12 area having elongated areas of cleared land with the heavy vegetation to the south and grassy fields to the north (Attachment A). According to Base Range Safety Officer, Duane Richardson, it was “common practice to pile up a large dirt berm in the units area and set up, small targets next so the rifle sights could be set. Possible lead in the soil issue, area presently very wooded area” (Richardson, 2008).

### 1.5.2 UXO-05 Range

UXO-05 Former Miniature Anti-tank Range (UXO-05) overlaps the UXO-12/UXO-18 investigation area in its southwestern corner. A separate PA/SI is being conducted at UXO-05 by CH2M HILL with fieldwork that was conducted in 2008. UXO-05 was used between 1942 and 1944 with .22 caliber small arms used to fire at a moving target car located on a transverse track (USACE, 2001). This area was also used during World War II for blank fire and non-firing events (Lowder, 2005), and as a trailer park in the 1960s.

During the 2008 PA/SI conducted at UXO-05, samples of surface soil, subsurface soil, and groundwater were collected from the portion of the site that overlaps the UXO-12/UXO-18 investigation area. Only one sample (surface soil) was reported to contain a target analyte (arsenic) at a concentration exceeding regional screening limits (residential); however, the detected concentration did not exceed two times the base background surface soil concentrations.

## 1.6 Climate

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

## 1.7 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 are assumed to be sandy with shallow groundwater, based on the work conducted at Site UXO-05. Site-specific data will be collected during the PA/SI activities and presented in the Focused PA/SI Report.



**Legend**

-  Surface Water Course Centerline
-  Site UXO-12/UXO-18 Boundary
-  Installation Boundary

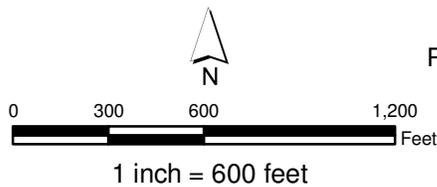
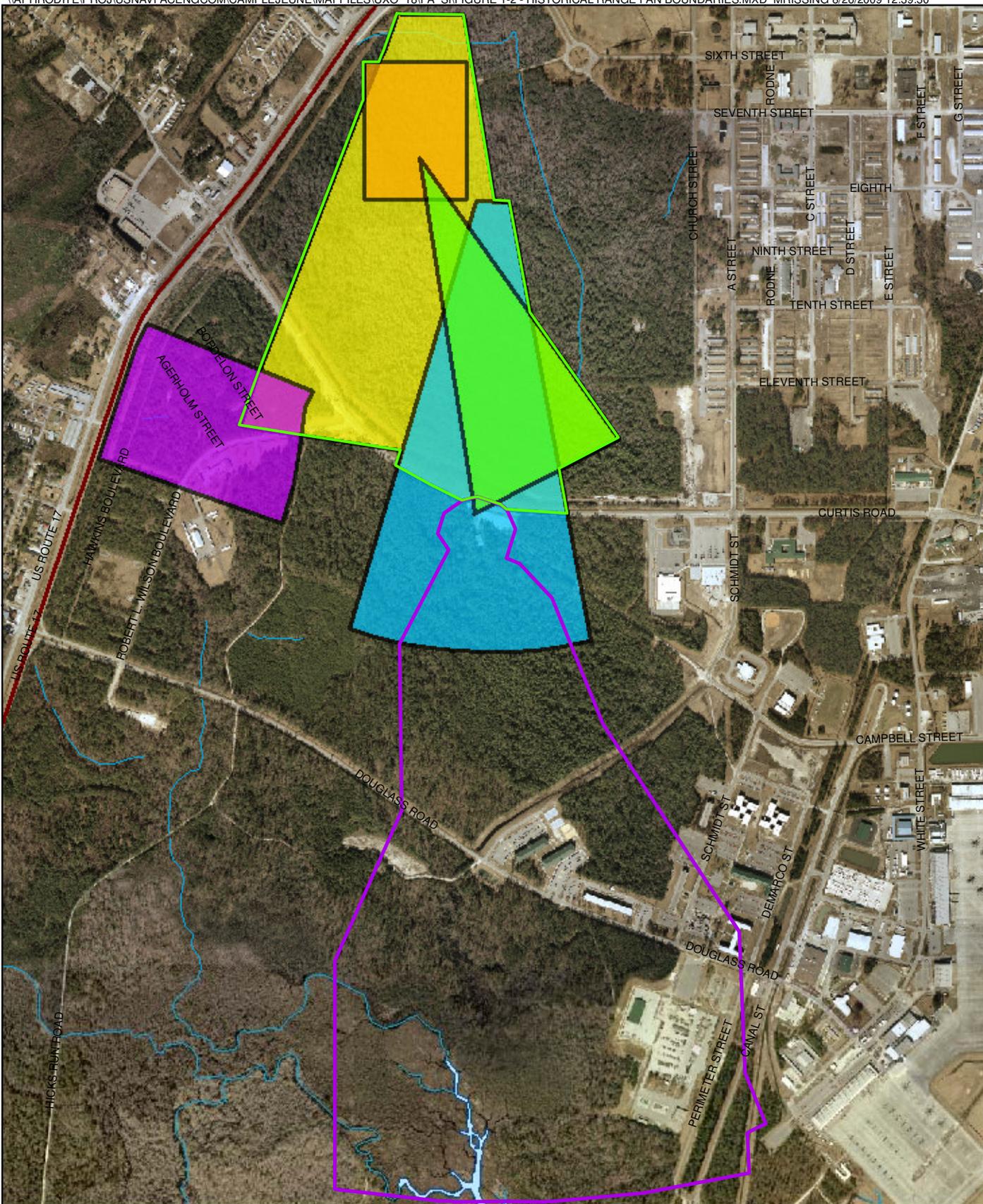


Figure 1-1  
Site UXO-12/UXO-18 Location Map  
Preliminary Assessment/Site Inspection  
MCB Camp Lejeune  
North Carolina



**Legend**

- Composite of B-12 Baffled Pistol Range
- UXO-18/B-6 50 Foot Small Arms Range (ASR# 2.44) from Plate 5 (USACE, 2001)
- UXO-12 New River 1,000-inch Range (ASR #2.5) from Plate 4 (USACE, 2001)
- UXO-18/B-6 50 Foot Small Arms Range (ASR # 2.44) from Plate 6 (USACE, 2001)
- UXO-05 Former Miniature Anti-tank Range (ASR #2.7a) from Plates 3 and 4 (USACE, 2001)
- UXO-18/B-6 1,000-inch Range (ASR #2.44) from Plate 8 (USACE, 2001)
- Site UXO-12/UXO-18 Boundary
- Surface Water Course Centerline
- Installation Boundary



0 600 1,200 Feet

1 inch = 1,200 feet

Figure 1-2  
 Historical Range Fan Boundaries  
 Preliminary Assessment/Site Inspection  
 MCB Camp Lejeune  
 North Carolina



# Technical Management Plan

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## 2.1 Project Personnel, Organization, and Schedule

This section describes the project organization and key personnel involved with carrying out the work described in the work plan.

### 2.1.1 Project Organization

The key organizations involved in this project are 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.

### 2.1.2 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**.

### 2.1.3 Project Schedule

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

## 2.2 Technical Approach

### 2.2.1 Planning

Planning includes all work necessary for controlling the project budget and schedule, work plan preparation, and subcontract procurement.

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.

Anticipated subcontractor services include buried utility locating, land surveying, vegetation clearing, direct push technology (DPT) soil sampling and temporary well installation, laboratory analysis, IDW management, and data validation.

### 2.2.2 Work Plan Preparation

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

Three versions of the WP will be prepared. 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 after incorporating comments from NAVFAC and MCB Camp Lejeune. A final WP will be prepared that will address all comments on the draft document.

### 2.2.3 Site Investigation

The scope of the field investigation and the technical approach are presented in Section 3. The primary field investigation activities include:

- Surveying
- Vegetation clearance
- Temporary well installation and abandonment
- Environmental sampling
- IDW Management

Details concerning the management of environmental data from the time the samples are collected until the validated data are received and incorporated into the project reports are provided in Section 8.1 of the MRP Master Plans.

### 2.2.4 Geographical Information System

CH2M HILL will also provide the UXO-12/UXO-18 investigation area geographical information system (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.

### 2.2.5 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, evaluate the environmental data, and present human health and ecological risk screenings (ERS) for the UXO-12/UXO-18 investigation area.

The ERS 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 this investigation. The data will be screened using the following criteria:

- Soil data will be compared to USEPA industrial and residential soil regional screening levels (RSLs) (USEPA, 2008) and NCDENR Hazardous Waste Section (HWS) Soil Screening Levels (SSLs) (NCDENR, 2008).

- Groundwater data will be compared to USEPA tap water RSLs (USEPA, 2008), USEPA Maximum Contaminant Levels (MCLs) (USEPA, 2009), and North Carolina Groundwater Quality Standards (NCGWQS).
- Surface water data will be compared to both North Carolina surface water standards and USEPA national recommended water quality criteria (NCDENR, 2007; USEPA, 2006).
- Sediment data will be compared to USEPA industrial and residential soil RSLs (USEPA, 2008).

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.

**TABLE 2-1**  
 Project Personnel Contact Information  
*Preliminary Assessment/Site Inspection Work Plan*  
*Site UXO-12/UXO-18*  
*MCB Camp Lejeune*  
*Jacksonville, North Carolina*

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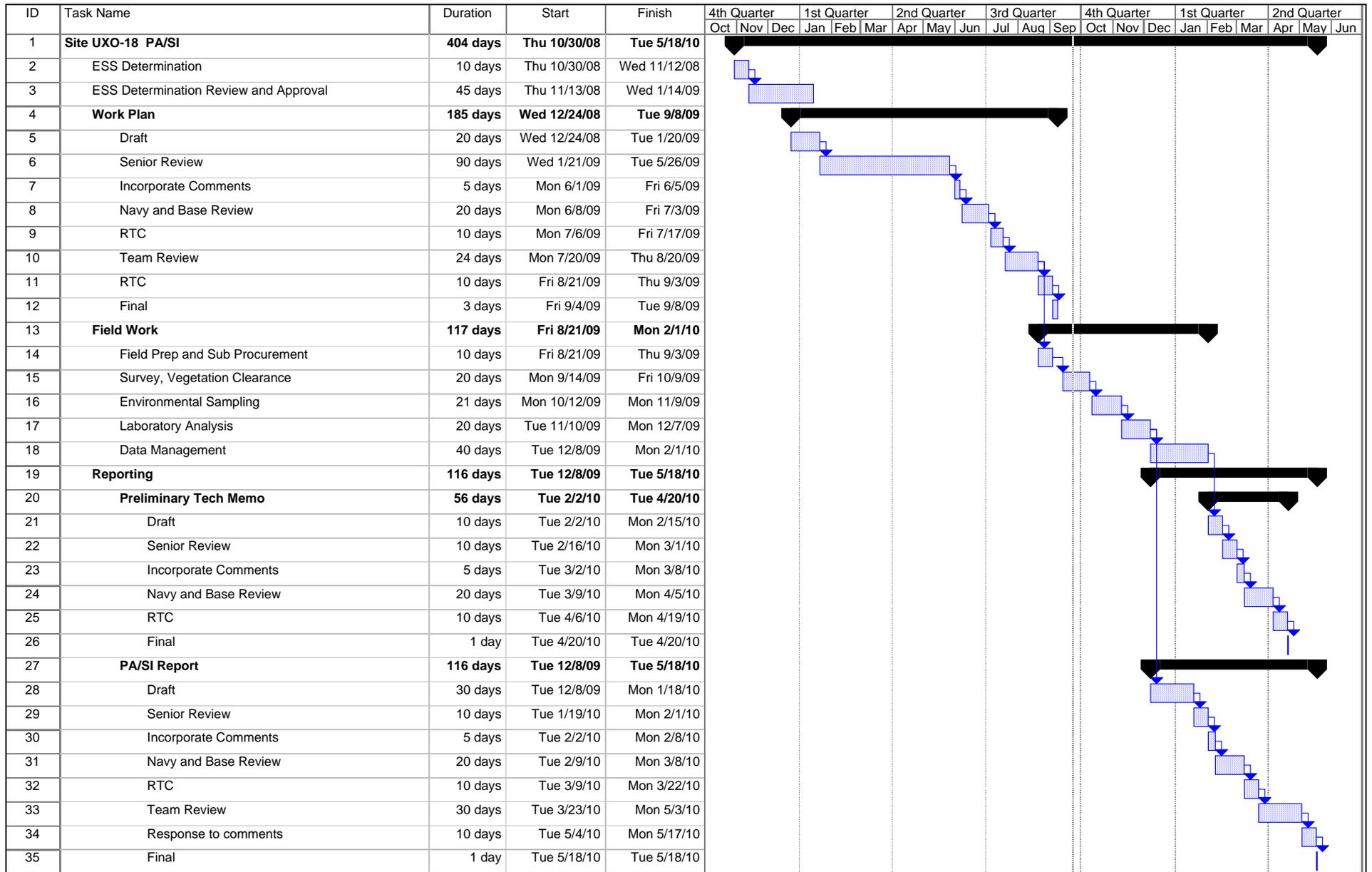


FIGURE 2-1  
Project Schedule



# Field Investigation Plan

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## 3.1 Overall Approach

The objectives for this field investigation are to evaluate the presence and nature of environmental contamination that may have resulted from historical use of small arms ammunition within the UXO-12/UXO-18 investigation area. Given that the historical use of the UXO-12/UXO-18 investigation area was limited to small arms use only, MEC avoidance procedures will not be practiced. If MEC is identified during the investigation, work will cease until the MEC has been removed from the site, and a determination is made as to whether MEC avoidance support is needed. All field activities will be conducted in accordance with the Standard Operating Procedures (SOPs) provided in the MRP Master Project Plans.

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

- Vegetation clearance to facilitate access to sampling locations.
- Buried utilities will be identified and avoided.
- A maximum of 536 surface soil samples will be screened in the field using a portable XRF instrument.
- Surface soil samples will be collected using the TR-02-1 sampling method from 134 locations. Additional samples may be collected based on the results of the XRF screening activities (not to exceed 536 samples, total).
- A total of 44 subsurface soil samples will be collected from DPT soil borings. Additional samples may be collected based on the results of the XRF screening activities (not to exceed 176 samples, total).
- Each DPT boring will be completed as a temporary groundwater monitoring well screened within the surficial aquifer. Groundwater samples will be collected from each well. Additional samples may be collected based on the results of the XRF screening activities (not to exceed 176 samples, total).
- Up to 10 co-located surface water and sediment samples will be collected from surface water bodies, if present.

The field investigation activities are detailed below and reference the MRP Master Project Plans (CH2M HILL, 2008).

## 3.2 Site Preparation and Restoration

The following subsections describe the procedures associated with site preparation, including mobilization of personnel and equipment and preparation for environmental investigation activities. Mobilization activities include general activities and a kickoff and safety meeting.

### 3.2.1 Mobilization

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

#### General Activities

General mobilization activities include:

- Identify/procure, package, ship, and inventory project equipment, including 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 procedures and HSP.
- 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

#### Kickoff/Safety Meeting

During mobilization, a kickoff and site safety meeting will be conducted, and will include a review and endorsement of this WP and 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 Site Survey

Land surveying activities will be conducted in accordance with Section 7.4 of the MRP Master Project Plans (CH2M HILL, 2008). The surveying at the UXO-12/UXO-18 investigation area will consist of two phases:

- **Phase 1** will lay out the areas requiring vegetation clearance (**Figure 3-1**) and sampling locations (**Figure 3-2**).
- **Phase 2** will occur after the environmental sampling activities have concluded and will entail surveying the coordinates and elevations of the temporary monitoring wells and soil sampling locations.

### 3.2.3 Vegetation Clearing

In order to support the planned environmental sampling activities, vegetation will be cleared to allow access for sampling teams and DPT equipment and 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 3 inches in diameter will not be removed unless absolutely necessary.

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**).

CH2M HILL will provide an ecologist/biologist during the vegetation clearing activities to assist with the identification of wetlands area.

### 3.2.4 Buried Utility Clearance

Prior to initiation of subsurface sampling activities, all buried utilities will be located and clearly marked within the vicinity of each proposed subsurface and/or groundwater sampling location.

### 3.2.5 Site Restoration and Demobilization

#### Site Restoration

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

#### 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:

- 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 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 (CH2M HILL, 2008).

## 3.4 Field Sampling Plan

### 3.4.1 Field Operations

In order to assess the presence and nature of potential environmental contamination that may exist in the investigation area, the project team will investigate groundwater, surface water, sediment, surface soil, and subsurface soil within the bounds of the UXO-12/UXO-18 investigation area. This will include collecting samples at pre-determined and field determined locations. Surface soil samples will be collected from 536 pre-determined locations for screening using a portable XRF instrument. Surface soil samples will be collected from 134 pre-determined locations for laboratory analysis. Subsurface soil and groundwater samples will be collected from 44 pre-determined locations, and submitted for laboratory analysis. Following review of the XRF screening data, up to 402 additional surface soil and 132 additional subsurface soil and groundwater samples may be collected. Sediment and surface water samples will be collected from up to ten field-determined locations. QA/QC samples will be collected in accordance with Section 3.6.2.

#### Surface Soil XRF Screening

Surface soil samples for XRF screening will be collected from approximately 536 locations, from ground surface to 1 foot below ground surface (bgs). Prior to screening, visible metallic objects (e.g., bullet fragments) will be removed from the sample so that it is most representative of the concentration of metals in the soil. The XRF screening will include antimony, arsenic, copper, lead and zinc. These are the same compounds that will be analyzed for in the fixed-based laboratory samples. Based on elevated XRF results, additional surface soil, subsurface soil, and groundwater sampling locations may be selected. The XRF screening locations are co-located with the proposed surface soil sampling locations (**Figures 3-1 and 3-2**).

#### Surface Soil Sampling

Surface soil samples will be collected using the TR-02-1 sampling method. It is anticipated that 134 composite surface soil samples (MR18-SS01 through MR18-SS134) will be collected within the UXO-12/UXO-18 investigation area (**Figure 3-2**). The distribution of surface soil sampling locations is biased toward the northern and eastern portions of the range due to the reported location of the historical firing points, targets, and the current potential surface water receptors. Based on the results of the XRF field screening, additional samples may be collected for laboratory analysis. A total of 404 additional surface soil samples may be collected following evaluation of the surface soil XRF screening activities.

The TR-02-1 approach is summarized below and described in USACE Technical Report ERDC/CRREL TR-02-1, *“Guide for Characterization of Sites Contaminated with Energetic Materials”* (Thiboutot, Ampleman, and Hewitt, 2002). Each sampling location will consist of an area of one meter (m) square. Coordinates of the sampling locations will be based on the center of the sampling area (**Figure 3-2**). If modifications of sample locations are necessary due to buried utilities or accessibility issues, the revised sample location(s) will be located as near as possible to the original proposed location. Composite soil samples will be collected from each sample area by thoroughly mixing a minimum of 30 aliquots collected from random locations within the 1 m × 1 m sampling area, in accordance with Appendix C of

the MRP Master Project Plans, *Homogenization of Soil and Sediment Samples*. The aliquots will be approximately equal in the amount of soil, and will be collected from depths of 0 to 1 feet. Samples will be analyzed by a fixed base laboratory for metals (lead, antimony, copper, zinc, and arsenic) by Method SW846 6010B (refer to **Tables 3-1** through **3-3**).

### Subsurface Soil Sampling

A 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. A total of 44 subsurface soil samples (MR18-IS01 through MR18-IS44) will be collected from a depth just above the water table (estimated to range from 8 to 14 feet bgs). **Figure 3-2** illustrates the proposed subsurface soil sample locations; actual sample locations will be based on field conditions. The subsurface soil sampling locations are biased toward the northern and eastern portions of the site due to the location of the historical firing points, targets, and the current potential surface water receptor. A total of 132 additional subsurface soil samples may be collected following evaluation of the surface soil XRF screening activities. Samples will be analyzed by a fixed base laboratory for metals (lead, antimony, copper, zinc, and arsenic) by Method SW846 6010B (refer to **Tables 3-1** through **3-3**).

### Groundwater Sampling

In order to facilitate the collection of shallow groundwater samples, a total of 44 temporary monitoring wells (MR18-TW01 through MR18-TW44) will be installed as shown by **Figure 3-2**. At each location, the borehole will be advanced to a depth of approximately 10 feet below the water table. The continuous soil cores retrieved during this process will be screened for the presence of volatile organic compounds (VOCs) using a flame-ionization detector (FID), inspected by a CH2M HILL geologist, and described using the Unified Soil Classification System.

Each well will consist of 1-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, developed, and subsequently abandoned in accordance with *Temporary Well Installation* SOP in **Appendix C** of the MRP Master Project Plans and North Carolina Well Construction Standards. A total of 132 additional temporary wells may be installed and sampled, as determined by the findings of the XRF surface soil screening activities. The distribution of the temporary monitoring well locations has been biased based upon historical range usage and the proximity of potential receptors.

Following well development, groundwater samples will be collected from each temporary well using low-flow purge and sampling techniques 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**):

- Metals—lead, antimony, copper, zinc, and arsenic (SW846 6010B)
- 12 of the 44 groundwater samples will be analyzed for dissolved metals—lead, antimony, copper, zinc, and arsenic in order to help assess impacts for the ERS (SW846 6010B).

Following sampling and surveying, all temporary wells will be removed from the boreholes and the boreholes will be abandoned by the DPT subcontractor in accordance with North Carolina Well Construction Standards.

### Surface Water and Sediment Sampling

A surface water body is shown to run through the northern portion of the investigation area, **Figure 1-1**. If the surface water body in the northern portion of the site is present, surface water and sediment samples will be collected at the proposed locations shown in **Figure 3-2**. Additional surface water and sediment samples, up to a total of 10 surface water and 10 sediment samples, may be collected in depositional areas based on site observations and the results of the initial site sampling activities. All surface water and sediment sampling will be completed in accordance with the *Surface Water Sampling* and *Sediment Sampling* SOPs in Appendix C of the MRP Master Project Plans (CH2M HILL, 2008).

Surface water and sediment samples will be analyzed by a fixed base laboratory for metals (lead, antimony, copper, zinc, and arsenic) by Method SW846 6010B (refer to **Tables 3-1** through **3-3**).

## 3.4.2 Analytical Requirements and Sample Handling

### Sample Preservation and Handling

Sample preservation must occur in the field immediately after collection and will be consistent with the UXO-12/UXO-18 investigation area UFP-SAP Cross-walk Table and QAPP (**Appendix C**). The laboratory supplied containers will contain the appropriate analyte-specific preservative. 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**.

### 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, 2008). 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**.

### Sample Collection Frequencies

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

### 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 UXO-12/UXO-18 under the Munitions Response Program. Therefore, the prefix "MR18-" will be used

**Media:** TW = Groundwater from temporary wells  
 SS = Surface soil  
 SD = Sediment  
 IS = Subsurface soil  
 SW = Surface water

**Station#:** Each sample location 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:

"09" = year 2009

"C" = Sampling during the third 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:

0-1 = 0 to 1 feet bgs

Under this sample designation format, “MR18 -TW01-08A” would mean the following:

<u>MR18</u> -TW01-09C	MRP UXO-18 Investigation Area
MR18 - <u>TW01</u> -09C	Groundwater sample from temporary well #1
MR18 -TW01- <u>09C</u>	Sampled during the third quarter of 2009

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.

### 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).

### 3.4.3 Investigation-derived Waste Management

All IDW generated during the investigation will be managed in accordance with Section 10 of the MRP Master Project Plans (CH2M HILL, 2008). IDW includes soil cuttings, liquid waste (e.g., purged groundwater or decontamination fluids), and personal protective equipment.

## 3.5 Health and Safety Plan

The HSP is provided in **Appendix B**. MEC is not suspected at the UXO-12/UXO-18 investigation area based on historical knowledge of the Site. However, Base Explosive Ordnance Disposal (EOD) will be contacted and will respond to any suspected MEC that may be discovered during site activities.

## 3.6 Data Management

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 (CH2M HILL, 2008).

## 3.7 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 (CH2M HILL, 2008).

TABLE 3-1  
 Summary of Sampling Program  
 Preliminary Assessment/Site Inspection Work Plan  
 Site UXO-12/UXO-18  
 MCB Camp Lejeune  
 Jacksonville, North Carolina

Sample Media	Sample ID Number	Sample Depth/Location and Rationale	Analysis
			Metals
Surface Soil	MR18-SS01 through MR18-SS134	Collected from a 0 – 1 feet below ground surface (bgs) at each location shown on Figure 3-1.  Will utilize the TR-02-1 sampling methodology to allow for characterization of surface soil. Additional samples if needed based on the results of XRF field screening.	X
Subsurface Soil	MR18-IS01 through MR18-IS44	Collected from the 2-foot interval just above the water table at each location on Figure 3-2. Will allow for characterization of subsurface soil. Additional samples if needed based on the results of XRF field screening.	X
Sediment	MR18-SD01 through MR18-SD10	Collected from a depth of 0 - 2 inches.  Will allow for characterization of sediment.	X
Surface Water	MR18 -SW01 through MR18 -SW10	Collected from an interval of 0 – 0.5 inches below the surface of the water body.  Will allow for characterization of surface water.	X
Temporary Well Groundwater	MR18 -TW01 through MR18 -TW44	Samples will be collected from shallow wells at each location shown on Figure 3-2.  Will allow for characterization of groundwater. Additional samples if needed based on the results of XRF field screening.	X

Notes and Abbreviations:

Sediment and Surface water samples will only be collected if surface water is located in the investigation area.

**TABLE 3-2**  
*Analyses, Bottleware, Preservation, and Holding Time Requirements*  
*Preliminary Assessment/Site Inspection Work Plan*  
*Site UXO-12/UXO-18*  
*MCB Camp Lejeune*  
*Jacksonville, North Carolina*

<b>Media</b>	<b>Analysis</b>	<b>Method</b>	<b>Container</b>	<b>Preservation &amp; Storage</b>	<b>Holding Times</b>
Soil/Sediment	Metals	SW846 6010B	1x4 oz glass/plastic jar	4°C	6 months, Mercury: 28 days
Groundwater/Surface water	Metals and Dissolved Metals	SW846 6010B	1x250-mL Poly bottle	HNO <sub>3</sub> to pH <2 and cool to 4°C	6 months, Mercury: 28 days

Notes: L = Liter, mL = milliliter, oz = ounce, HNO<sub>3</sub> = nitric acid

**TABLE 3-3**  
 Required QA/QC Samples  
*Preliminary Assessment/Site Inspection Work Plan*  
*Site UXO-12/UXO-18*  
*MCB Camp Lejeune*  
*Jacksonville, North Carolina*

<b>Sample Type</b>	<b>Description</b>	<b>Frequency</b>	<b>Analytes</b>
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  
*Preliminary Assessment/Site Inspection Work Plan*  
*Site UXO-12/UXO-18*  
*Jacksonville, North Carolina*

Analysis	Sample Matrix	Field Samples	Field Duplicates	Equipment Blanks	Field Blanks	MS/MSDs
<b>Surface Soil Samples</b>						
Metals	Solid	134	14	14	2	7
<b>Subsurface Soil Samples</b>						
Metals	Solid	44	5	4	2	3
<b>Sediment Samples*</b>						
Metals	Solid	10	1	2	1	1
<b>Groundwater Samples</b>						
Metals	Aqueous	44	5	5	1	3
Dissolved Metals		12	2	5	1	1
<b>Surface Water Samples*</b>						
Metals	Aqueous	10	1	2	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

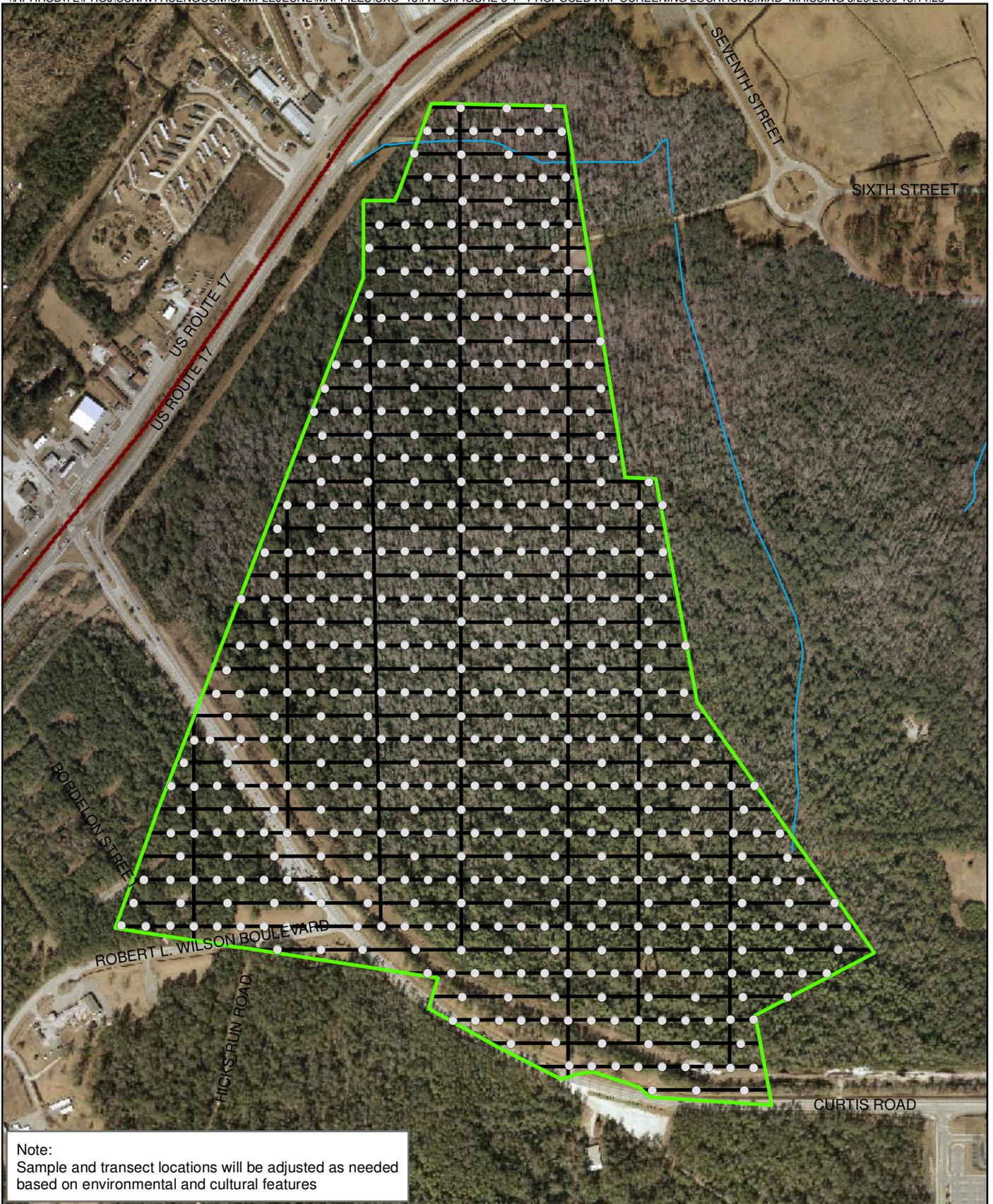
Surface soil sample equipment blanks and field blanks based on one 14 day event

Sediment equipment blanks and field blanks based on one 2 day event

Groundwater sample equipment blanks and field blanks based on one 5 day event

Surface water sample equipment blanks and field blanks based on one 2 day event

\*Sediment and Groundwater samples are to be determined in the field based on the presence of surface water bodies



Note:  
Sample and transect locations will be adjusted as needed based on environmental and cultural features

**Legend**

- Proposed XRF Soil Screening Location
- Vegetation Clearance Transects
- Surface Water Course Centerline
- ▭ Site UXO-12/UXO-18 Boundary
- ▭ Installation Boundary

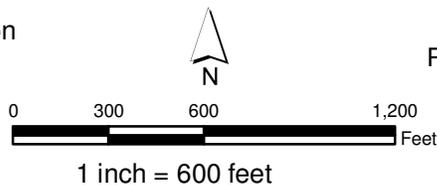
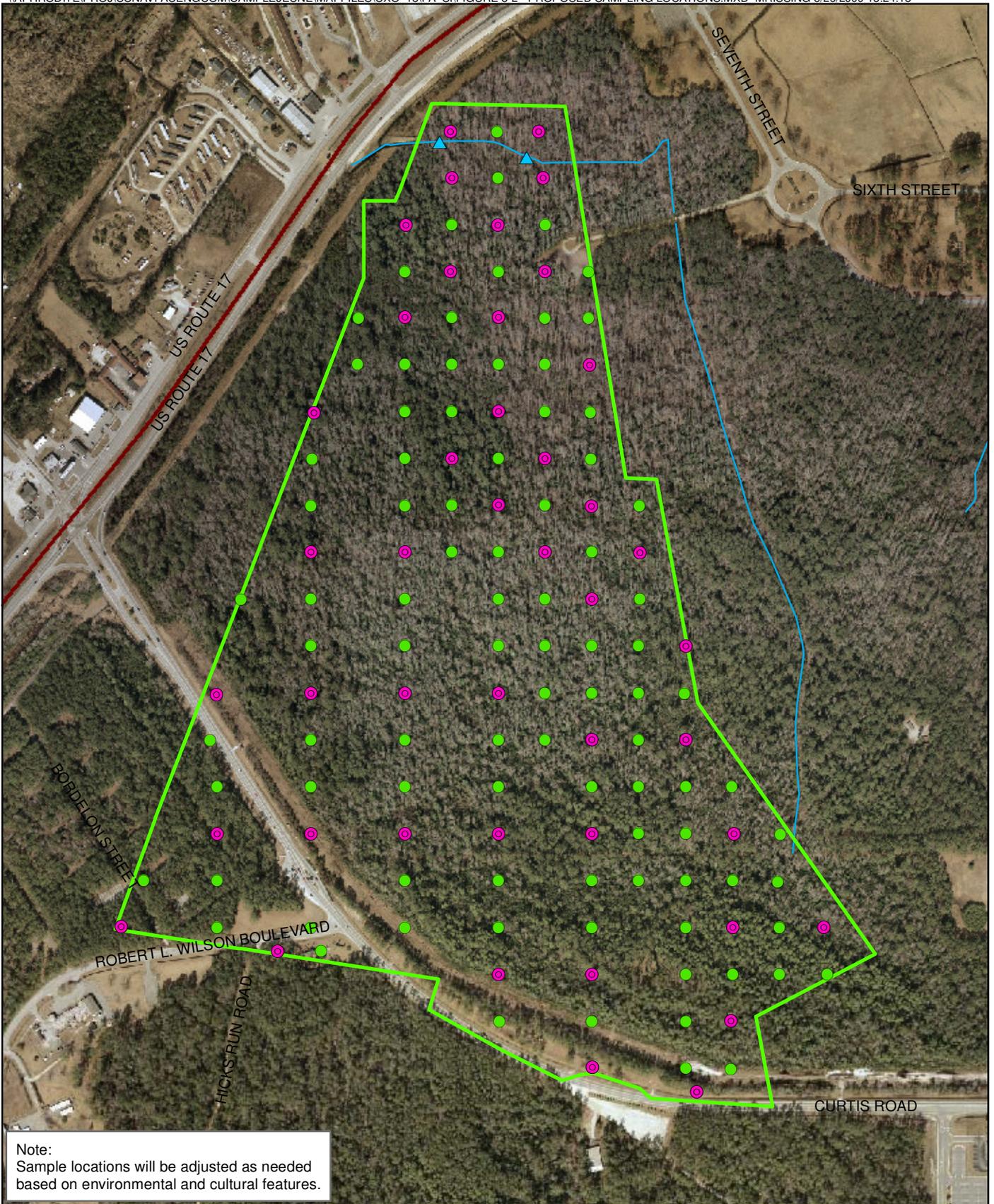


Figure 3-1  
Proposed XRF Screening Locations  
Preliminary Assessment/Site Inspection  
MCB Camp Lejeune  
North Carolina



Note:  
Sample locations will be adjusted as needed based on environmental and cultural features.

**Legend**

- ▲ Proposed Surface Water and Sediment Sample Location
- Proposed Surface Soil, Subsurface Soil, and Temporary Well Sample Location
- Proposed Surface Soil Sample Location
- Surface Water Course Centerline
- Site UXO-12/UXO-18 Boundary
- Installation Boundary



1 inch = 600 feet

Figure 3-2  
Proposed Sampling Locations  
Preliminary Assessment/Site Inspection Work Plan  
MCB Camp Lejeune  
North Carolina



#### SECTION 4

# Quality Control Plan

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All applicable work conducted at the UXO-12/UXO-18 investigation area will be performed in accordance with the QCP in Section 8 of the MRP Master Project Plans (CH2M HILL, 2008). The QCP describes the QC approach and procedures to be employed during the UXO-12/UXO-18 investigation.

The specific QC audit procedures for the definable features of work (DFOW) to be employed at the UXO-12/UXO-18 investigation area, 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 4-1**.

TABLE 4-1  
 Definable Features of Work Auditing Procedures  
 Preliminary Assessment/Site Inspection Work Plan  
 Site UXO-12/UXO-18  
 MCB Camp Lejeune  
 Jacksonville, North Carolina

Definable Feature of Work with Auditable Function	Responsible Person(s) <sup>1</sup>	Audit Procedure <sup>2</sup>	QC Phase <sup>3</sup>	Freq. of Audit	Pass/Fail Criteria	Action if Failure Occurs
<b>Planning</b>						
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	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, Data Manager	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 (Technical Project Planning)	Project 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
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.
<b>Field Operations</b>						
Site preparation (Mobilization)	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)	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)	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)	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)	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)	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 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.

TABLE 4-1  
 Definable Features of Work Auditing Procedures  
 Preliminary Assessment/Site Inspection Work Plan  
 Site UXO-12/UXO-18  
 MCB Camp Lejeune  
 Jacksonville, North Carolina

Definable Feature of Work with Auditable Function	Responsible Person(s) <sup>1</sup>	Audit Procedure <sup>2</sup>	QC Phase <sup>3</sup>	Freq. of Audit	Pass/Fail Criteria	Action if Failure Occurs
Site Preparation (Vegetation Removal)	Site Manager	Verify vegetation removal is conducted according to the Field Investigation Plan (Chapter 3 of Work Plan).	FP	D	Verify vegetation removal is conducted according to the Field Investigation Plan (Chapter 3 of 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.
Final Project Reports and Closeout						
Site Specific Final Report preparation and approval	Project Manager	Verify all phases of environmental investigation were performed correctly and are complete.	FP	O	investigation performed is accurate and complete.	investigation performed is 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

QC Phase  
 PP = Preparatory Phase  
 IP = Initial Phase  
 FP = Follow-up Phase

Frequency  
 O = Once  
 D = Daily  
 W = Weekly  
 E = Each occurrence

<sup>1</sup> The responsible person (if other than the MEC QCS) is the individual with whom the MEC QCS will coordinate with to ensure compliance with requirements and to verify that any necessary follow-up actions are taken.  
<sup>2</sup> Where appropriate, a reference has been included referring the reader to a more detailed description of the procedures being audited.  
<sup>3</sup> Documentation to be in accordance with the three-phase control process as outlined in the Quality Control Plan.

# Environmental Protection Plan

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## 5.1 Regional Ecological Summary

A summary of the regional ecology is provided in Section 9.1 of the MRP Master Project Plans (CH2M HILL, 2008).

## 5.2 Endangered/Threatened Species within the Project Site

Many protected species have been sighted in the vicinity of and aboard MCB Camp Lejeune, such as American alligator, green sea turtle, loggerhead sea turtle, piping plover, red-cockaded woodpecker, seabeach amaranth, and rough-leaf loosestrife (USMC, 2006). **Table 5-1** 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 two federally protected avian species (piping plover and red cockaded woodpecker) that are known to occur on the Base. The UXO-12/UXO-18 investigation area is not within the vicinity of any of these management areas. Suitable habitat for the piping plover does not exist at the UXO-12-UXO-18 investigation area. No impacts to this species would result.

MCB Camp Lejeune worked with the USFWS to establish guidelines for military training in red-cockaded woodpecker cluster sites. Additionally, through Section 7 Consultation, MCB Camp Lejeune implemented measures to properly manage the red-cockaded woodpecker habitats located on base (loblolly pine [*Pinus taeda*], longleaf [*Pinus palustris*], and pond pine [*Pinus serotina*] areas). These guidelines and measures are presented in the 2007-2011 Integrated Natural Resource Management Plan (INRMP) (USMC, 2006). MCB Camp Lejeune's red-cockaded woodpecker population has been monitored since 1985.

Reproductive success, population demographics, and habitat use are recorded annually to help successfully manage the population while facilitating the military use of the land. The UXO-12/UXO-18 investigation area is not within the vicinity of any current red-cockaded woodpecker management areas and the closest active red-cockaded woodpecker habitat is located over 2 miles south of the site. No impacts to this species would result.

The UXO-12/UXO-18 investigation area contains no open water habitat and does not connect to the ocean. Therefore, the federally protected marine species (e.g., green sea turtle, leatherback sea turtle, loggerhead sea turtle, West Indian manatee) listed in **Table 5-1** would not occur the area. No impacts to these species would result.

The American alligator is listed on the Federal Threatened and Endangered species list due to its similarity of appearance to the American crocodile. There is no potentially suitable habitat for the American alligator in the UXO-12/UXO-18 investigation area and the species would not occur in the project area. No impact to this species is expected.

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 MCB 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 feet from the outermost individuals. None of these sites are located on or adjacent to the UXO-12/UXO-18 investigation area. No impacts to rough-leaved loosestrife are expected.

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. Seabeach amaranth does not occur on or adjacent to the UXO-12/UXO-18 investigation area because there is no beach or dune habitat. No impacts to this species would occur.

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. Suitable habitat for the eastern cougar does not exist at the UXO-12/UXO-18 investigation area and the level of human activity would tend to make the species avoid the area. Because the eastern cougar has not been verified in the area in more than 50 years and there is human activity in proximity to the UXO-12/UXO-18 investigation area, it is very unlikely that the eastern cougar would occur on the site and no impacts are expected.

Environmental reviews completed in preparation for the INRMP determined that the remaining species listed in **Table 5-1** are not expected to exist at the site. No adverse impacts to listed species are expected to result from the proposed work within the investigation area at the UXO-12/UXO-18 investigation area. Project design features have been developed to prevent impacts to listed species.

### 5.3 Wetlands within the Project Site

Jurisdictional wetland areas are known to occur within the southeast corner of the UXO-12/UXO-18 investigation area and the immediate vicinity of the site. An ecologist/biologist will be onsite to identify any wetlands during the vegetation clearance process. Work in wetland areas will be avoided to the extent practical. However, if work in areas determined to be jurisdictional wetlands is completed the USACE Wilmington District will be contacted if necessary to obtain authorization. Because the ground disturbance will be minimal, the work will not require a storm water pollution prevention plan. No wetlands on or downstream of the UXO-12/UXO-18 investigation area are expected to be impacted by the project. However if the potential for runoff to jurisdictional wetlands exists, appropriate protection measures will be put in place (Section 5.5).

## 5.4 Cultural and Archaeological Resources within the Project Site

The environmental sampling activities proposed to support this work plan involve 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 MCB Camp Lejeune archaeologist confirmed that a cultural or archaeological resource is known to lie partially within the UXO-12/UXO-18 investigation area boundary. This site is not assessed and potentially eligible for the National Register of Historic Places (NRHP). The current WP does not include investigation within this area. Should future work be planned and verified to be within the archaeological resource area (NRHP eligible site), the MCB Camp Lejeune Project Manager (PM) and archeologist will be contacted and submit a Request for Environmental Impact Review through the National Environmental Policy Act (NEPA) process, prior to subsurface activity within the boundary. If any unmapped cultural or archaeological materials or resources are discovered within the project investigation area, the MCB Camp Lejeune archaeologist will be notified to provide guidance on performing further work in the area.

## 5.5 Water Resources within the Project Site

A channel/stream occurs at the northern end of the UXO-12/UXO-18 investigation area. Sampling in the channel/stream may take place if deemed necessary. 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 and ultimately to the wetland.

## 5.6 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). Federal projects within a State's coastal zone are reviewed under the Coastal Zone Management Act, which requires that a proposed Federal action be consistent, to the maximum extent practicable, with the relevant enforceable policies of the State's coastal management program. North Carolina's coastal zone management program consists of, but is not limited to, the CAMA, the State's Dredge and Fill Law, Chapter 7 of Title 15A of the North Carolina Administrative Code, and the land use plan of the County and/or local municipality in which the proposed project is located.

The investigation at the UXO-12/UXO-18 investigation area will include surface investigations (surface soil sampling), subsurface soil sampling, the collection groundwater samples using DPT, and sediment and surface water sampling, where applicable. The Marine Corps is not required to apply for a CAMA permit for a federal project. No proposed project activities fall under the definition of "development" as defined by CAMA.

Further, as outlined in Subpart “C” of 15 Code of Federal Regulations (CFR) 930, the Marine Corps has determined that the proposed project would have no effects on any coastal use or resource. Therefore, a negative determination under §930.35 is not required and the Marine Corps will not coordinate with the North Carolina Division of Coastal Management (DCM) in advance of the proposed work.

Should it be determined by collection of new or additional information that development, as defined under CAMA, would occur under the proposed project further coordination with DCM would be initiated.

## **5.7 Vegetation to be removed within the Project Site**

Vegetation removal is anticipated in association with the field activities described in this WP. Vegetation less than 3 inches in diameter will be removed to within 6 inches of the ground surface in order to support environmental sampling activities. Vegetation will be cleared to allow site access for sampling teams and DPT equipment. It is estimated that up to 13 acres will be cut from the 176-acre investigation area. Large trees will be avoided to the extent practicable during path clearing. Consultation with the Base wildlife biologist confirms no threatened or endangered species occur within UXO-12/UXO-18 investigation area. Procedures in place will prevent excessive exposure of bare ground.

## **5.8 Existing Waste Disposal Sites within the Project Site**

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

## **5.9 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 (CH2M HILL, 2008). No permits have been determined to be required for the proposed work.

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

**TABLE 5-1**

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

*Preliminary Assessment/Site Inspection Work Plan*

*Site UXO-12/UXO-18*

*MCB Camp Lejeune*

*Jacksonville, North Carolina*

<b>Scientific Name</b>	<b>Common Name</b>	<b>Federal Status</b>	<b>Habitat</b>
<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.

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.

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.
<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.

Scientific Name	Common Name	Federal Status	Habitat
<i>Sagittaria weatherbiana</i>	Grassleaf arrowhead	FSC	Found in shallow water of brackish swamps
<i>Dichantheium 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> )
<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.

Scientific Name	Common Name	Federal Status	Habitat
<p>E = Endangered—A taxon in danger of extinction throughout all or a significant portion of its range.</p> <p>T = Threatened—A taxon likely to become endangered within the foreseeable future throughout all or a significant portion of its range.</p> <p>FSC = Federal species of special concern—species may or may not be listed in the future.</p> <p>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.</p> <p>*Historic record—the species was last observed in the county more than 50 years ago.</p>			

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**Appendix A**  
**Archival Records Search Report**

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Final

**Archival Records Search Report for the Preliminary  
Assessment/Site Inspection of Site UXO-12 New River  
1,000-inch Range (ASR #2.5) and UXO-18 50-foot  
Small Bore Range (ASR #2.44)**

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

**Contract Task Order 040**

**September 2009**

Prepared for

**Department of the Navy  
Naval Facilities Engineering Command  
Mid-Atlantic**

Under the

**NAVFAC CLEAN 1000 Program  
Contract N62470-08-D-1000**

Prepared by



**CH2MHILL**

**Charlotte, North Carolina**

# Contents

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<b>Acronyms and Abbreviations .....</b>	<b>v</b>
<b>1. Introduction, Purpose, and Scope.....</b>	<b>1-1</b>
<b>2. Site Information.....</b>	<b>2-1</b>
2.1 Facility Information .....	2-1
2.2 Ownership History .....	2-1
2.2.1 Camp Lejeune Ownership History .....	2-1
2.3 Site Description .....	2-2
2.4 Operational History.....	2-3
2.4.1 Review of Historical Aerial Photographs and Site Maps.....	2-3
2.4.2 Site UXO-18, B-6, 50-Foot Small Arms Range (ASR #2.44).....	2-4
2.4.3 Site UXO-05, Former Miniature Anti-Tank Range (ASR #2.7a).....	2-5
2.4.4 Site UXO-12, New River 1000-inch Range (ASR #2.5).....	2-5
2.4.5 Current Site Conditions .....	2-6
2.5 Previous Investigations.....	2-6
2.5.1 Solid Waste Management Units.....	2-6
2.5.2 Site 35, Former Camp Geiger Fuel Farm .....	2-7
2.5.3 Site 93, Within Camp Geiger near Building TC-942 .....	2-7
2.5.4 Site 40.....	2-8
2.5.5 Site UXO-05.....	2-8
<b>3. References .....</b>	<b>3-1</b>

## Figures

1-1	Site Map
1-2	UXO-12/UXO-18 Range Area Map
2-1	Property Map Area B - 1941
2-2	Historical Range Fan Boundaries
2-3	UXO-12/UXO-18 (Plates 5, 6, 8, 10) Overlay Map - 1951, 1953, 1954, 1958
2-4	UXO-12/UXO-18 Existing Conditions - 1949
2-5	UXO-12/UXO-18 Existing Conditions - 1953
2-6	UXO-12/UXO-18 Existing Conditions - 1963
2-7	Historical Aerial - 1962
2-8	UXO-12/UXO-18 Existing Conditions - 1964
2-9	UXO-12/UXO-18 Existing Conditions - 1979
2-10	UXO-12/UXO-18 Existing Conditions - 1985
2-11	Historical Aerial - 1989
2-12	UXO-12/UXO-18 Existing Conditions - 2005
2-13	UXO-12/UXO-18 (Plates 3, 4) Overlay Map - 1942-1946

## Attachments

1	Resource Review Summary
2	Historical Aerial Photographs

# Acronyms and Abbreviations

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CAP	Corrective Action Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CTO	Contract Task Order
°F	degrees Fahrenheit
ft	feet/foot
IAS	Initial Assessment Study
ITB	Infantry Training Battalion
ITR	Infantry Training Regiment
MC	munitions constituent
MCB	Marine Corps Base
MCTBn	Marine Combat Training Battalion
MEC	munitions of explosive concern
mm	millimeter
MRP	Munitions Response Program
msl	above sea level
NARA	National Archives and Records Administration
NAVFAC	Naval Facilities Engineering Command
NCDENR	North Carolina Department of the Environment and Natural Resources
NCWQS	North Carolina Water Quality Standards
NFA	no further action
PA/SI	Preliminary Assessment/Site Inspection
PSW	public supply well
SOI	Marine Corps School of Infantry
SWMU	solid waste management unit
U.S.	United States
USEPA	United States Environmental Protection Agency
UST	underground storage tank
UXO	unexploded ordnance
WWII	World War II

## SECTION 1

# Introduction, Purpose, and Scope

---

The United States Marine Corps and Naval Facilities Engineering Command (NAVFAC) are in the process of investigating closed ranges at Marine Corps Base (MCB) Camp Lejeune following the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation process. A munitions response program (MRP) Preliminary Assessment/Site Inspection (PA/SI) included under Contract Task Order (CTO)-040 will be conducted at the UXO-12 New River 1000-inch Range/UXO-18 50-foot (ft) Small Bore Range (hereafter referred to as the UXO-12/UXO-18 investigation area), shown in **Figure 1-1**. The UXO-12/UXO-18 investigation area is located east of U.S. Route 17 just west of Church Street and mostly contained on the north side of Curtis Road on the New River Air Station (**Figure 1-1**). The site is approximately 176 acres. The site is currently primarily wooded and is located at 34°43'53"N and 77°28'06" W, military grid 7406 4495.

The results of the environmental investigation will determine if any impacts to soil and groundwater have occurred at the UXO-12/UXO-18 investigation area 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 the UXO-12/UXO-18 investigation area that may have resulted in environmental contamination with munitions of explosive 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. **Figure 1-2** shows the site boundary in relation to the surrounding areas where previous environmental investigations have been completed.

The scope of this report includes:

- A review of existing information about the site (including MCB Camp Lejeune maps, drawings, 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 Alfred M. Gray Research Center at MCB Quantico, National Archives and Records Administration (NARA) map and text files, and MCB Camp Lejeune files. **Attachment 2** contains historical aerial photographs from 1946 to 1951 obtained during the research activities (MCB Quantico, 1946; 1948; 1951).



**Legend**

-  Surface Water Course Centerline
-  UXO-12/UXO-18 Boundary
-  Installation Boundary

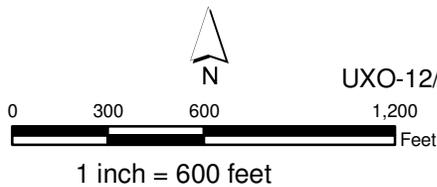


Figure 1-1  
Site Map  
UXO-12/UXO-18 Archival Records Search Report  
MCB Camp Lejeune  
North Carolina





**Legend**

- ✕ Public Supply Well
- SWMU/UST Sites
- Surface Water Course Centerline
- UXO-12/UXO-18 Boundary
- IR Site
- Installation Boundary

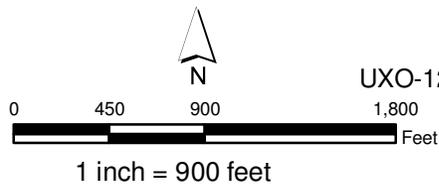


Figure 1-2  
 UXO-12/UXO-18 Area Map  
 UXO-12/UXO-18 Archival Records Search Report  
 MCB Camp Lejeune  
 North Carolina



# Site Information

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## 2.1 Facility Information

MCB Camp Lejeune is located on the Atlantic coast in Jacksonville, North Carolina. The city of Jacksonville in Onslow County is the principal support community for the base. MCB Camp Lejeune occupies 153,000 acres including more than 450 miles of roads, approximately 6,800 buildings and facilities, and 14 miles of beach on the Atlantic Ocean for amphibious training. Approximately 14,000 acres of land have been developed for administrative, maintenance, logistics and personnel support facilities. Originally established in 1941, the base is home to several tenant commands including II Marine Expeditionary Force, 2nd Marine Division, and 2nd Marine Logistics Group, two Navy commands, one Coast Guard command, and several Marine Corps formal schools. MCB Camp Lejeune supports a total population of approximately 150,000 people, including active duty military and dependants, retirees, and civilian employees (Global Security, 2008).

## 2.2 Ownership History

### 2.2.1 Camp Lejeune Ownership History

The history of the land now occupied by Camp Lejeune is documented primarily through land records and maps. Following the start of World War II (WW II), 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 occupation by the Marine Corps, 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, 2008).

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.

The UXO-12/UXO-18 investigation area is located in Area B, along the west side of the New River from Brinson Creek to Southwest Creek/Hicks (or Hickory) Run, as shown on **Figure 2-1**, the 1941 Property Map for Area B (Bureau of Yards and Docks, 1941). Area B included 47 tracts of land. The UXO-12/UXO-18 investigation area appears to have included two tracts of land purchased from private land owners, as shown in **Figure 2-1**. The facility at that time was known as Marine Barracks New River, NC and was changed to MCB Camp Lejeune in 1942 (Global Security, 2008).

## 2.3 Site Description

The UXO-12/UXO-18 investigation area is located in the Camp Geiger area of Camp Lejeune and contains the School of Infantry (formerly known as Infantry Training Regiment [ITR]), which is composed of two training battalions - the Infantry Training Battalion (ITB) and the Marine Combat Training Battalion (MCTBn). Marines are trained in the following: Military Occupational Specialties; Marine Rifleman; Machine Gunner; Mortarman; Assaultman; or Antitank Guided Missileman (Louis Berger Group, 2002).

The Camp Geiger area was originally used during WWII to house the 1st Marine Division. During that time period (1941-1942), the area was known as the Tent Camps and consisted of approximately 2,000 tents. The Tent Camps were located in the area northeast of the UXO-12/UXO-18 investigation area. The Tent Camps consisted of 6-man canvas tents, 20 feet square, arranged in blocks on a grid like street pattern, and 14-man "huts" made from sheets of compressed cellulose called Homasote (Global Security, 2007). By the end of the WWII, corrugated steel Quonset huts replaced most of the tents, but the Homasote huts remained until the early 1950's when all huts were removed (CH2M HILL, 2007).

From 1950 to 1953, the canvas tents at Camp Geiger were replaced with concrete block barracks. In 1953, the Tent Camp was rededicated in honor of Marine Corps General Roy S. Geiger. Camp Geiger has undergone additional improvements since the 1970s, in order to keep up with the demands of the Marine Corps School of Infantry (SOI) - East, located on its grounds (Global Security, 2007). Today, the SOI-East is still located at Camp Geiger, and is a major training facility for the Marine Corps.

The UXO-12/UXO-18 investigation area site boundary encompasses three historic ranges: Site Unexploded Ordnance (UXO)-18 B-6 50-Foot Small Arms Range (ASR 2.44); Site UXO-05, Former Miniature Anti-Tank Range (ASR 2.7a); and Site UXO-12, New River 1,000-inch Range (ASR 2.5), **Figure 2-2**. The UXO-18 B-6 50-Foot Small Arms Range is also referred to as the B-6 1000-Inch Range in Section 2.44 of the Archive Search Report (USACE, 2001).

The UXO-18 site boundary encompasses the B-6 50-Foot Small Arms Range (ASR #2.44). Four different range fans appear around the Camp Geiger area from 1951 to 1958 and are identified as B-6 50-Foot Small Arms Range (ASR #2.44) (USACE, 2001). The UXO-12/UXO-18 site boundary was delineated by plotting three of the historical range fans and incorporating Site UXO-12. It should be noted that the southernmost range from Plate 10, (USACE, 2001) located south of Curtis Road, was not used in the delineation of the UXO-12/UXO-18 investigation area site boundary (**Figure 2-3**). The reason for this is that another former military range, the B-12 range complex, is located in this area.

The UXO-12/UXO-18 investigation area site boundary overlaps the northeast corner of Site UXO-05 by approximately 4.5 acres, **Figure 2-2**. Field work for Site UXO-05 PA/SI was completed in 2008 and the PA/SI was completed in early 2009 (CH2M HILL, 2009a). However, due to the limited sampling density completed during the Site UXO-05 PA/SI, the UXO-12/UXO-18 investigation area that overlaps Site UXO-05 will be included in the UXO-12/UXO-18 investigation area PA/SI.

Site UXO-12 is located in the north-central portion of the B-6 Range and is completely encompassed by the UXO-12/UXO-18 investigation area site boundary, **Figure 2-2**. Upon

discussions with MCB Camp Lejeune personnel, it was determined to include Site UXO-12 in the UXO-18 site boundary for investigation efficiency.

## 2.4 Operational History

### 2.4.1 Review of Historical Aerial Photographs and Site Maps

The UXO-12/UXO-18 investigation area and immediate area are described over time below and the three historical ranges will be discussed in depth in the following sections.

Aerial photos from 1946 show the eastern portion of the UXO-12/UXO-18 investigation area site boundary, **Attachment 2**. The area is sparsely wooded.

The existing conditions maps for the area within and near the UXO-12/UXO-18 investigation area do not show any buildings, wells or pumping stations present from first available map in 1943 through 1949. The existing conditions map from 1949, (**Figure 2-4**) obtained from MCB Camp Lejeune, shows an Ammunitions Storage Building, Building 605, and Pumphouse and Well - M, Building 1001, appearing within the UXO-12/UXO-18 investigation area site boundary. Building 605 appears to be located in the northern portion of the UXO-12/UXO-18 investigation area and Building 1001 is located on the southwest side, immediate north of Curtis Road.

Historical aerial photos from 1948 and 1951 show the UXO-12/UXO-18 investigation area area having elongated areas of cleared land in the northern area of the site and heavily wooded in the southern portions of the site boundary (**Attachment 2**). Building 605 can be seen in the aerials directly to the north of the long cleared areas.

After 1949 existing conditions, there are no changes in the existing conditions maps until 1953 (**Figure 2-5**) when the PHA Trailer Park appears in the southwest corner of the UXO-12/UXO-18 investigation area site boundary. The PHA Trailer Park consisted of 917 trailers. The 1953 existing conditions map continues to include Buildings 605 and 1001. Building 504, Pumphouse for Deep Well - J is also present on **Figure 2-5** located outside of the UXO-18 boundary.

The 1963 existing conditions map shows a building labeled S-652 located in a similar location as Building 605 and within the UXO-12/UXO-18 investigation area site boundary (**Figure 2-6**); this building is not identified in the legend for this map. Two other buildings, S-OC-1-C and S-OC-15-C, appear within the UXO-12/UXO-18 investigation area site boundary on **Figure 2-6** and are identified as classrooms.

The aerial photograph from 1962 (**Figure 2-7**) indicates that most of the site is heavily wooded. A road transects the site from east to west near the northern site boundary with a road intersecting perpendicular leading north out the site. There is a cleared area south of the road in the vicinity of Site UXO-12. The aerial photograph shows Building S-652 on the boundary of UXO-12, the two other buildings, S-OC-1-C and S-OC-15-C from **Figure 2-6**, do not appear on this photograph. Trails or roads are seen in the northwestern portion of the site in a grid pattern. Running east-west across the southern portion of the site utility line access is visible.

In the southern portion of the site the PHA Trailer Park, part of the Site UXO-05 is clearly visible. The area of Site UXO-05 was used as a trailer park in the 1960's. The 1964 Camp Lejeune existing conditions map provides the layout of the trailer park, including streets and sleeper trailer numbers (**Figure 2-8**).

**Figure 2-7** shows a cleared area just south of the Curtis Road, outside of the UXO-12/UXO-18 investigation area site boundary, that maybe the firing line of the B-12 Baffled Pistol Range. The B-12 range was shown on the 1961 Master Shore Station Development Plan and was identified as a rifle and pistol range. The B-12 Range appears in the 1970 to 1993 range overlay maps. Authorized firing at this range consisted of .22 caliber rifles, service pistols, and revolvers. The range has remained in service from approximately 1961 to the present time. The Base Range Safety Officer indicated that the range is currently used for pistol training with 9 millimeter (mm) and 0.45 caliber pistols (Richardson, 2007).

From 1953 until 1985, there are no changes in the infrastructure near or within the UXO-12/UXO-18 investigation area site boundary according to available existing condition maps. The 1979 Camp Lejeune existing conditions map shows the footprint of the former trailer park in the area of UXO-05 and various small buildings on the site that were/are used for classrooms, storage, a sewer pump station and pump houses for wells (**Figure 2-9**).

In 1985 (**Figure 2-10**), building STC 1256 appears in the center of the southern border of UXO-18, just north of Curtis Road; this building is not identified on the legend page for the map.

The 1989 aerial photograph, **Figure 2-11**, shows the area as densely vegetated, the cleared area in the northern part of UXO-12 is overgrown although there is still evidence of a path or road cutting across the site. The trail or road running east/west in the southern portion of the site is still visible. Vegetation appears to be less dense in the middle of the UXO-12/UXO-18 investigation area site boundary.

The next available existing conditions map is from 2005 (**Figure 2-12**). The map includes the loop road in the northern portion of the site and well as Building S-OC-15-C. An unknown Building B-12 is located just south of the site boundary in the area of the B-12 Range.

The UXO-12/UXO-18 investigation area is currently densely vegetated over most of the site. A road loop is located in the northern portion of the site, Curtis Road runs through the southern portion of the site and the roads for the PHS Trailer Park are visible, **Figure 1-1**.

## 2.4.2 Site UXO-18, B-6 50-Foot Small Arms Range (ASR #2.44)

The UXO-18 B-6 50-Foot Small Arms Range first appears on a 1951 range overlay map. Base Order 1101.0B, dated 5 May 1960, stated that this range was used with .22 caliber rifle and pistol, .32, .38, and .45 caliber pistols (USACE, 2001). The range was in use from 1950 to approximately 1961. The B-6 50-Foot Small Arms Range appears on several different historical range overlay maps in varying places with slightly different names over time. Small arms were used at this range in an unknown quantity. Sections of Plates 5, 6, and 8 (**Figures 2-3**) were used to define the area of investigation for the UXO-12/UXO-18 investigation area PA/SI.

The 1951 range overlay map, Plate 5, depicts a small 500-ft small arms range fan with the firing direction to the southeast, **Figure 2-3**. The 1953 range overlay map, Plate 6, shows a larger 1000 inch range with the firing direction to the southwest. The 1954 range overlay map identifies a 50-ft small arms range with a firing position further north and a larger range fan than the 1951 or 1953 map. The final range map depicting the B-6 Range is from 1958 and shows a larger range fan located significantly more south of the other locations with a southeastern firing position, **Figure 2-3**.

The B-6 50-Foot Small Arms Range had 25 station targets for .22 caliber rifles and 10 stations for .32, .38 and .45 caliber pistols. Explosive hazards exist with complete rounds that would be found near the firing line. The estimated depth of munitions is at the surface, however, “over the years, construction and other ground movement may have caused the rounds to become buried to an unknown depth” (USACE, 2001).

According to Base Range Safety Officer, Duane Richardson, it was “common practice to pile up a large dirt berm in the units area and set up, small targets next so the rifle sights could be set. Possible lead in the soil issue, area presently very wooded area” (Richardson, 2008).

### 2.4.3 Site UXO-05, Former Miniature Anti-Tank Range (ASR #2.7a)

The Site UXO-05, former Miniature Anti-Tank Range was identified from a map enclosed in the Construction Completion Report for Camp Lejeune, TM-9-855, dated August 17, 1944 (USACE, 2001). Site UXO-05 was used from 1942 to 1944 and appears as Feature 1 of Plate 3 on the 1942 Range Overlay Map, **Figure 2-13**, and as Feature 5 of Plate 4 on the 1946 Range Overlay Map, **Figure 2-13** (USACE, 2001). The 1942 range overlay map depicts Site UXO-05 immediately south of Curtis Road as a large rectangle, as shown on **Figure 2-13**. The 1946 range overlay map depicts the boundary of UXO-05 well to the southwest of Curtis Road as a much smaller rectangle, **Figure 2-13**. Site UXO-05 was investigated in 2008 and the PA/SI is summarized Section 2.5.

According to the 2001 *Range Identification and Preliminary Range Assessment*, a 1000-Inch Miniature Antitank Range that involved firing at a moving target car on a transverse track was identified as being in the location of Site UXO-05. The downrange safety distance of 1,600 yards indicated that firing was limited to .22 caliber weapons (USACE, 2001).

The Base Range Safety Officer noted that the area was used extensively during WWII for blank fire and non-firing events (Richardson, 2007a,b). He also noted that the form of firing was from .22 caliber small arms, which was restricted to the site. Evidence (or remnants) of past ammunition use that may be expected to be found at this site consists of spent .22 caliber munitions casings and unspent .22 caliber cartridges at or near the firing line (USACE, 2001). Complete rounds would be located at the surface, but over the years, construction and other ground movement may have caused the rounds to become buried to an unknown depth (USACE, 2001).

### 2.4.4 Site UXO-12, New River 1000-inch Range (ASR #2.5)

Site UXO-12, New River 1000-inch Range, was identified from a map enclosed in the Construction Completion Report for Camp Lejeune and Camp Training Order Number 5-1946, dated March 18, 1946 (USACE, 2001). The training order states that the range was used for .30 caliber weapons firing, and as of the date of March 18, 1946 the range was

disestablished. Site UXO-12, New River 1000-inch Range, was used from 1942 to 1945.

**Figure 2-13** shows the site as Feature 1 of Plate 4 on the 1946 Range Overlay Map (USACE, 2001).

Only small arms ammunition is documented to have been used at this site; the estimated quantity used is unknown. The estimated depth of ammunition is at the surface; however, “over the years, construction and other ground movement may have caused the rounds to become buried to an unknown depth” (USACE, 2001). According to Base Range Safety Officer, Duane Richardson, it was “common practice to pile up a large dirt berm in the units area and set up small targets next so the rifle sights could be set. Possible lead in the soil issue, area presently very wooded area” (Richardson, 2008).

Historical aerial photos from 1948 and 1951 show the UXO-12 area having elongated areas of cleared land with the heavy vegetation to the south and grassy fields to the north. A small building, Building 605, an Ammunitions Storage Building, is located in on the northern side of the site in middle of the long cleared areas (**Attachment 2**).

## 2.4.5 Current Site Conditions

The site currently appears to be densely vegetated, with evidence of one stream, one road, one utility line access, and no buildings, **Figure 1-1**.

There are seven active public supply wells (PSW) located in the vicinity of the UXO-12/UXO-18 investigation area, and three former PSWs (**Figure 1-2**). The active wells range in pump depth from 50 to 82 ft below ground surface (AHEC, 2002). These active wells, including PSW-TC1001 located within the UXO-12/UXO-18 investigation area site boundary, do not show evidence of contamination. In 2000, former wells PSW-TC502 and PSW-TC700 were demolished due to benzene contamination in historical monitoring (AHEC, 2002). PSW-TC1254 is also inactive, but information regarding when or why this well was taken offline is not available.

PSW-TC600 is currently active, but it was recommended in the 2002 *Wellhead Protection Plan* that this well be demolished. As shown in **Figure 1-2**, PSW-TC600 is very close to PSW-TC502, which is now inactive due to benzene contamination.

## 2.5 Previous Investigations

### 2.5.1 Solid Waste Management Units

There is one solid waste management unit (SWMU) located within the UXO-12/UXO-18 investigation area site boundary, SWMU 183, and three SWMUs near the UXO-12/UXO-18 investigation area: SWMU 356, 146, and 186, **Figure 1-2**. These SWMU's contained underground storage tanks (USTs) which were removed in the early 1990's. Varying levels of activity have taken place since removal of the UST's.

A 300-gallon UST containing gas/diesel fuel was located at SWMU-183 until 1994 (Environmental and Safety Designs, 1996). A release from the UST was confirmed in 1994, due to levels of contamination in the soil during removal of the UST. An excavation was planned for 1997 to remove contaminated soils from the site. However, during pre-excavation sampling in April 1997, soil contamination levels were found to be below the soil

site rehabilitation levels. As a result, the excavation was not completed (J. A. Jones, 1998). Groundwater monitoring at ten wells (MW-1, MW-2, MW-4, MW-5, MW-7, and MW-9 through MW-13) was conducted quarterly for a period of 1 year from May 1997 through May 1998. During this time, groundwater contamination levels including benzene were detected above North Carolina Department of the Environment and Natural Resources (NCDENR) standards. However, the levels did not exceed NCDENR gross contamination levels (J. A. Jones, 1998). After a year of groundwater monitoring and a risk characterization evaluation, SWMU-183 was classified as a low risk site, and approved for No Further Action (NFA) (J.A. Jones, 1998).

SWMU-186 was the site of five USTs containing a total of 17,100 gallons of gas, oil, and diesel fuel (Catlin Engineers, 2007). The USTs were installed in 1964, and removed in 1992-1993. Petroleum-based contamination of soils at SWMU-186 was confirmed in 1993, and a Corrective Action Plan (CAP) was prepared in 1996. Remediation efforts included an Air Sparge / Soil Vapor extraction system which was constructed in 1998 and operated until 2001 (Catlin Engineers, 2007). After remediation, a request for NFA was submitted to the NCDENR in March, 2004. The site was determined eligible for NFA, with a groundwater Land Use Restriction (LUR). In 2007, Catlin Engineers conducted a groundwater sampling event and found that contamination levels had naturally attenuated to below the 2L Groundwater Quality Standard, and recommended SWMU-186 for NFA without LURs.

At SWMU-146, a release of oil to soil and groundwater was confirmed. An underground storage tank (UST) and four associated monitoring wells (USTCG1-MW01 through USTCG1-MW04) are associated with Building CG1 (Base Game Warden and Archery Club Offices). The CG1 UST was a 500-gallon, used oil tank, which was removed in February 1994. The site was issued NFA status by NCDENR in July 2000. The four monitoring wells were subsequently abandoned in accordance with North Carolina well abandonment standards (CH2M HILL, 2009a).

There is no groundwater contamination at SWMU-356, and NFA has been required (Environmental and Safety Designs, 1996).

### 2.5.2 Site 35, Former Camp Geiger Fuel Farm

Site 35, the former Camp Geiger Fuel Farm, is located to the east of UXO-18, **Figure 1-2**. There have been several recorded fuel/oil spills at Site 35 since 1957 (CH2M HILL, 2008a). Contaminants (volatile organic compounds [VOCs] and semivolatile organic compounds [SVOCs]) have been detected in the soil and surface water at Site 35. However, surface water contaminant levels did not exceed the North Carolina Water Quality Standards (NCWQS) and/or the United States Environmental Protection Agency (USEPA) surface water standards (CH2M HILL, 2008a). The primary constituents of groundwater contamination are chlorinated solvent-related compounds. Although contaminants are present at Site 35, migration of chemicals has mostly been in a northerly direction, while the UXO-12/UXO-18 investigation area lies to the west of this site.

### 2.5.3 Site 93, Within Camp Geiger near Building TC-942

Site 93 is located east of UXO-18, **Figure 1-2**. A UST containing waste oil was previously located at Site 93. This UST was removed in 1993 (Environmental and Safety Designs, 1996).

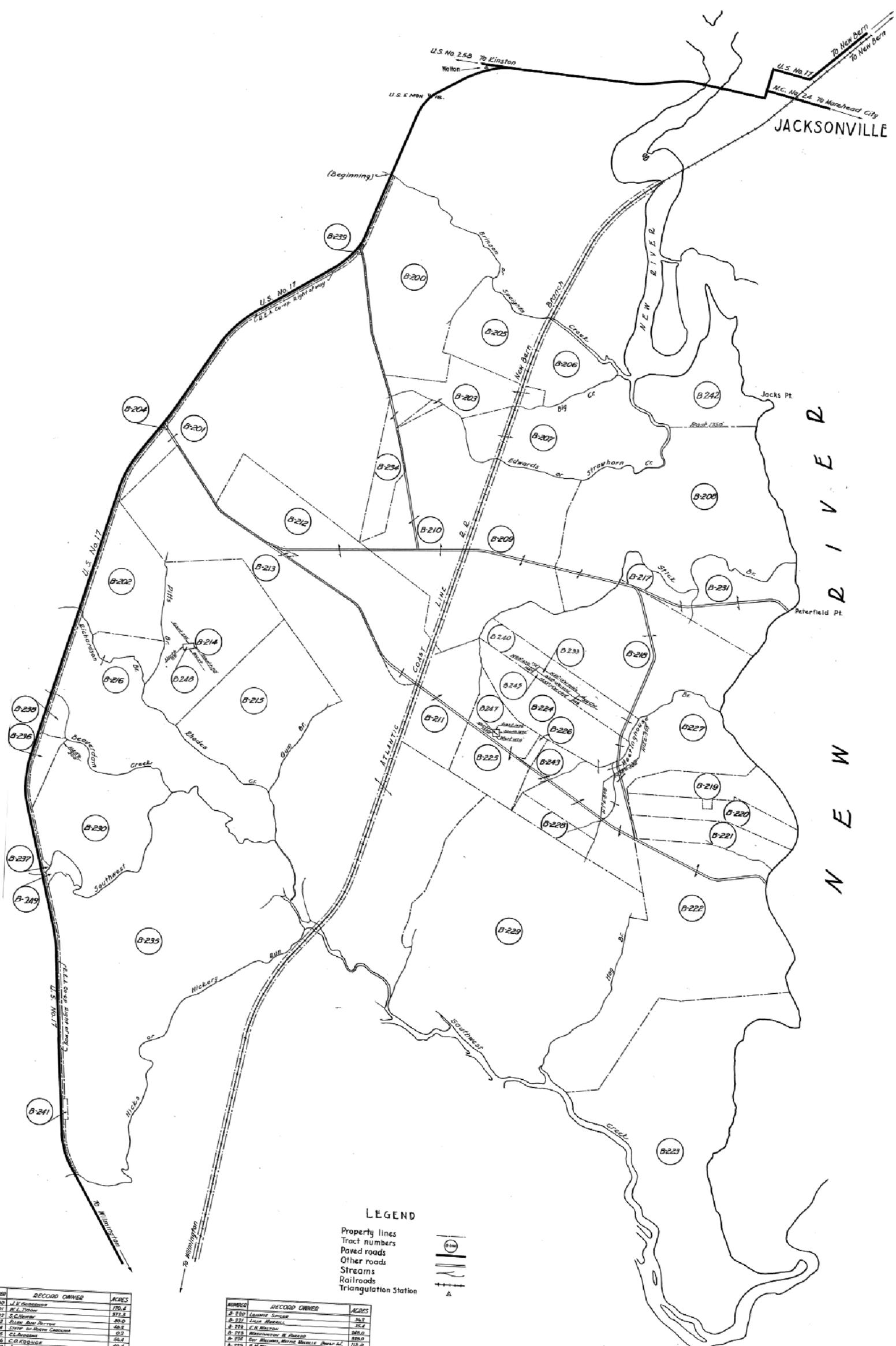
A release was suspected due to high concentrations of oil and gas during the tank removal. A chlorinated VOC groundwater plume was identified at Site 93 during an RI conducted in 1996-1997. The plume was not within the boundaries of the UXO-12/UXO-18 investigation area. Remedial action at Site 93 began in 2006, and was completed in 2008 (Environmental and Safety Designs, 1996).

#### 2.5.4 Site 40

Site 40, the Former Camp Geiger Borrow Pit Dump, is located to the south of the UXO-12/UXO-18 investigation area, **Figure 1-2**. In the 1983 Base-wide Initial Assessment Study (IAS), this site was identified as a waste disposal site for automobile parts and scrap metal, and was recommended for NFA (CH2M HILL 2008b). In 2008, a PA/SI was conducted to assess potential risks to human health and the environment at Site 40. Soil, groundwater, and surface water samples were collected and analyzed for contamination from VOCs, SVOCs, PCBs, and metals. Although some low-level contamination was found, the PA/SI determined there were no unacceptable risks for current or future human health exposure, or for ecological receptor populations at Site 40 (CH2M HILL 2008b).

#### 2.5.5 Site UXO-05

A PA/SI was completed at Site UXO-05 and included Site UXO-01, former B-3 Gas Chamber, in 2008. The PA/SI focused on impacts to soil and groundwater by munitions constituents (MC). For further information on the PA/SI see the *Draft Preliminary Assessment/Site Inspection Report MMRP Site UXO-05, Former Miniature Anti-tank Range and Site UXO-01, Former B-3 Gas Chamber* (CH2M HILL, 2009b).



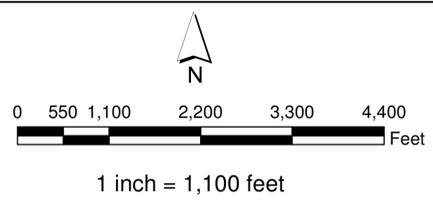
**LEGEND**  
 Property lines  
 Tract numbers  
 Paved roads  
 Other roads  
 Streams  
 Railroads  
 Triangulation Station

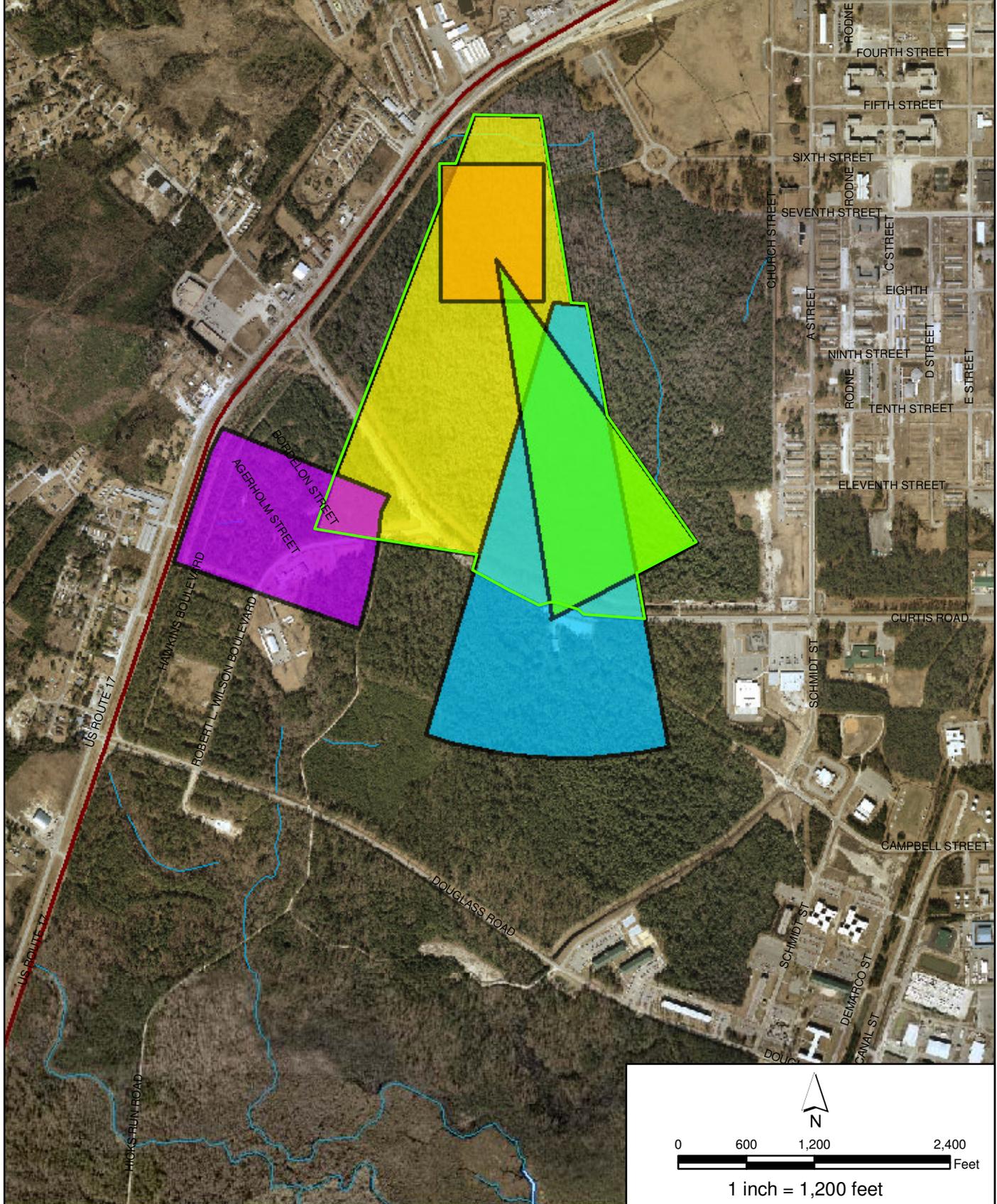
NUMBER	RECORD OWNER	ACRES
B-200	M. E. Gaudin	170.4
B-201	M. E. Gaudin	171.1
B-202	C. C. Moore	40.0
B-203	Edwards or Strawhorn Cc	40.0
B-204	C. C. Moore	40.0
B-205	C. C. Moore	40.0
B-206	C. C. Moore	40.0
B-207	C. C. Moore	40.0
B-208	C. C. Moore	40.0
B-209	C. C. Moore	40.0
B-210	C. C. Moore	40.0
B-211	C. C. Moore	40.0
B-212	C. C. Moore	40.0
B-213	C. C. Moore	40.0
B-214	C. C. Moore	40.0
B-215	C. C. Moore	40.0
B-216	C. C. Moore	40.0
B-217	C. C. Moore	40.0
B-218	C. C. Moore	40.0
B-219	C. C. Moore	40.0
B-220	C. C. Moore	40.0
B-221	C. C. Moore	40.0
B-222	C. C. Moore	40.0
B-223	C. C. Moore	40.0
B-224	C. C. Moore	40.0
B-225	C. C. Moore	40.0
B-226	C. C. Moore	40.0
B-227	C. C. Moore	40.0
B-228	C. C. Moore	40.0
B-229	C. C. Moore	40.0
B-230	C. C. Moore	40.0
B-231	C. C. Moore	40.0
B-232	C. C. Moore	40.0
B-233	C. C. Moore	40.0
B-234	C. C. Moore	40.0
B-235	C. C. Moore	40.0
B-236	C. C. Moore	40.0
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B-238	C. C. Moore	40.0
B-239	C. C. Moore	40.0
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B-241	C. C. Moore	40.0
B-242	C. C. Moore	40.0
B-243	C. C. Moore	40.0
B-244	C. C. Moore	40.0
B-245	C. C. Moore	40.0
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B-247	C. C. Moore	40.0
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B-250	C. C. Moore	40.0

NUMBER	RECORD OWNER	ACRES
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B-251	C. C. Moore	40.0
B-252	C. C. Moore	40.0
B-253	C. C. Moore	40.0
B-254	C. C. Moore	40.0
B-255	C. C. Moore	40.0
B-256	C. C. Moore	40.0
B-257	C. C. Moore	40.0
B-258	C. C. Moore	40.0
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B-260	C. C. Moore	40.0
B-261	C. C. Moore	40.0
B-262	C. C. Moore	40.0
B-263	C. C. Moore	40.0
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B-265	C. C. Moore	40.0
B-266	C. C. Moore	40.0
B-267	C. C. Moore	40.0
B-268	C. C. Moore	40.0
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B-276	C. C. Moore	40.0
B-277	C. C. Moore	40.0
B-278	C. C. Moore	40.0
B-279	C. C. Moore	40.0
B-280	C. C. Moore	40.0
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B-282	C. C. Moore	40.0
B-283	C. C. Moore	40.0
B-284	C. C. Moore	40.0
B-285	C. C. Moore	40.0
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B-287	C. C. Moore	40.0
B-288	C. C. Moore	40.0
B-289	C. C. Moore	40.0
B-290	C. C. Moore	40.0

**REVISION SCHEDULE**  
 A Corrected B-208, B-214, B-224, B-225, B-227, B-230, B-236, B-240, B-248, B-249, B-248, B-249. Contract Number added to Title Block.

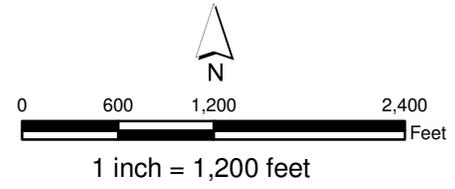
I hereby certify that this map was compiled from information contained in maps and deeds recorded in the Onslow County Registry, aerial photographs, and partial surveys made on the ground by Boney and Broadfoot. The items entered as revisions represent information added from surveys made since original date of compilation.  
 Dated July 18, 1941. **DONEY AND BROADFOOT**  
 By: *[Signature]*  
 Acting Chief Engineer





**Legend**

- Surface Water Course Centerline
- Installation Boundary
- UXO-12/UXO-18 Boundary
- UXO-18/B-6 1,000-inch Range (ASR #2.44) from Plate 8 (USACE, 2001)
- UXO-05 Former Miniature Anti-tank Range (ASR #2.7a) from Plates 3 and 4 (USACE, 2001)
- UXO-18/B-6 50 Foot Small Arms Range (ASR # 2.44) from Plate 6 (USACE, 2001)
- UXO-12 New River 1,000-inch Range (ASR #2.5) from Plate 4 (USACE, 2001)
- UXO-18/B-6 50 Foot Small Arms Range (ASR# 2.44) from Plate 5 (USACE, 2001)



**Figure 2-2**  
 Historical Range Fan Boundaries  
 UXO-12/UXO-18 Archival Records Search Report  
 MCB Camp Lejeune  
 North Carolina



50 Foot  
Small Arms  
Range

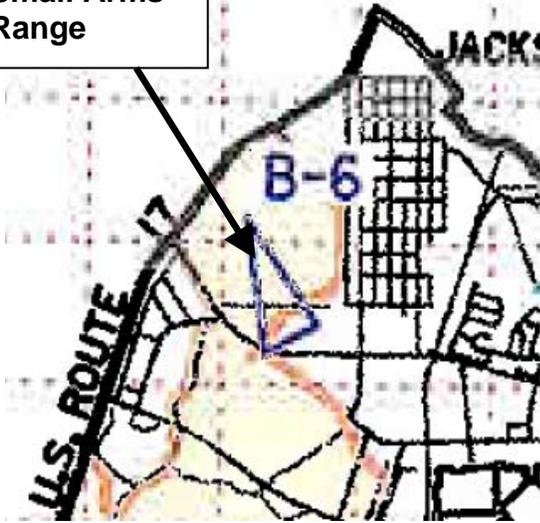


Plate 5 (1951)

1000 Inch  
Range

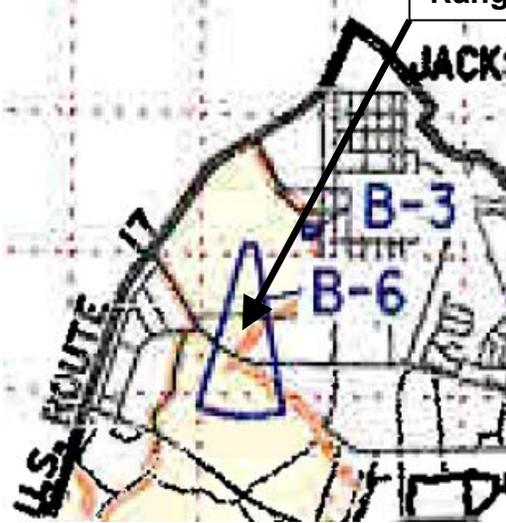


Plate 6 (1953)

50 Foot  
Small Arms  
Range

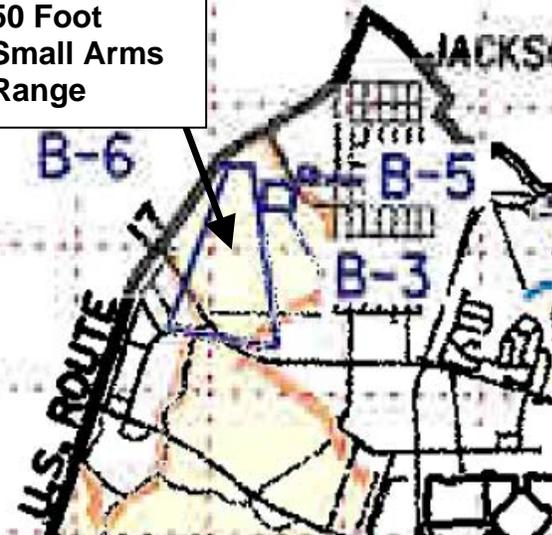
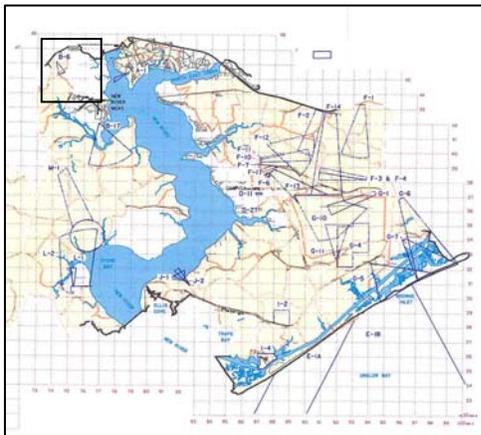


Plate 8 (1954)

50 Foot Small  
Arms Range



Plate 10 (1958)



0 1000 2000



Approximate scale in  
Meters

N

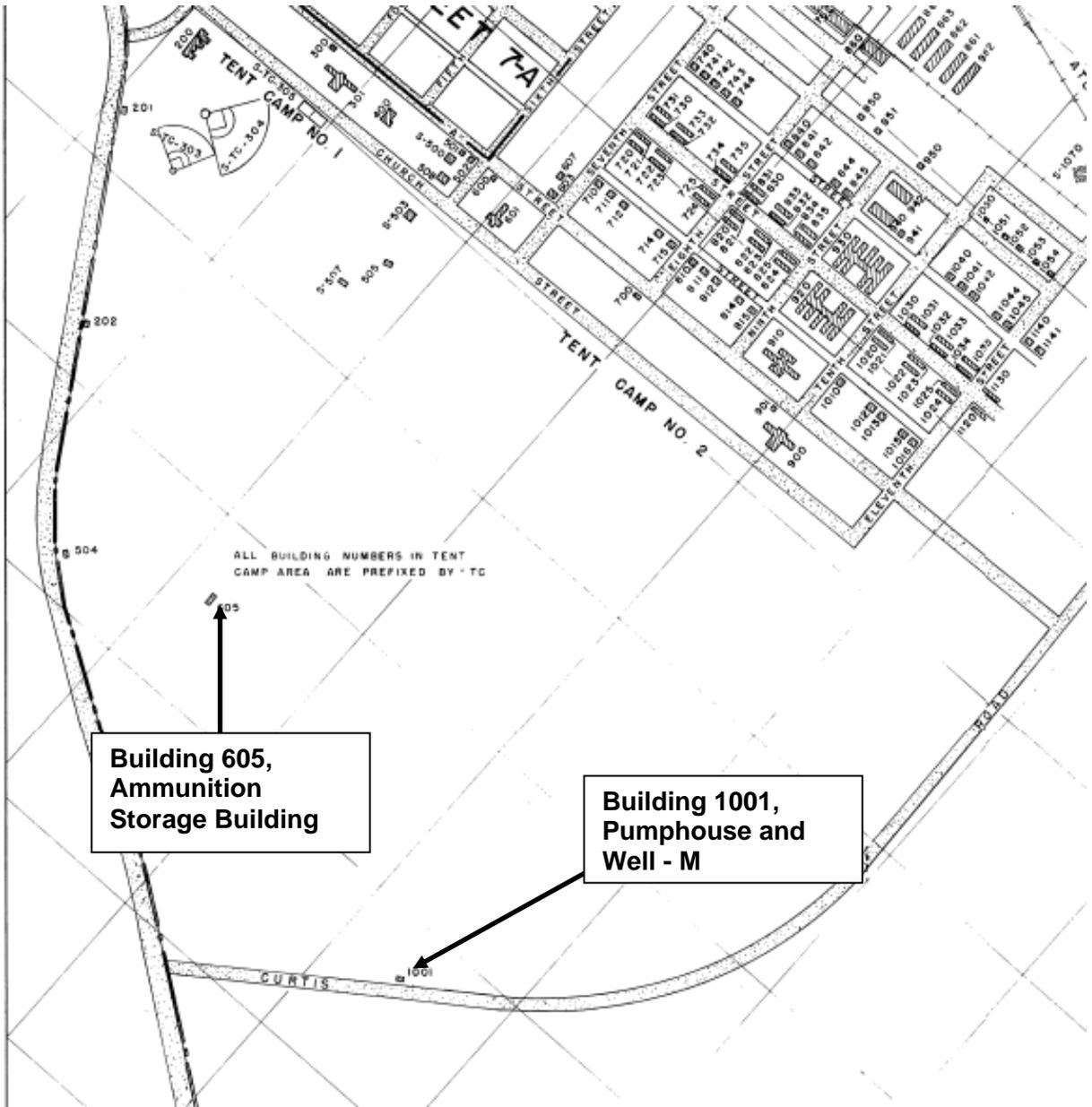


**Figure 2-3**  
UXO-12/UXO-18 (Plates 5,6,8,10) Overlay Map – 1951,  
1953, 1954, 1958  
UXO-12/UXO-18 Archival Records Research Report  
MCB Camp Lejeune  
North Carolina

Source: USACE, 2000



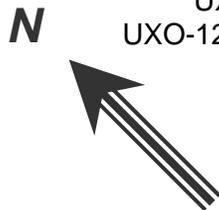
**CH2MHILL**



0 1000 2000



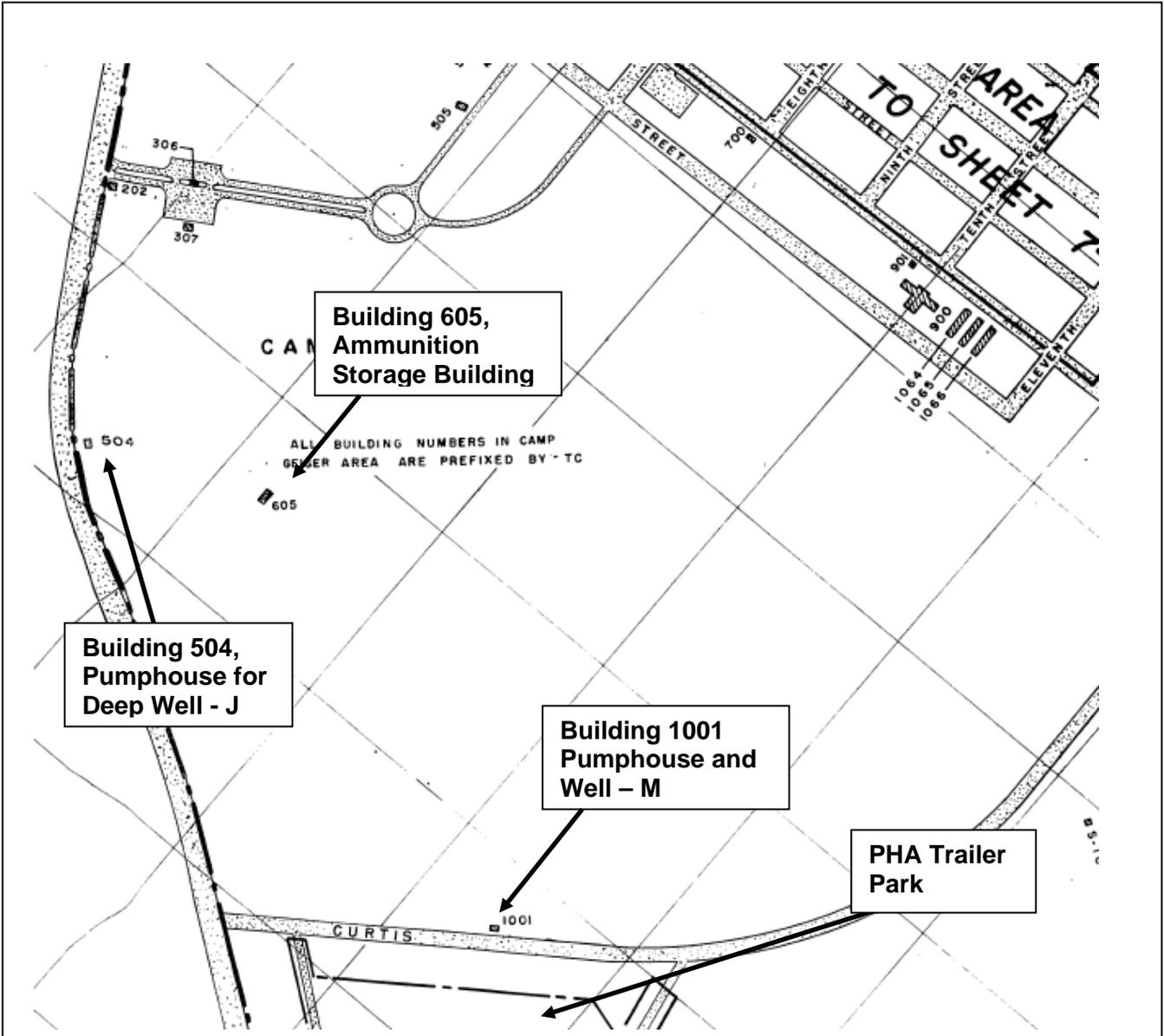
Approximate Scale in Feet



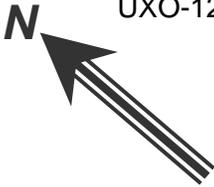
**Figure 2-4**  
 UXO-12/UXO-18 Existing Conditions – 1949  
 UXO-12/UXO-18 Archival Records Search Report  
 MCB Camp Lejeune  
 North Carolina



Source: MCB Camp Lejeune, 1949



Approximate Scale in Feet

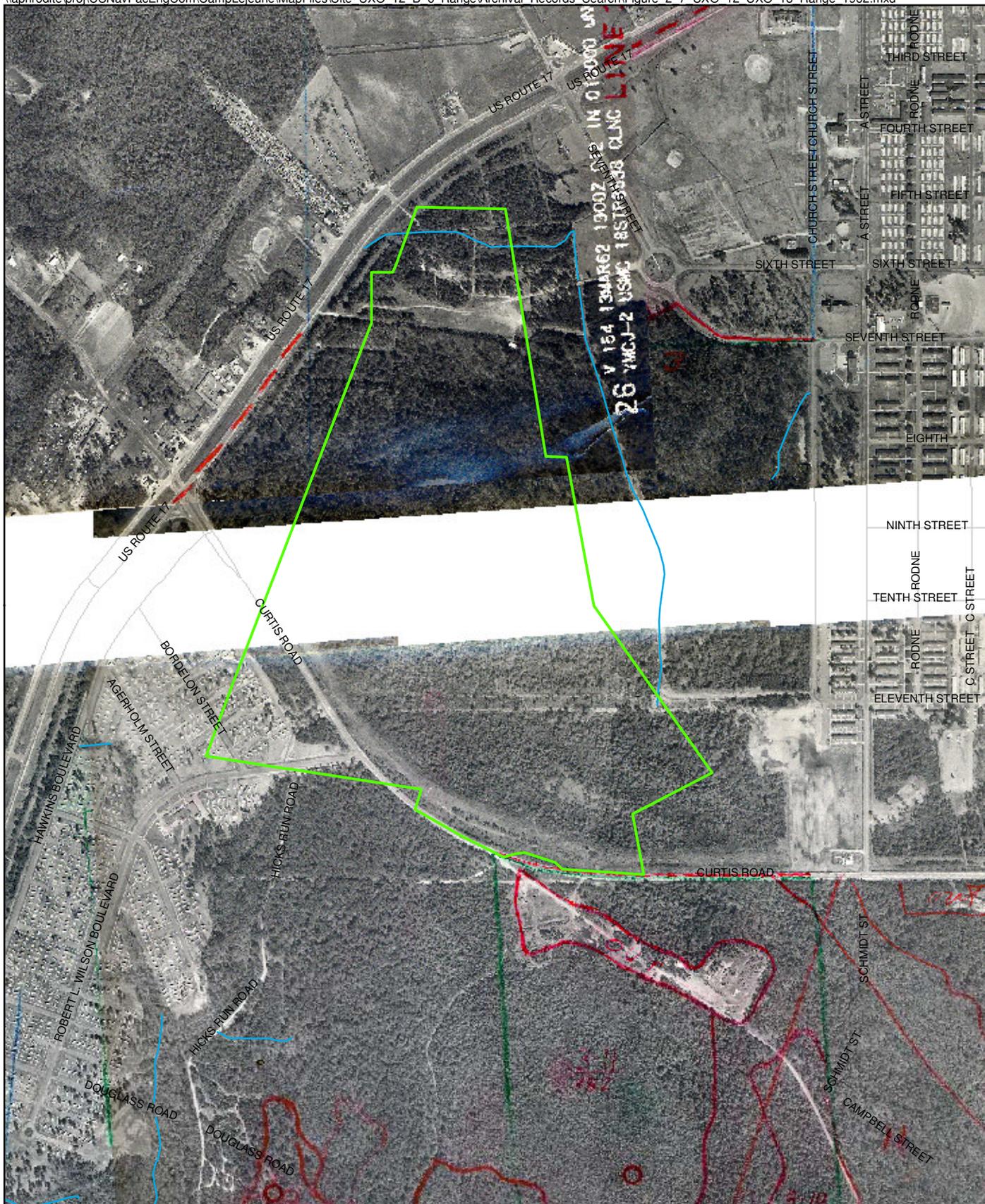


**Figure 2-5**  
 UXO-12/UXO-18 Existing Conditions – 1953  
 UXO-12/UXO-18 Archival Records Search Report  
 MCB Camp Lejeune  
 North Carolina



Source: MCB Camp Lejeune, 1953





- Legend**
- Surface Water Course Centerline
  - Road
  - UXO-12/UXO-18 Boundary

**Note:**  
 Historic 1962 imagery is unavailable on the white area in the above map.

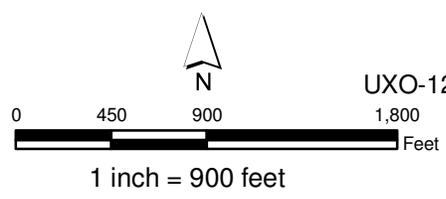
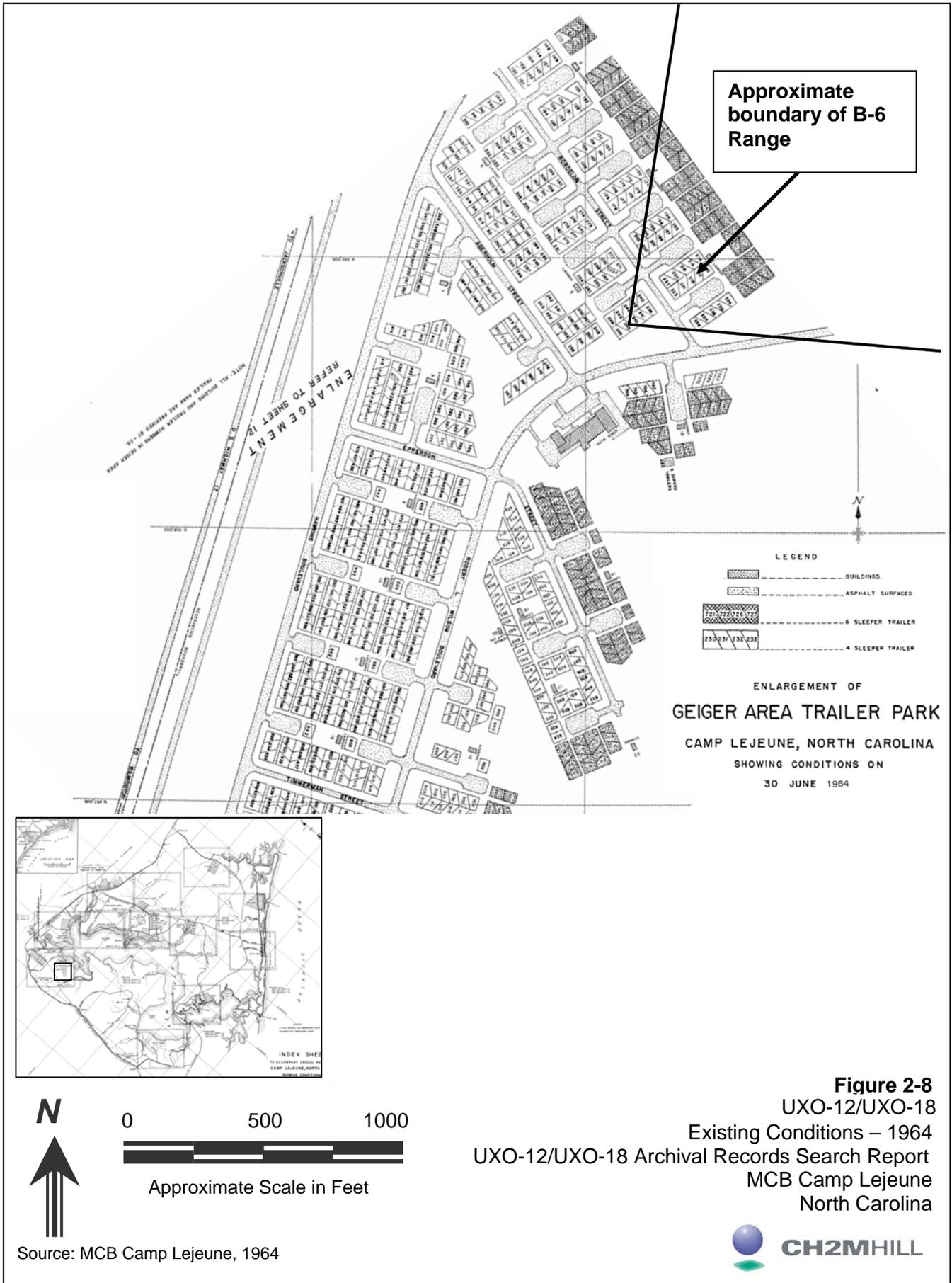
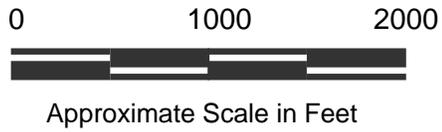
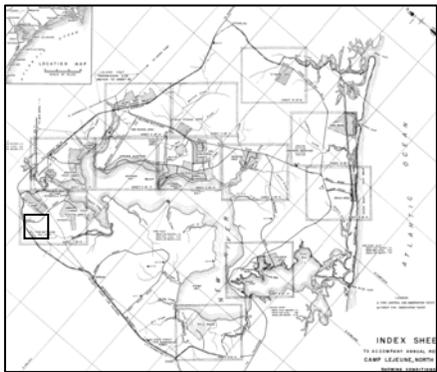
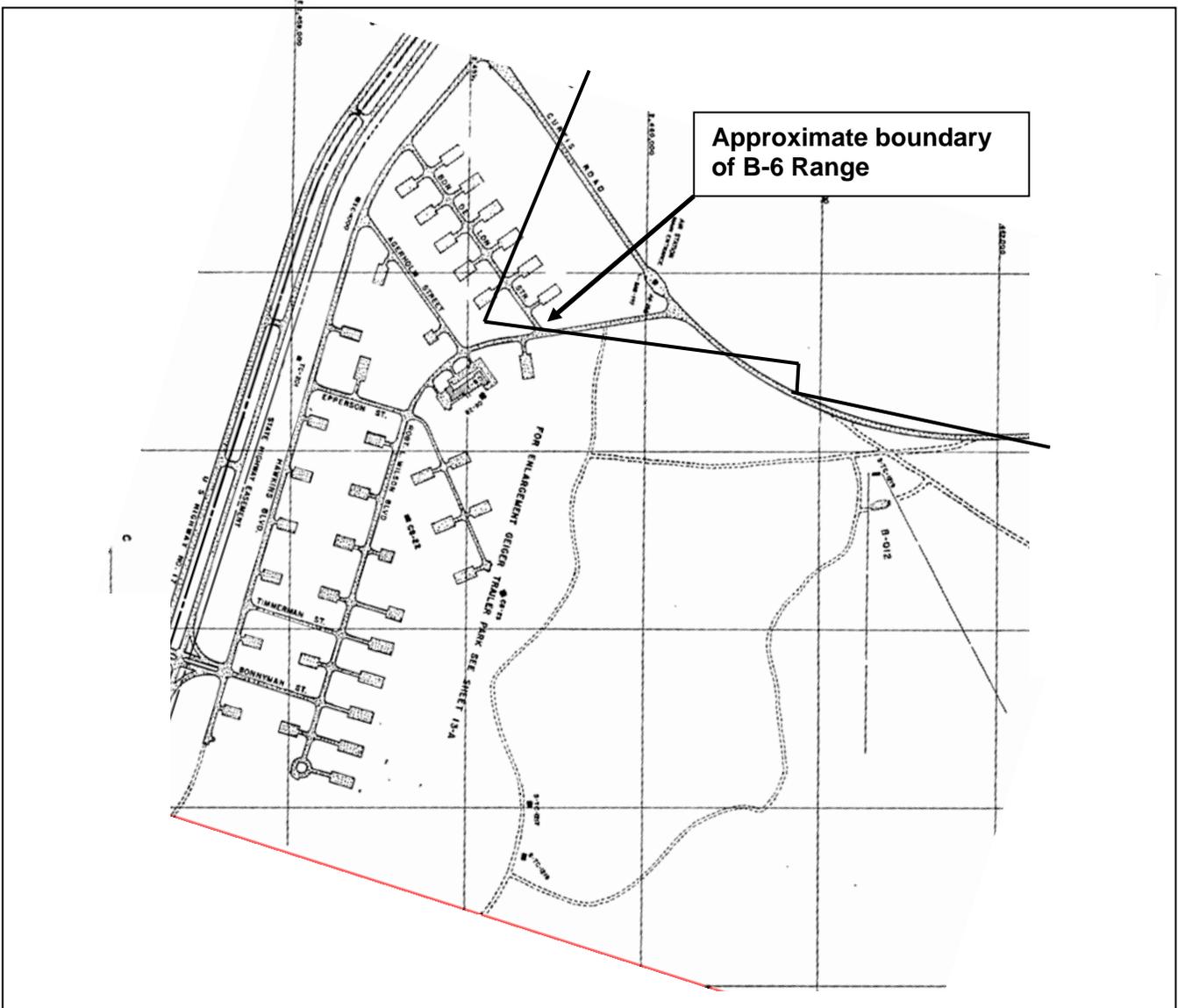


Figure 2-7  
 Historical Aerial - 1962  
 UXO-12/UXO-18 Archival Records Search Report  
 MCB Camp Lejeune  
 North Carolina



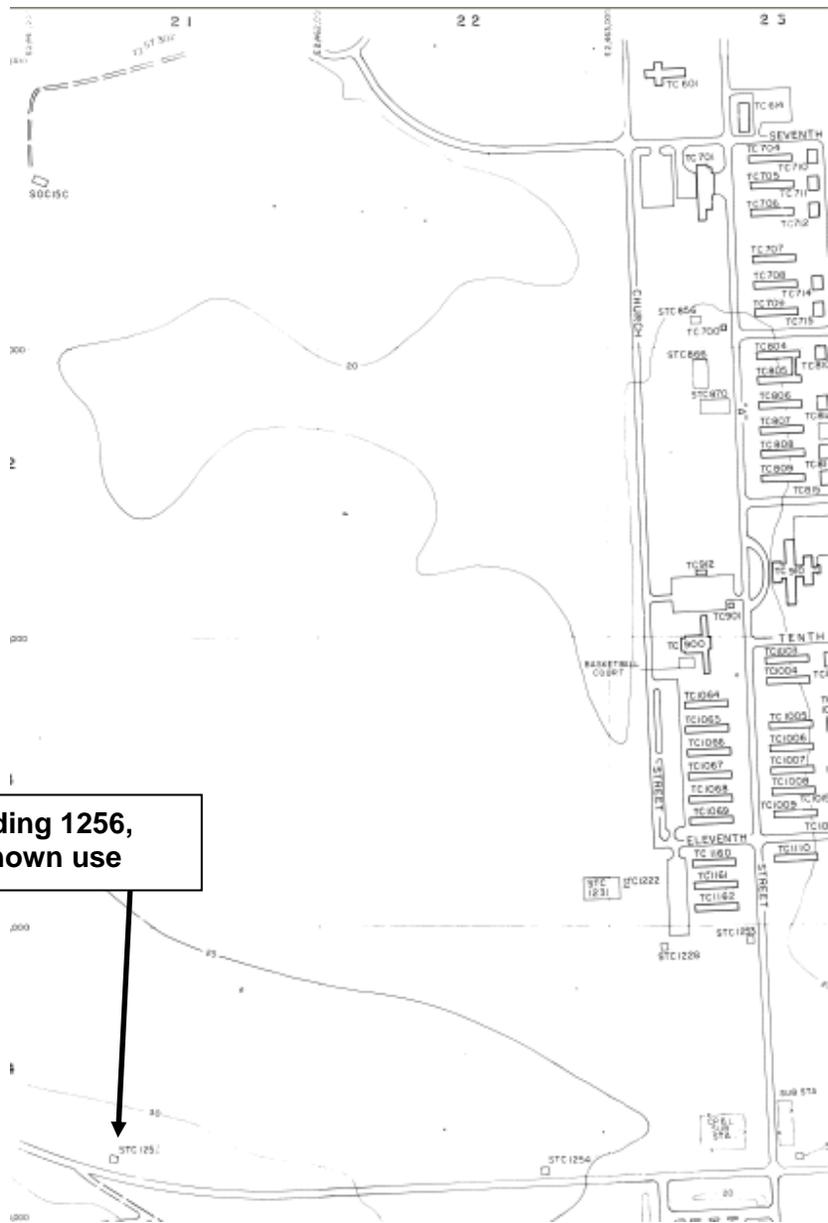




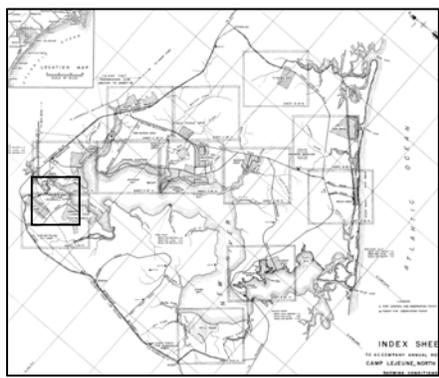
**Figure 2-9**  
 UXO-12/UXO-18 Existing Conditions –1979  
 UXO-12/UXO-18 Archival Records Search Report  
 MCB Camp Lejeune  
 North Carolina



Source: MCB Camp Lejeune, 1979



**Building 1256,  
unknown use**



Approximate Scale in Feet



**Figure 2-10**  
 UXO-12/UXO-18 Existing Conditions – 1985  
 UXO-12/UXO-18 Archival Records Search Report  
 MCB Camp Lejeune  
 North Carolina



Source: MCB Camp Lejeune, 1985



- Legend**
- Surface Water Course Centerline
  - Road
  - UXO-12/UXO-18 Boundary

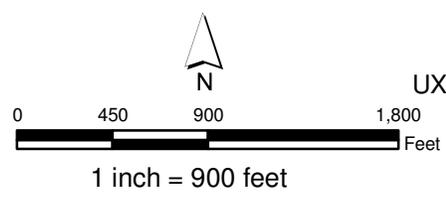
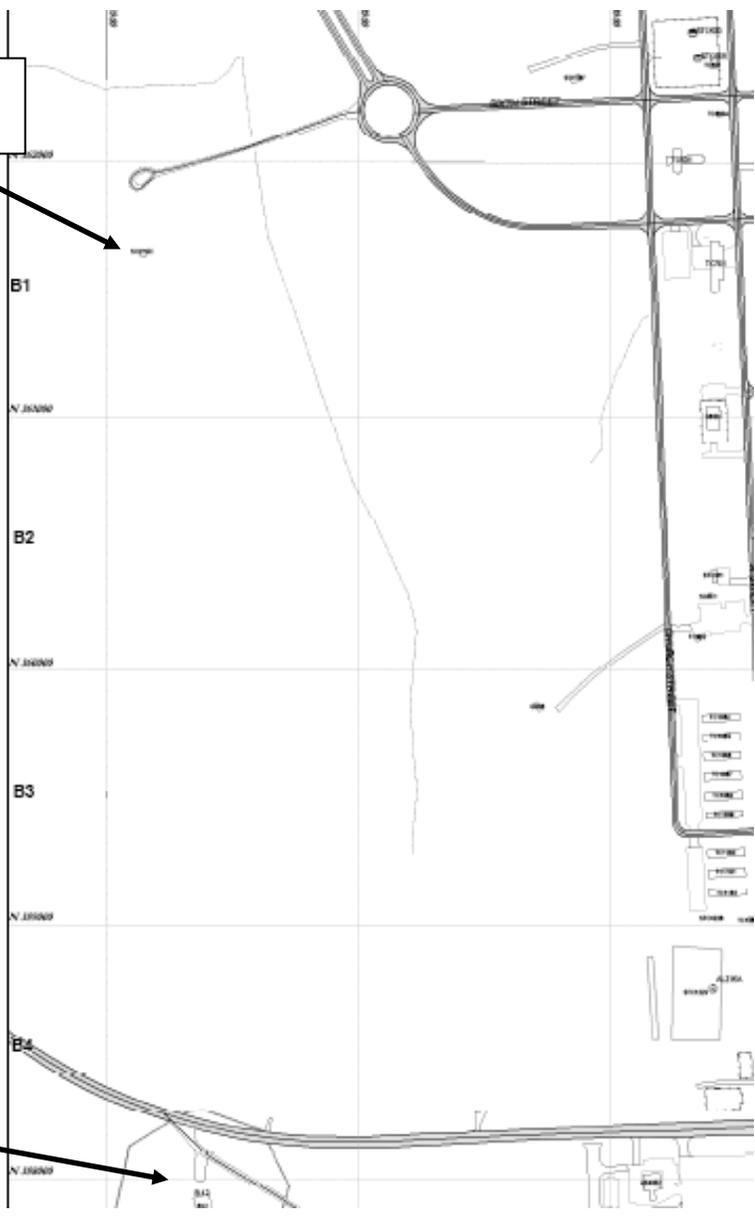


Figure 2-11  
Historical Aerial - 1989  
UXO-12/UXO-18 Archival Records Search Report  
MCB Camp Lejeune  
North Carolina



**Building S-OC-15-C,  
Classroom**



**B-12 Baffled  
Pistol Range**



Source: MCB Camp Lejeune, 2005



Approximate Scale in Feet



**Figure 2-12**  
UXO-12/UXO-18 Range Existing Conditions – 2005  
UXO-12/UXO-18 Archival Records Search Report  
MCB Camp Lejeune  
North Carolina



Miniature Anti-Tank Range (UXO-05)

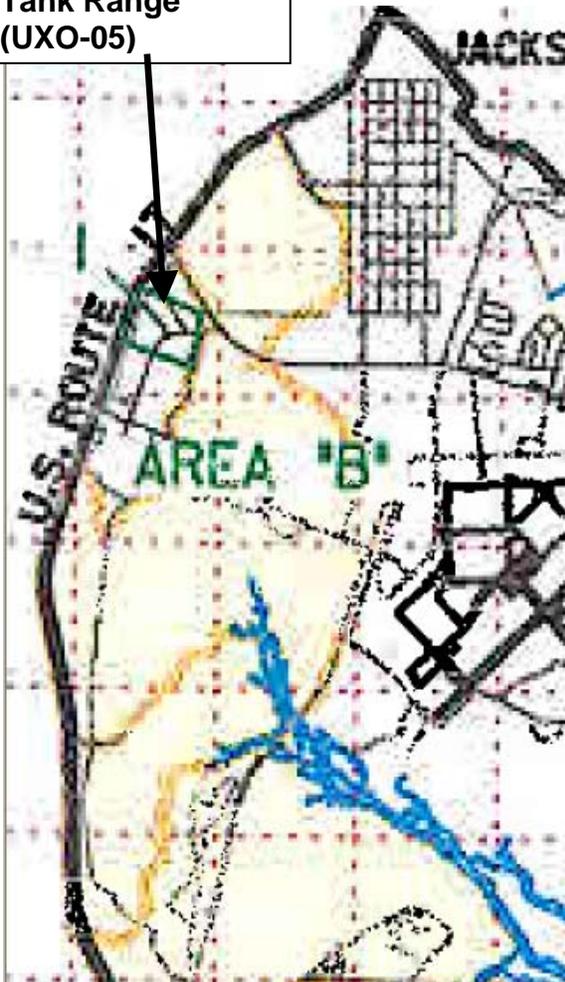


Plate 3 (1942)

1000 Inch Range (UXO-12)

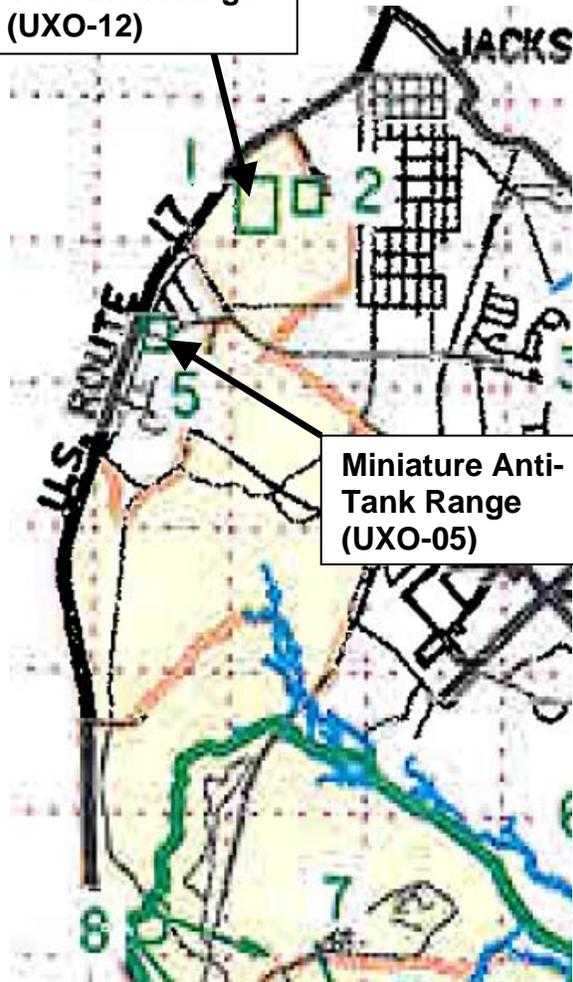
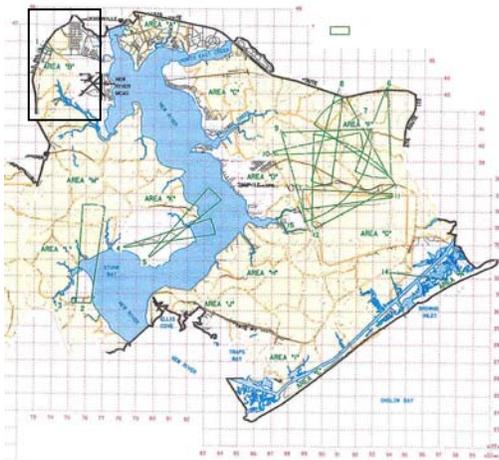


Plate 4 (1946)



0 1500 3000



Approximate scale in Meters



Source: USACE, 2000

Figure 2-13

UXO-12/UXO-18 (Plates 3, 4) Overlay Map – 1942-1946

UXO-12/UXO-18 Archival Records Search Report

MCB Camp Lejeune

North Carolina



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## SECTION 3

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CH2M HILL. 2009a. *Draft Preliminary Assessment/Site Inspection Report MMRP Site UXO-05, Former Miniature Anti-tank Range and Site UXO-01, Former B-3 Gas Chamber*. January.

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J. A. Jones Environmental Services Company. 1998. *Annual Report: Request for No Further Action Status, Delivery Order No. 036d, Building TC-1255, Marine Corps Base Camp Lejeune, North Carolina*. December.

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Richardson, Duane, Camp Lejeune Range Safety Officer. 2008. *Personal Communication*. August 19.

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**Attachment 1**  
**Resource Review Summary**

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# Resource Review Summary

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The following table provides a summary of the specific references identified for review, interview, or contact for the Archival Records Search Report for the Preliminary Assessment/Site Inspection of UXO-12/UXO-18.

<b>Resource</b>	<b>Actions Completed</b>
Quantico, Virginia, Marine Corps Library Gray Research Center	Reviewed and copied all relevant documents related to historical land use for each site on November 12, 2008.
US National Archives (NARA II) Historical Files	Reviewed and copied all relevant documents related to historical land use for each site on November 14, 2008.
<b>Camp Lejeune Personnel</b>	
Duane Richardson/ Base Range Safety Officer	Contacted and interviewed on October 1, 2008
Dennis Dunham/ Technical Records	Contacted and interviewed on October 2, 2008

## Marine Corp Library Review

### Text Division

Contact: Gregory Cina, Archivist  
USMC Archives & Special Collections  
2040 Broadway Street  
Quantico, Virginia 22134  
(703) 784-4685  
cinagl@usmcu.edu

Site Visit: November 12, 2008

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; however, maps showing the subject site were reviewed and copied.

- "New River, North Carolina", 1972. Published by the Defense Mapping Agency.
- "Approaches to New River", 1987, 8<sup>th</sup> Edition.
- "New River, North Carolina", 1972. Published by the Defense Mapping Agency.
- "Approaches to New River".

- “Jacksonville South Quadrangle”, 1952. Published by the United States Geological Survey.
- “Camp Lejeune, New River, North Carolina”, 1943.

## National Archives and Records Administration Review

### Text Division

Contact: Ms. Deborah Edge, Archivist  
8601 Adelphi Road  
College Park, Maryland 20740  
(301) 837-1687

Site visit on November 14, 2008

Reviewed 5 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, 2295-10 Brooklyn to 2285-10 Camp Lejeune, Box 1570.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2295-10 Camp Lejeune to 2285-10 Camp Lejeune, Box 1571.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2295-10 Camp Lejeune to 2285-10 Camp Lejeune, Box 1572.

The boxes contained information primarily related to basic activities and events occurring at Camp Lejeune. Several historic maps and documents were found referencing the Small Bore Range.

### List of Documents Obtained from National Archives

- “Camp Lejeune General Area Map”, February 10, 1942.
- “Camp Lejeune General Area Map”, February 10, 1942.
- “Camp Lejeune General Area Map”, March 11, 1947.
- “Camp Lejeune, New River, North Carolina”, 1943.
- “Index Sheet to Accompany Annual Report Maps, Camp Lejeune, North Carolina”, June 30, 1947.
- “Training Facilities, Regulations Governing Use of.” Document, December 9, 1946.
- “Training Facilities, Regulations Governing Use of.” Document, March 6, 1947.

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# MCB Camp Lejeune Base Site Visit and Records Review

Base Contact: Mr. Dennis Dunham  
Technical Records  
910-451-2818 x3259

Interviews were conducted with Bob Lowder/Environmental Manager, Anna Watts/Technical Records, Carl Baker/Technical Records, and Duane Richardson/EOD Base Range Safety Officer (910-451-1240) on October 1, 2008.

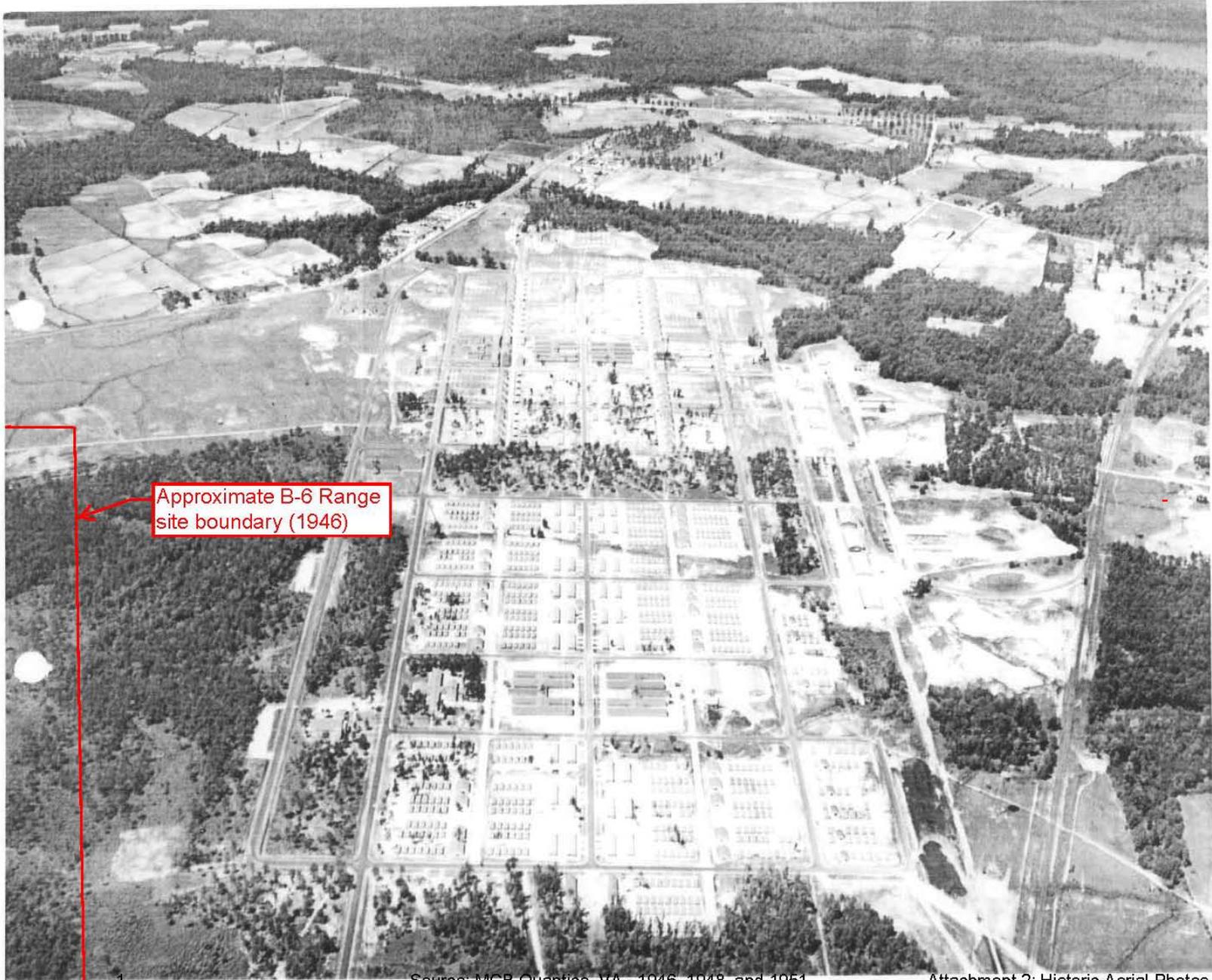
## List of Documents Obtained from Camp Lejeune

### Base Library

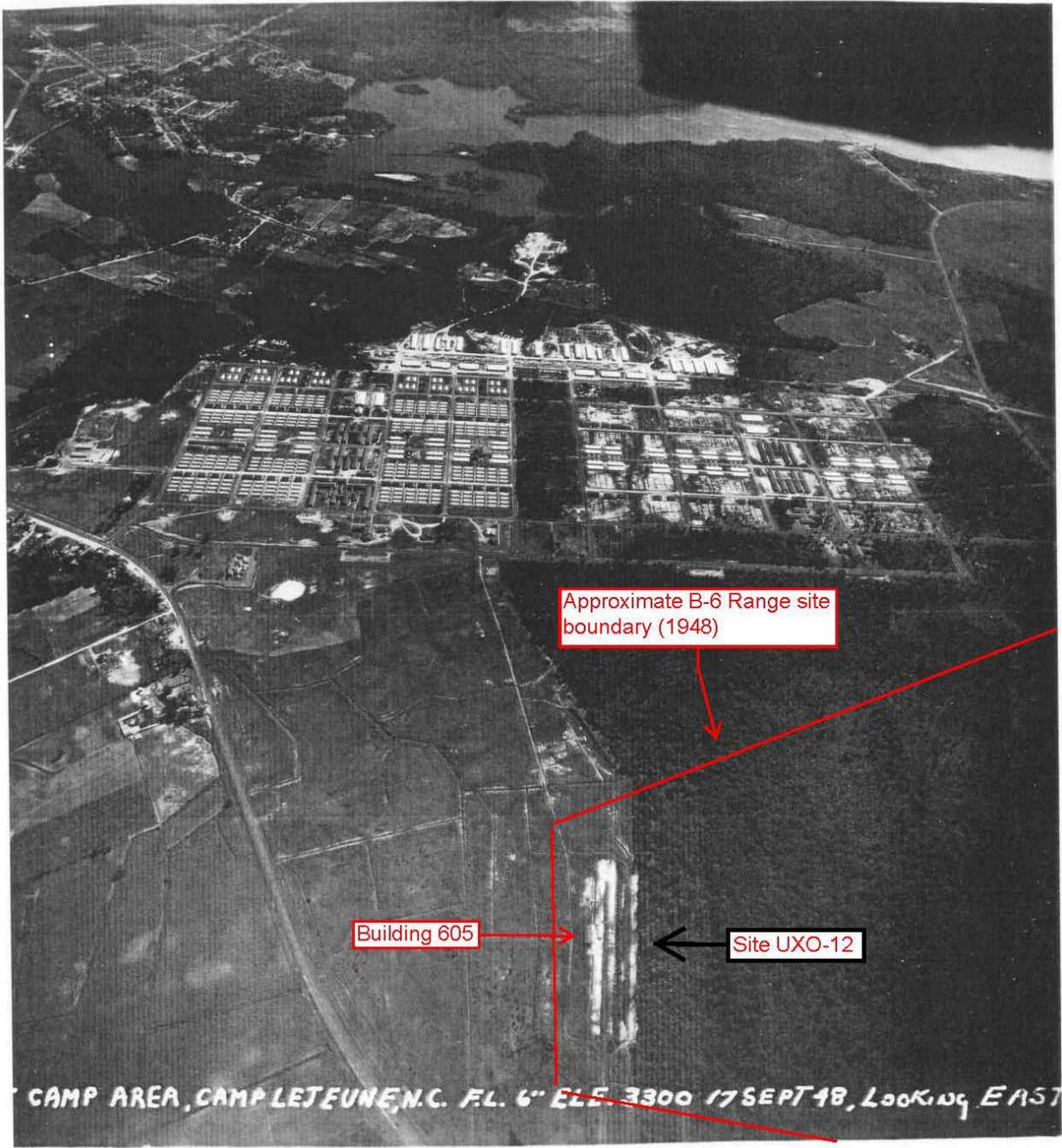
- Louis Berger Group, Inc. Under USCOE, Wilmington District Contract DACWS4-99-C-0004, *Semper Fidelis: A Brief History of Onslow County, North Carolina and MCB, Camp Lejeune, 2002, United States Marine Corps, Lt. Col Lynn J. Kimball (USMC, Retired) Consulting Historian.*
- Lotfield, Thomas, C. Principal 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.*

**Attachment 2**  
**Historical Aerial Photographs**

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TENT



**Appendix B**  
**Health and Safety Plan**

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# CH2M HILL HEALTH AND SAFETY PLAN

This Health and Safety Plan (HSP) 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 Enterprise-wide Core Standards (CS) and Standard Operating Procedures (SOPs), as appropriate. In addition, this plan adopts procedures in the project Work Plan. The Safety Coordinator (SC) is to be familiar with the CSs and SOPs and the contents of these instructions. CH2M HILL's personnel and subcontractors must be trained on this plan and sign Attachment 1.

## Project Information and Background

**PROJECT NO:** 380666

**CLIENT:** Department of the Navy, Naval Facilities Engineering Command, Atlantic Division  
Norfolk, Virginia

**PROJECT/SITE NAME:** Preliminary Assessment/Site Inspection UXO-12/UXO-18

**SITE ADDRESS:** The UXO-12/UXO-18 Range encompasses approximately 176 acres of land located in the northwest corner of MCB Camp Lejeune just south of Foster Boulevard, mostly north of Curtis Road, and west of Church Street.

**CH2M HILL PROJECT MANAGER:** Hope Oaks

**CH2M HILL OFFICE:** CLT

**DATE HEALTH AND SAFETY PLAN PREPARED:** December 17, 2008

**DATE(S) OF SITE WORK:** 2009

**SITE BACKGROUND AND SETTING:** Site UXO-18 was also known as the:

- B-6, 50-Foot Small Arms Range,
- B-6, 50-Foot, .22 Caliber Range
- B-6, 1000-Inch Range [machine gun (MG) and .22 Caliber]

One or all of these ranges were used from approximately 1950 to 1961. The USACE report documents 25 target stations using .22 caliber (rifle and pistol) and 10 target stations using .32, .38, and .45 caliber (pistol). There is no other available documentation or data concerning the historic usage of UXO-18.

Two other investigation areas overlap the UXO-18 investigation area. The UXO-12 New River 1,000-inch Range, ASR #2.5 (Site UXO-12) is located in the north-central portion of Site UXO-18. The northeastern corner of UXO-12 protrudes from the Site UXO-18 boundary. Site UXO-12 was used from approximately 1942 to 1945 (USACE, 2001). The Preliminary Range Assessment states that only small caliber ammunition (.30 caliber weapons firing) was used at this site (USACE, 2001).

The second overlapping investigation area is the UXO-05 Former Miniature Anti-tank Range (Site UXO-05) located in the southwest corner of the UXO-18 investigation area. A PA/SI report

for UXO-05 is currently being prepared (CH2M HILL, in progress). UXO-05, specified in Section 2.7a of the ASR, was used between 1942 and 1944. During this period of operation, .22 caliber small arms were used to fire at a moving target car located on a transverse track (USACE, 2001). This area was also used during WWII for blank fire and non-firing events (Lowder, 2005), and as a trailer park in the 1960s.

**TASKS CONDUCTED BY CH2MHILL:** The objective of this field investigation is to evaluate the presence and nature of environmental contamination that may have resulted from historical usage of small arms ammunition within the 176-acre investigation area of UXO-12/UXO-18. Given that the historical use of the UXO-12/UXO-18 investigation area was limited to small arms fire only, MEC avoidance procedures will not be practiced unless MEC is identified during the investigation. If MEC is identified during the investigation, work will cease until the MEC has been removed from the site, and a determination is made as to whether MEC avoidance support is needed. All field activities will be conducted in accordance with the Standard Operating Procedures (SOPs) provided in the MRP Master Project Plans.

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

- Vegetation clearance to facilitate access to sampling locations
- Buried utilities will be identified and avoided
- A maximum of 536 surface soil samples will be screened in the field using a portable XRF instrument
- Surface soil samples will be collected using the TR-02-1 sampling method from 134 locations. Additional samples may be collected based on the results of the XRF screening activities (not to exceed 536 samples, total).
- A total of 44 subsurface soil samples will be collected from DPT soil borings. Additional samples may be collected based on the results of the XRF screening activities (not to exceed 176 samples, total).
- Each DPT boring will be completed as a temporary groundwater monitoring well screened within the surficial aquifer. Groundwater samples will be collected from each well. Additional samples may be collected based on the results of the XRF screening activities (not to exceed 176 samples, total).
- Up to 10 co-located surface water and sediment samples will be collected from surface water bodies, if present.

## Site Map

**This page is reserved for a Site Map.**

**Note locations of Support, Decontamination, and Exclusion Zones; site telephone; first aid station; evacuation routes; and assembly areas.**

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## 1.0 Tasks to be Performed under this Plan

### 1.1 Description of Tasks

Refer to project documents (i.e., Work Plan) for detailed task information. A health and safety risk analysis (Table 1) 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 (Hazwoper).

#### 1.1.1 Hazwoper-Regulated Tasks

- Well installation
- Groundwater monitoring
- Direct-push technology (DPT)
- Surface water sampling
- Sediment sampling
- Surface soil sampling

#### 1.1.2 Non-Hazwoper-Regulated

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 Responsible Health and Safety Manager (RHSM) is required before these tasks are conducted on regulated hazardous waste sites.**

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TASKS	CONTROLS
<ul style="list-style-type: none"><li>• Surveying</li><li>• Underground Utility Locating</li></ul>	<ul style="list-style-type: none"><li>• Brief on hazards, limits of access, and emergency procedures</li><li>• Post contaminant areas as appropriate (refer to Section 8.2 for details)</li><li>• Sample and monitor as appropriate (refer to Section 5.0)</li></ul>

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<b>Table 1 Hazard Analysis</b> (Refer to Section 2.0 for Hazard Controls)					
<b>Potential Hazards</b>	<b>Project Activities</b>				
	<b>Drilling/Well Installation</b>	<b>Surveying</b>	<b>Utility Locating</b>	<b>Soil Sampling</b>	<b>Surface Water and Sediment Sampling</b>
Arsenic					
Benzene					
Cadmium					
Chemical Hazard-Dermal/Inhalation	X			X	X
Compressed Gas Cylinders					
Drilling	X				
Electrical Safety	X				
Energized Electrical Work					
Excavations					
Fall Protection					
Fire Prevention	X				
Hand & Power Tools	X	X		X	
Heavy Equipment	X			X	
Hoists					
Lead	X			X	X
Lockout /Tagout					
Manual Lifting	X	X	X	X	X
Methylene Chloride					
Noise	X				
Pressure Washing/Equip Decon	X				
Pressurized Lines/Equipment					
Slips, Trips and Falls	X	X	X	X	X
Utilities (underground/overhead)	X		X		
Vehicle Traffic	X		X		X
Vinyl Chloride					
Visible Lighting	X		X		
Welding and Cutting					
Work Alone	X	X	X	X	X
Work Over Water					X

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## 2.0 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 RHSM for clarification.

The health and safety hazards posed by field activities have been identified for each project activity and are provided in the Hazard Analysis Table (Table 1). Hazard control measures for project-specific and general H&S hazards are provided in 2.1 and 2.2 of this section.

In addition to the controls specified in this section, Project-Activity Self-Assessment Checklists are contained in Attachment 5. 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 RHSM. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records.

Applicable project activity self-assessment checklists (see Attachment 5) shall be completed weekly by a CH2M HILL representative during the course of the project depending on the work performed at the time.

### 2.1 Project-Specific Hazards

#### 2.1.1 Drilling Safety

- The drill rig is not to be operated in inclement weather.
- The driller is to verify that the rig is properly leveled and stabilized before raising the mast.
- Personnel should be cleared from the sides and rear of the rig before the mast is raised.
- The driller is not to drive the rig with the mast in the raised position.
- The driller must check for overhead power lines before raising the mast. A minimum distance of 15 feet between mast and overhead lines (<50 kV) is recommended. Increased separation may be required for lines greater than 50 kV.
- Personnel should stand clear before rig startup.
- The driller is to verify that the rig is in neutral when the operator is not at the controls.
- Become familiar with the hazards associated with the drilling method used (cable tool, air rotary, hollow-stem auger, etc.).
- Do not wear loose-fitting clothing, watches, etc., that could get caught in moving parts.
- Do not smoke or permit other spark-producing equipment around the drill rig.
- The drill rig must be equipped with a kill wire or switch, and personnel are to be informed of its location.

- Be aware and stand clear of heavy objects that are hoisted overhead.
- The driller is to verify that the rig is properly maintained in accordance with the drilling company's maintenance program.
- The driller is to verify that all machine guards are in place while the rig is in operation.
- The driller is responsible for housekeeping (maintaining a clean work area).
- The drill rig should be equipped with at least one fire extinguisher.
- If the drill rig comes into contact with electrical wires and becomes electrically energized, do not touch any part of the rig or any person in contact with the rig, and stay as far away as possible. Notify emergency personnel immediately

### **2.1.2 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.

### **2.1.3 Manual Lifting**

(Reference CH2M HILL SOP HSE-112, *Manual Lifting*)

- Back injuries are the leading cause of disabling work and most back injuries are the result of improper lifting techniques or overexertion. Office or field tasks and activities involving manual lifting are to be identified and a program implemented to assist employees to mitigate the risks associated with manual lifting.
- When possible, the task should be modified to minimize manual lifting hazards.
- Effectiveness of manual handling control measures will be evaluated during assessments (HSE-114, Office & Warehouse Safety Program, or HSE-109, Audits).
- Manual handling incidents are reviewed as part of the HSE Program reviews, and the results influence program development, training, and education efforts.
- Lifting of loads weighing more than 40 pounds (18 kilograms) should be evaluated by the SC using the Lifting Evaluation Form contained in SOP HSE-112.

- Using mechanical lifting devices is the preferred means of lifting heavy objects such as forklifts; cranes, hoists, and rigging; hand trucks; and trolleys.
- Personnel shall seek assistance when performing manual lifting tasks that appear beyond their physical capabilities.
- Physical differences make it difficult to set up safe lifting limits, unless extensive individual testing is performed. In general, the following steps must be practiced when planning and performing manual lifts: Assess the situation before you lift; ensure good lifting and body positioning practices; ensure good carrying and setting down practices.
- All employees must receive training for the correct procedures to lift safely using the computer-based health and safety training or project-specific training.

#### **2.1.4 Noise**

(Reference CH2M HILL SOP HSE-108, *Hearing Conservation*)

- A noise assessment shall be conducted by the RHSM or designee based on potential to emit noise above 85 dBA.
- Areas or equipment emitting noise at or above 90dBA shall be evaluated to determine feasible engineering controls. When engineering controls are not feasible, administrative controls can be developed and appropriate hearing protection will be provided.
- Areas or equipment emitting noise levels at or above 85 dBA, hearing protection must be worn.
- Employees exposed to 84 dBA or a noise dose of 50% must participate in the Hearing Conservation program including initial and annual (as required) audiograms.
- The RHSM will evaluate appropriate controls measures and work practices for employees who have experienced a standard threshold shift (STS) in their hearing.
- Hearing protection is selected based upon noise levels and specific tasks to be performed.
- Employees are trained in the hazards of noise and how to properly wear and maintain their hearing protection.
- Hearing protection will be maintained in a clean and reliable condition, inspected prior to use and after any occurrence to identify any deterioration or damage, and damaged or deteriorated hearing protection repaired or discarded.
- In work areas where actual or potential high noise levels are present at any time, hearing protection must be worn by employees working or walking through the area.
- Areas where tasks requiring hearing protection are taking place may become hearing protection required areas as long as that specific task is taking place.
- High noise areas requiring hearing protection should be posted or employees must be informed of the requirements in an equivalent manner.

## 2.1.5 Traffic Control

(Reference CH2M HILL SOP HSE-216, *Traffic Control*)

The following precautions must be taken when working around traffic, and in or near an area where traffic controls have been established by a contractor.

- Exercise caution when exiting traveled way or parking along street – avoid sudden stops, use flashers, etc.
- Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier.
- All staff working adjacent to traveled way or within work area must wear reflective/high-visibility safety vests.
- Eye protection should be worn to protect from flying debris.
- Remain aware of factors that influence traffic related hazards and required controls – sun glare, rain, wind, flash flooding, limited sight-distance, hills, curves, guardrails, width of shoulder (i.e., breakdown lane), etc.
- Always remain aware of an escape route -- behind an established barrier, parked vehicle, guardrail, etc.
- Always pay attention to moving traffic – never assume drivers are looking out for you
- Work as far from traveled way as possible to avoid creating confusion for drivers.
- When workers must face away from traffic, a “buddy system” should be used, where one worker is looking towards traffic.
- When working on highway projects, obtain a copy of the contractor’s traffic control plan.
- Work area should be protected by a physical barrier – such as a K-rail or Jersey barrier.
- Review traffic control devices to ensure that they are adequate to protect your work area. Traffic control devices should: 1) convey a clear meaning, 2) command respect of road users, and 3) give adequate time for proper traffic response. The adequacy of these devices are dependent on limited sight distance, proximity to ramps or intersections, restrictive width, duration of job, and traffic volume, speed, and proximity.
- Either a barrier or shadow vehicle should be positioned a considerable distance ahead of the work area. The vehicle should be equipped with a flashing arrow sign and truck-mounted crash cushion (TMCC). All vehicles within 40 feet of traffic should have an orange flashing hazard light atop the vehicle.
- Except on highways, flaggers should be used when 1) two-way traffic is reduced to using one common lane, 2) driver visibility is impaired or limited, 3) project vehicles enter or exit traffic in an unexpected manner, or 4) the use of a flagger enhances established traffic warning systems.

Lookouts should be used when physical barriers are not available or practical. The lookout continually watches approaching traffic for signs of erratic driver behavior and warns workers. Vehicles should be parked at least 40 feet away from the work zone and traffic. Minimize the amount of time that you will have your back to oncoming traffic.

### 2.1.6 Utilities (underground)

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).

### 2.1.7 Utilities (overhead)

#### Proximity to Power Lines

No work is to be conducted within 50 feet of overhead power lines without first contacting the utility company to determine the voltage of the system. No aspect of any piece of equipment is to be operated within 50 feet of overhead power lines without first making this determination.

**Operations adjacent to overhead power lines are PROHIBITED unless one of the following conditions is satisfied:**

- Power has been shut off, positive means (such as lockout) have been taken to prevent the lines from being energized, lines have been tested to confirm the outage, and the utility company has provided a signed certification of the outage.
- The minimum clearance from energized overhead lines is as shown in the table below, or the equipment will be repositioned and blocked to ensure that no part, including cables, can come within the minimum clearances shown in the table.

**MINIMUM DISTANCES FROM POWERLINES**

Powerlines Nominal System Kv	Minimum Required Distance, Feet
0-50	10
51-100	12
101-200	15
201-300	20
301-500	25
501-750	35
751-1000	45

*(These distances have been determined to eliminate the potential for arcing based on the line voltage.)*

- The power line(s) has been isolated through the use of insulating blankets which have been properly placed by the utility. If insulating blankets are used, the utility will determine the minimum safe operating distance; get this determination in writing with the utility representative's signature.
- All inquiries regarding electric utilities must be made in writing and a written confirmation of the outage/isolation must be received by the Project Manager/Construction Manager prior to the start of work.

## **2.2 General Hazards**

### **2.2.1 General Practices and Housekeeping**

- Site work should be performed during daylight hours whenever possible.
- 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.
- Review the safety requirements of each job you are assigned to with your supervisor. You are not expected to perform a job that may result in injury or illness to yourself or to others.
- Familiarize yourself with, understand, and follow jobsite emergency procedures.
- Do not fight or horseplay while conducting the firm's business.
- Do not use or possess firearms or other weapons while conducting the firm's business.
- Report unsafe conditions or unsafe acts to your supervisor immediately.
- Report occupational illnesses, injuries, and vehicle accidents.
- Do not remove or make ineffective safeguards or safety devices attached to any piece of equipment.
- Report unsafe equipment, defective or frayed electrical cords, and unguarded machinery to your supervisor.
- Shut don and lock out machinery and equipment before cleaning, adjustment, or repair. Do not lubricate or repair moving parts of machinery while the parts are in motion.

- Do not run in the workplace.
- When ascending or descending stairways, use the handrail and take one step at a time.
- Do not apply compressed air to any person or clothing.
- Do not wear steel taps or shoes with metal exposed to the sole at any CH2M HILL project location.
- Do not wear finger rings, loose clothing, wristwatches, and other loose accessories when within arm's reach of moving machinery.
- Remove waste and debris from the workplace and dispose of in accordance with federal, state, and local regulations.
- Note the correct way to lift heavy objects (secure footing, firm grip, straight back, lift with legs), and get help if needed. Use mechanical lifting devices whenever possible.
- Check toe work area to determine what problems or hazards may exist.

### **Personal Hygiene**

- Keep hands away from nose, mouth, and eyes.
- Keep areas of broken skin (chapped, burned, etc.) covered.
- Wash hands with hot water and soap frequently prior to eating and smoking.

### **Drugs and Alcohol**

The following situations pertaining to drugs and alcohol are prohibited:

- Use or possession of intoxicating beverages while performing CH2M HILL work
- Abuse of prescription or nonprescription drugs
- Regulations. Use or possession of illegal drugs or drugs obtained illegally
- Sale, purchase, or transfer of illegal or illegally obtained drugs
- Arrival at work under the influence of legal or illegal drugs or alcohol

### **2.2.2 Hazard Communication**

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

The Hazard Communication Coordinator 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.

### **2.2.3 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 RHSM or the Warehouse Coordinator for additional information.

### **2.2.4 Ultraviolet (UV) Radiation (sun exposure)**

Health effects regarding UV radiation are confined to the skin and eyes. Overexposure can result in many skin conditions, including erythema (redness or sunburn), photoallergy (skin rash), phototoxicity (extreme sunburn acquired during short exposures to UV radiation while on certain medications), premature skin aging, and numerous types of skin cancer.

Acute overexposure of UV radiation to the eyes may lead to photokeratitis (inflammation of the cornea), also known as snow blindness. Symptoms include redness of the eyes and a gritty feeling, which progresses to pain and an inability to tolerate any kind of light. This condition can also occur when working in or around water and other UV radiation reflectors. In addition, long-term exposure to sunlight is thought to cause cataracts or clouding of the lens of the eye.

#### **Limit Exposure Time**

- Rotate staff so the same personnel are not exposed all of the time.
- Limit exposure time when UV radiation is at peak levels (approximately 2 hours before and after the sun is at its highest point in the sky).
- Avoid exposure to the sun, or take extra precautions when the UV index rating is high.

#### **Provide Shade**

- Take lunch and breaks in shaded areas.
- Create shade or shelter through the use of umbrellas, tents, and canopies.
- Fabrics such as canvas, sailcloth, awning material and synthetic shade cloth create good UV radiation protection.
- Check the UV protection of the materials before buying them. Seek protection levels of 95 percent or greater, and check the protection levels for different colors.

#### **Clothing**

- Reduce UV radiation damage by wearing proper clothing; for example, long sleeved shirts with collars, and long pants. The fabric should be closely woven and should not let light through.

- Head protection should be worn to protect the face, ears, and neck. Wide-brimmed hats with a neck flap or “Foreign Legion” style caps offer added protection.
- Wear UV-protective sunglasses or safety glasses. These should fit closely to the face. Wrap-around style glasses provide the best protection.

### **Sunscreen**

- Apply sunscreen generously to all exposed skin surfaces at least 20 minutes before exposure, allowing time for it to adhere to the skin.
- Re-apply sunscreen at least every 2 hours, and more frequently when sweating or performing activities where sunscreen may be wiped off.
- Choose a sunscreen with a high sun protection factor (SPF). Most dermatologists advocate SPF 30 or higher for significant sun exposure.
- Waterproof sunscreens should be selected for use in or near water, and by those who perspire sufficiently to wash off non-waterproof products.
- Check for expiration dates, because most sunscreens are only good for about 3 years. Store in a cool place out of the sun.
- Remember—no sunscreen provides 100% protection against UV radiation. Other precautions must be taken to avoid overexposure.

### **2.2.5 Heat 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 report it to their supervisor immediately to avoid progression of heat-related illness.

<b>SYMPTOMS AND TREATMENT OF HEAT STRESS</b>					
	<b>Heat Syncope</b>	<b>Heat Rash</b>	<b>Heat Cramps</b>	<b>Heat Exhaustion</b>	<b>Heat Stroke</b>
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!

### 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.

### 2.2.6 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 report it immediately to their supervisor/PM 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 <b>not</b> hot—water. Have victim drink warm fluids, but <b>not</b> 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 <b>not</b> coffee or alcohol. Get medical attention.

## 2.3 Biological Hazards and Controls

### 2.3.1 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.

### 2.3.2 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.

### 2.3.3 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.

### Tick Analysis Procedure for Lyme disease

1. For tick removal, follow the instructions in your tick removal kit using a fine pointed pair of tweezers. If the tick is alive, place it in two layered zip-lock bags. It is highly recommended that you wear gloves when removing the tick from the skin to avoid infection.
2. It is important to remove the entire tick and place it in a zip lock bag.
3. Place the zip-lock bag in an envelope and fill out the sample submission form from the Clongen website. Please identify yourself as a CH2M HILL employee by completing all the contact information in the form. The cost of the analysis will be paid for; you do not have to use a credit card or check. The account will be assigned a blanket PO and billed directly to Health Resources for payment.
4. In 1 – 3 days, you will be contacted to discuss the results of your tick testing and any necessary treatment. In the mean time, should your current condition change in any way, please contact the Health Resources Nurse Case Manager who assisted you

### 2.3.4 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 your supervisor 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.

### 2.3.5 Bloodborne Pathogens

(Reference CH2M HILL SOP HSE-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 (PIM).

- Employees trained in first-aid/CPR or those exposed to PIM must complete CH2M HILL's 1-hour bloodborne computer-based training module annually.
- Hepatitis B vaccine (HBV) is offered to employees who may be exposed to PIM when they complete training and within 10 working days of assignment. (Note: Employees whose exposure stems only from rendering first aid as a collateral duty receives the vaccine after exposure.)
- Employees who decline the HBV vaccine must sign the declination form (contact regional Safety Program Assistant [SPA]) indicating they declined the vaccination. Anyone who declines the vaccination and chooses to receive the vaccination at a later time may still receive the vaccination by contacting the SPA.
- Hepatitis B and tetanus vaccinations can be requested by completing the medical portion of the enrollment form, located under Tools & Forms at the HS&E web page, or by contacting the regional SPA.

### Post Exposure

CH2M HILL will provide exposed employees with a confidential medical examination should an exposure to PIM occur. This examination includes the following procedures:

- Documenting the exposure
- Testing the exposed employee's and the source individual's blood (with consent)

- Administering post-exposure prophylaxis

### **2.3.6 Mosquito Bites**

Due to the recent detection of the West Nile Virus in the Southwestern United States it is recommended that **preventative measures** be taken to reduce the probability of being bitten by mosquitoes whenever possible. Mosquito's 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.

Contact the project RHSM with questions, and immediately report any suspicious symptoms to your supervisor/PM.

## **2.4 MEC**

**MEC Avoidance Procedures.** MEC avoidance operations will not be required during sampling operations as only small arms ammunition were used at this site. If suspected MEC is encountered, work in the area will cease. Personnel should note the location of the suspect item and will notify the CH2M HILL project manager and the Munitions Response health and safety manager. Following internal notifications, the Base Explosive Ordnance Disposal (EOD) should be contacted via the Range Control office.

<b>2.5 Contaminants of Concern</b>					
<b>Contaminant</b>	<b>Location and Maximum<sup>a</sup> Concentration (ppm)</b>	<b>Exposure Limit<sup>b</sup></b>	<b>IDLH<sup>c</sup></b>	<b>Symptoms and Effects of Exposure</b>	<b>PIP<sup>d</sup> (eV)</b>
Lead	GW: SB: SS:	0.050 mg/m <sup>3</sup>	100 mg/m <sup>3</sup>	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypotension	NA
Footnotes:					
<sup>a</sup> 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). <sup>b</sup> Appropriate value of PEL, REL, or TLV listed. <sup>c</sup> 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. <sup>d</sup> PIP = photoionization potential; NA = Not applicable; UK = Unknown.					
<b>Potential Routes of Exposure</b>					
<b>Dermal:</b> Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 4.		<b>Inhalation:</b> Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 4 and 5, respectively.		<b>Other:</b> Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).	

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### 3.0 Project Organization and Personnel

#### 3.1 CH2M HILL Employee Medical Surveillance and Training

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

The employees listed 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” have completed a 12-hour site safety coordinator course, and have documented requisite field experience. An SC 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 one FA-CPR designated employee 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.

Pregnant employees are to be informed of and are to follow the procedures in CH2M HILL- SOP HSE-120, *Reproductive Health*, including obtaining a physician’s statement of the employee’s ability to perform hazardous activities before being assigned fieldwork.

Employee Name	Office	Responsibility	SSC/FA-CPR
TBD			Level ___ SSC; FA-CPR
TBD			
TBD			
TBD			

#### 3.2 Field Team Chain of Command and Communication Procedures

##### 3.2.1 Client

**Contact Name:** Bryan Beck, NAVFAC Mid-Atlantic

**Phone:** (757) 322-4734

**Facility Contact Name:** Bob Lowder, Base Environmental Management Division

**Phone:** (910) 451-9607

##### 3.2.2 CH2M HILL

**Program Manager:** Doug Dronfield

**Project Manager (PM):** Hope Oaks

**Responsible Health and Safety Manager (RHSM):** Michael Goldman/ATL

**Corporate MR Safety & QC Officer:** Dan Young

**Field Team Leader:** TBD

**Safety Coordinator (SC):** TBD

The PM is responsible for providing adequate resources (budget and staff) for project-specific implementation of the HS&E management process. The PM has overall management

responsibility for the tasks listed below. The PM may explicitly delegate specific tasks to other staff, as described in sections that follow, but retains ultimate responsibility for completion of the following in accordance with this SOP:

- Include standard terms and conditions, and contract-specific HS&E roles and responsibilities in contract and subcontract agreements (including flow-down requirements to lower-tier subcontractors)
- Select safe and competent subcontractors by:
  - obtaining, reviewing and accepting or rejecting subcontractor pre-qualification questionnaires
  - ensuring that acceptable certificates of insurance, including CH2M HILL as named additional insured, are secured as a condition of subcontract award
  - including HS&E submittals checklist in subcontract agreements, and ensuring that appropriate site-specific safety procedures, training and medical monitoring records are reviewed and accepted prior to the start of subcontractor's field operations
- Maintain copies of subcontracts and subcontractor certificates of insurance (including CH2M HILL as named additional insured), bond, contractors license, training and medical monitoring records, and site-specific safety procedures in the project file accessible to site personnel
- Provide oversight of subcontractor HS&E practices per the site-specific safety plan
- Manage the site and interfacing with 3<sup>rd</sup> parties in a manner consistent with our contract and subcontract agreements and the applicable standard of reasonable care
- Ensure that the overall, job-specific, HS&E goals are fully and continuously implemented

**The CH2M HILL RHSM is responsible for:**

- Review and accept or reject subcontractor pre-qualification questionnaires that fall outside the performance range delegated to the Contracts Administrator (KA)
- Review and accept or reject subcontractor training records and site-specific safety procedures prior to start of subcontractor's field operations
- Support the oversight of subcontractor (and lower-tier subcontractors) HS&E practices and interfaces with on-site 3<sup>rd</sup> parties per the site-specific safety plan

**The SC is responsible for verifying that the project is conducted in a safe manner including the following specific obligations:**

- Verify this HSP is current and amended when project activities or conditions change.
- Verify CH2M HILL site personnel and subcontractor personnel read the HSP and sign Attachment 1, Employee Sign-Off Form prior to commencing field activities.
- Verify CH2M HILL site personnel and subcontractor personnel have completed any required specialty training (e.g., fall protection, confined space entry) and medical surveillance as identified in Section 2.
- Verify compliance with the requirements of this HSP and applicable subcontractor health and safety plan(s)
- Act as the project "Hazard Communication Coordinator" and perform the responsibilities outlined in Section 2.2.2

- Act as the project “Emergency Response Coordinator” and perform the responsibilities outlined in Section 9.
- Post OSHA job-site poster; the poster is required at sites where project field offices, trailers, or equipment-storage boxes are established.
- Verify that safety meetings are conducted and documented in the project file initially and as needed throughout the course of the project (e.g., as tasks or hazards change)
- Verify that project H&S forms and permits, found in Attachment 5 and 6, are being used as outlined in Section 2.
- Perform oversight and/or assessments of subcontractor HS&E practices per the site-specific safety plan and verify that project activity self-assessment checklists, found in Attachment 6, are being used as outlined in Section 2
- Verify that project files available to site personnel include copies of executed subcontracts and subcontractor certificates of insurance (including CH2M HILL as named additional insured), bond, contractors license, training and medical monitoring records, and site-specific safety procedures prior to start of subcontractor’s field operations
- Manage the site and interfacing with 3<sup>rd</sup> parties in a manner consistent with our contract/subcontract agreements and the applicable standard of reasonable care
- Coordinate with the RHSM regarding CH2M HILL and subcontractor operational performance, and 3<sup>rd</sup> party interfaces
- Ensure that the overall, job-specific, HS&E goals are fully and continuously implemented

The training required for the SC is as follows:

- SC-Initial and SC-Construction
- OSHA 10-hour course for Construction
- First Aid and CPR
- Relevant Competent Person Courses (excavation, confined space, scaffold, fall protection, etc.)

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

### **3.2.3 CH2M HILL Subcontractors**

(Reference CH2M HILL SOP HSE-215, *Contracts and Subcontracts*)

Subcontractor: TBD

Subcontractor Contact Name:

Telephone:

The subcontractors listed above are required to submit their own Accident Prevention Plan, specific to this project. Other plans, such as Lead or Asbestos Abatement Compliance plans, may be required as well. Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit their plans to CH2M HILL for review before the start of field work.

Subcontractors are also required to prepare an Activity Hazard Analysis (AHA) before beginning each activity posing H&S hazards to their personnel using the AHA form provided in Attachment 6 as a guide. The AHA shall identify the principle steps of the activity, potential H&S hazards for each step and recommended control measures for each identified hazard. In addition, a listing of the equipment to be used to perform the activity, inspection requirements and training requirements for the safe operation of the equipment listed must be identified.

CH2M HILL should continuously endeavor to observe subcontractors' safety performance and adherence to their Accident Prevention Plan and AHAs. 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. Self-assessment checklists contained in Attachment 5 are to be used by CH2M HILL personnel to review subcontractor performance. CH2M HILL oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

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 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 PM and RHSM as appropriate.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

### **3.2.4 Drug-Free Work Place Program**

Subcontractor has certified to CH2M HILL that it implements a drug policy which meets CH2M HILL's minimum standards for a drug-free workplace, which standards are incorporated into the Subcontract by this reference ("Standards"). CH2M HILL may require the Subcontractor to conduct reasonable searches of Subcontractor's employees' (personal property brought onto project locations) and employees of its lower tier subcontractors and suppliers and may require and receive the results of a 5-panel drug screen and blood alcohol tests for any employee of Subcontractor or its lower tier subcontractors. Any employee of Subcontractor, its lower tier subcontractors or suppliers found to possess or be under the influence of an article prohibited by the Standards, or refusing to test or to consent to a reasonable search by CH2M HILL may, in CH2M HILL's sole discretion, be immediately removed from the Project site and denied future access. Subcontractor agrees to enforce its drug policy and to bind its lower tier subcontractors to its policy and to the provisions of this paragraph. Any violation of the requirements of this paragraph may be grounds for withholding payment to Subcontractor or for termination for default pursuant to Article 10. Nothing in this paragraph shall require CH2M HILL to undertake testing or searches.

## 4.0 Personal Protective Equipment (PPE)

(Reference CH2M HILL- SOP HSE-117, *Personal Protective Equipment*)

- PPE must be worn by employees when actual or potential hazards exist and engineering controls or administrative practices cannot adequately control those hazards.
- A PPE assessment has been conducted by the RHSM based on project tasks (see PPE specifications below). Verification and certification of assigned PPE by task is completed by the RHSM or designee.
- Employees must be trained to properly wear and maintain the PPE.
- In work areas where actual or potential hazards are present at any time, PPE must be worn by employees working or walking through the area.
- Areas requiring PPE should be posted or employees must be informed of the requirements in an equivalent manner.
- PPE must be inspected prior to use and after any occurrence to identify any deterioration or damage.
- PPE must be maintained in a clean and reliable condition.
- Damaged PPE shall not be used and must either be repaired or discarded.
- PPE shall not be modified, tampered with, or repaired beyond routine maintenance.

Note that PPE is required when exposed to the general hazards listed below. Because certain tasks (e.g., welding, energized work, etc.) require specialized PPE, refer to [Section 2](#) for task-specific PPE requirements.

### PPE Specifications <sup>a</sup>

Task	Level	Body	Head	Respirator <sup>b</sup>
General site entry Surveying Utility Locating	D	Work clothes; safety toed leather work boots and gloves	Hardhat <sup>c</sup> Safety glasses with side shields Ear protection <sup>d</sup>	None required
Surface soil sampling Geoprobe boring	Modified D	Work clothes or cotton coveralls <b>Boots:</b> Safety-toe, chemical-resistant boots OR Safety -toe, leather work boots with outer rubber boot covers <b>Gloves:</b> Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat <sup>c</sup> Safety glasses with side shields Ear protection <sup>d</sup>	None required
Groundwater, surface water and sediment sampling	Modified D	<b>Coveralls:</b> Uncoated Tyvek® <b>Boots:</b> Safety -toe, chemical-resistant boots OR Safety -toe, leather work boots with outer rubber boot covers <b>Gloves:</b> Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat <sup>c</sup> Splash shield <sup>c</sup> Safety glasses with side shields Ear protection <sup>d</sup>	None required.
Tasks requiring upgrade	C	<b>Coveralls:</b> Polycoated Tyvek® <b>Boots:</b> Safety -toe, chemical-resistant boots OR Safety -toe, leather work boots with outer rubber boot covers <b>Gloves:</b> Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat <sup>c</sup> Splash shield <sup>c</sup> Ear protection <sup>d</sup> Spectacle inserts	APR, full face, MSA Ultratwin or equivalent; with GME-H cartridges or equivalent <sup>e</sup> .

## Reasons for Upgrading or Downgrading Level of Protection

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

<sup>a</sup> Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.

<sup>b</sup> No facial hair that would interfere with respirator fit is permitted.

<sup>c</sup> Hardhat and splash-shield areas are to be determined by the SSC.

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

<sup>e</sup> 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.

<sup>f</sup> 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 SSC qualified at that level is present.

### 4.1 Respiratory Protection

(Reference CH2M HILL SOP HSE-121, *Respiratory Protection*)

- Respirator users must have completed appropriate respirator training within the past 12 months. Level C training is required for air-purifying respirators (APR) use.
- Respirator users must complete the respirator medical monitoring protocol and been approved for the specific type of respirator to be used.
- Tight-fitting facepiece respirator (negative or positive pressure) users must have passed an appropriate fit test within past 12 months.
- Respirator use shall be limited to those activities identified in this plan. If site conditions change that alters the effectiveness of the specified respiratory protection, the RHSM shall be notified to amend the written plan.
- Tight-fitting facepiece respirator users shall be clean-shaven and shall perform a user seal check before each use.
- Canisters/cartridges shall be replaced according to the change-out schedule specified in this plan. Respirator users shall notify the SC or RHSM of any detection of vapor or gas breakthrough. The SC shall report any breakthrough events to the RHSM for schedule upgrade.
- Respirators in regular use shall be inspected before each use and during cleaning
- Respirators in regular use shall be cleaned and disinfected as often as necessary to ensure they are maintained in a clean and sanitary condition.
- Respirators shall be properly stored to protect against contamination and deformation.
- Field repair of respirators shall be limited to routine maintenance. Defective respirators shall be removed from service.
- The SC or designee shall complete the H&S Self-Assessment Checklist – Respiratory Protection included in Attachment 5 of this plan to verify compliance with CH2M HILL's respiratory protection program.

## 5.0 Air Monitoring/Sampling

(Reference CH2M HILL SOP HSE-207, Exposure Monitoring for Airborne Chemical Hazards)

### 5.1 Air Monitoring Specifications

Instrument	Tasks	Action Levels <sup>a</sup>	Action to be Taken when Action Level reached	Frequency <sup>b</sup>	Calibration
FID: OVA model 128 or equivalent	Well installation	< 1 ppm 1 to 10 ppm	Level D Level C	Initially and periodically during task	Daily
	Ground water and soil sampling	> 10 ppm	Evacuate work area and contact HSM		
Visual Monitoring for dust	Well installation	< 5 mg/m <sup>3</sup> or visible dust	Level D	Continuous during advancement of boring	Daily
	Ground water and soil sampling	>5 mg/m <sup>3</sup> or visible dust	Evacuate work area and contact HSM		

<sup>a</sup> Action levels apply to sustained breathing-zone measurements above background.

<sup>b</sup> The exact frequency of monitoring depends on field conditions and is to be determined by the SSC; 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.).

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

<sup>d</sup> Refer to SOP HS-10 for instructions and documentation on radiation monitoring and screening.

<sup>e</sup> 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
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

### 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

Additional air sampling is not anticipated.

#### Personnel and Areas

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

HSM: Michael Goldman

Other: Rich Rathnow

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## 6.0 Decontamination

(Reference CH2M HILL SOP HSE-218, *Hazardous Waste Operations*)

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

### 6.1 Decontamination Specifications

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

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### 6.2 Diagram of Personnel-Decontamination Line

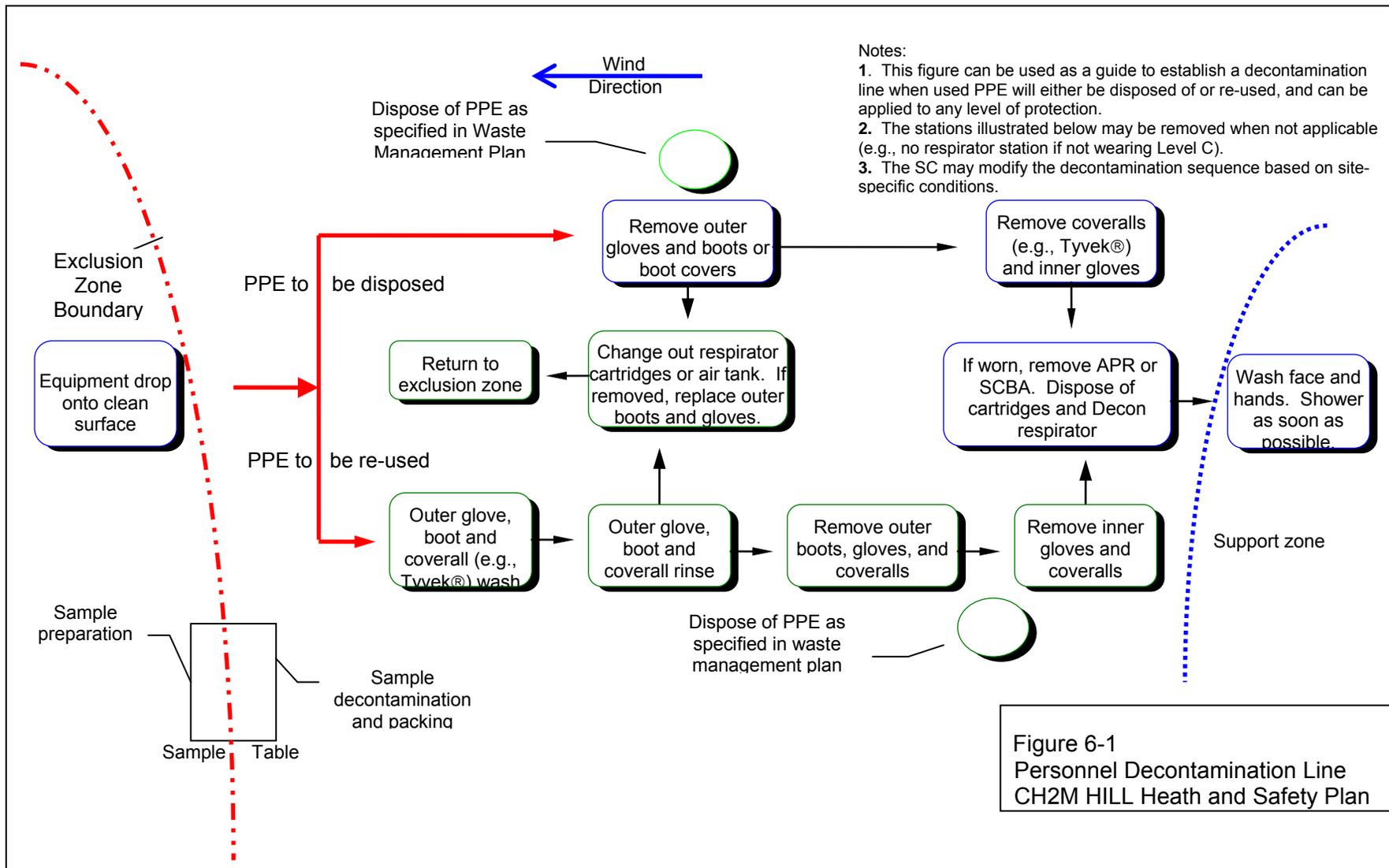
No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SC should establish areas for eating, drinking, and smoking. Contact lenses are not permitted in exclusion or decontamination zones.

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

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## **7.0 Spill Containment Procedures**

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



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## 8.0 Site-Control Plan

### 8.1 Site-Control Procedures

(Reference CH2M HILL SOP HSE-218, *Hazardous Waste Operations*)

- The SSC 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 SSC 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, *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 SC in appropriate level of protection.
- The SC 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 Hazwoper Compliance Plan

(Reference CH2M HILL SOP HSE-220, *Written Plans and HSE-218 Hazardous Waste Operations*)

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 is working in proximity to Hazwoper activities. Other data (e.g., soil) also must document that there is no potential for exposure. The RHSM must approve the interpretation of these data. Refer to Sections 2.0 and 5.0 for contaminant data and air sampling requirements, respectively.

- When non-Hazwoper-trained personnel are at risk of exposure, the SC 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.

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## 9.0 Emergency Response Plan

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

### 9.1 Pre-Emergency Planning

- The Emergency Response Coordinator (ERC) 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. Drills should take place periodically but no less than once a year.
- Brief new workers on the emergency response plan.
- The ERC will evaluate emergency response actions and initiate appropriate follow-up actions.

### 9.2 Emergency Equipment and Supplies

The ERC should mark the locations of emergency equipment on the site map and post the map.

<b>Emergency Equipment and Supplies</b>	<b>Location</b>
20 (or two 10) class A,B,C fire extinguisher	
First aid kit	
Eye Wash	
Emergency Shower	
Potable water	
Bloodborne-pathogen kit	
Additional equipment (specify):	

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### 9.3 Incident Response

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

- Notify appropriate response personnel.
- Shut down CH2M HILL operations and evacuate the immediate work area.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.
- Implement HSE-111, Incident Notification, Reporting and Investigation.
- Notify and submit reports to clients as required in contract.

Small fires or spills posing minimal safety or health hazards may be controlled with onsite spill kits or fire extinguishers without evacuating the site. When in doubt evacuate. Follow the incident reporting procedures in Section 5.7.

### 9.4 Emergency Medical Treatment

Emergency medical treatment is needed when there is a life-threatening injury (such as severe bleeding, loss of consciousness, breathing/heart has stopped). When in doubt if an injury is life-threatening or not, treat it as needing emergency medical treatment.

- Notify 911 or other appropriate emergency response authorities as listed in Attachment 4.
- The ERC 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, perform decontamination (if applicable) where feasible; lifesaving and first aid or medical treatment takes priority.
- Initiate first aid and CPR where feasible.
- Notify supervisor and if the injured person is a CH2M HILL employee. The supervisor will call the occupational nurse at 1-800-756-1130 and make other notifications as required by HSE SOP-111, *Incident Notification, Reporting and Investigation*.
- Make certain that the injured person is accompanied to the emergency room.
- Follow the Serious Incident Reporting process in HSE SOP-111, Incident Notification, Reporting and Investigation, and complete incident report forms in Attachment 6.
- Notify and submit reports to client as required in contract

### 9.5 Evacuation

- Evacuation routes, assembly areas, and severe weather shelters (and alternative routes and assembly areas) are to be specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the ERC or designee before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The ERC 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 ERC will account for all personnel in the onsite assembly area.

- A designated person will account for personnel at alternate assembly area(s).
- The ERC will follow the incident reporting procedures in Section 5.7.

## 9.6 Evacuation Signals

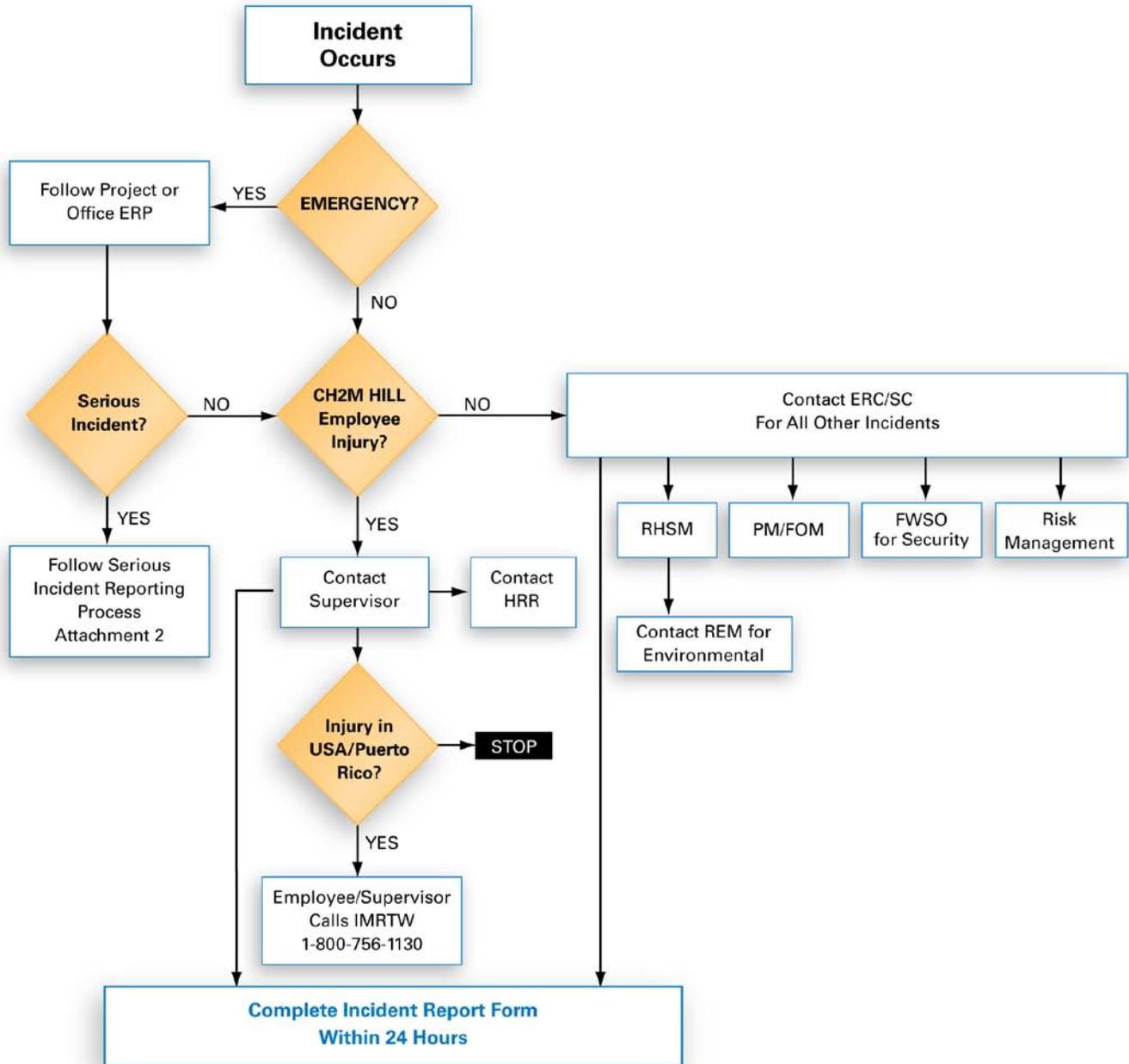
Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

## 9.7 Incident Notification and Reporting

(Reference CH2M HILL SOP HSE-111, Incident Notification, Reporting and Investigation)

- If you are injured at work, notify your supervisor immediately and contact the Injury Management/Return-to-Work toll free number (for US and Puerto Rico) 1-800-756-1130. All supervisors must contact their Human Resources Representative and complete the employee injury/illness in the Incident Report Form (IRF) in the HITS database within 24 hours of the incident
- Immediately notify the Project Manager (PM), Emergency Response Coordinator (ERC), and/or Responsible Health and Safety Manager (RHSM) for any project incident (fire, spill/release, injury/illness, near miss, property damage, or security-related)
- Report any **serious incidents** (life-threatening injury/illness, death, kidnap/missing person, terrorism, property damage greater than \$500K, significant environmental release) **immediately** to your ERC, PM, or RHSM. The Serious Incident Reporting number is 720-286-4911.
- For serious incidents, the Corporate Legal Department will determine who completes the IRF.
- For CH2M HILL subcontractor incidents, immediately notify the ERC and HSM to complete and submit an IRF.
- The RHSM will inform the Responsible Environmental Manager (REM) of any environmental incidents.
- Evaluation and follow-up of the IRF will be completed by the type of incident by the RHSM, REM, or FWSO. The Business Group (BG) HSE Lead will review all BG incidents and modify as required.
- Incident Investigations must be initiated and completed as soon as possible but no later than 72 hours after the incident.
- See the following flowcharts for Immediate Incident Reporting and Serious Incident Reporting.

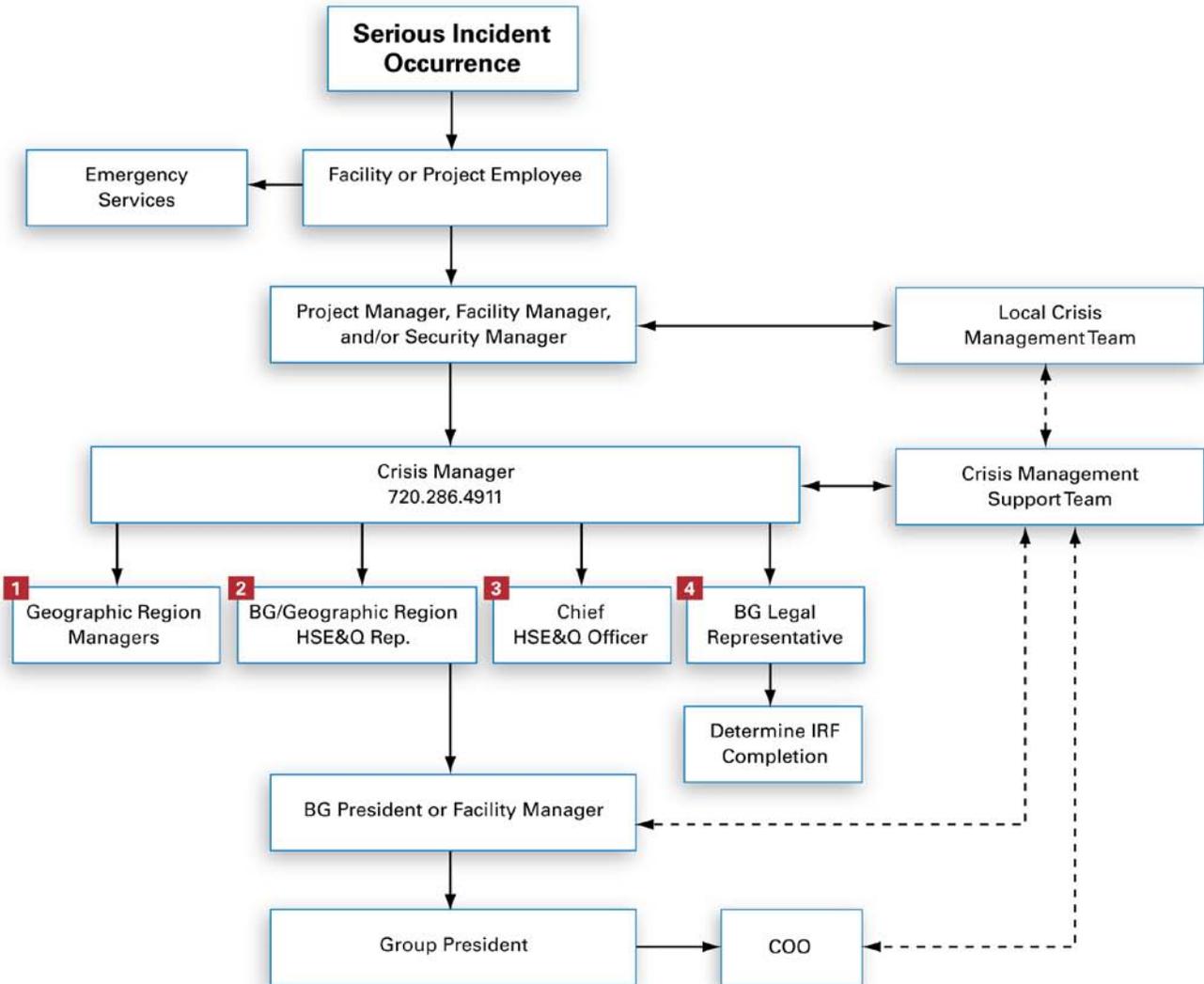
## Attachment 1 CH2M HILL Immediate Incident Notification



ERC = Emergency Response Coordinator  
(designated in Emergency Response Plan)  
ERP = Emergency Response Plan  
FOM = Facility Office Manager  
FWSO = Firm Wide Security Operations  
HRR = Human Resources Representative

IMRTW = Injury Management/Return-to-Work  
PM = Project Manager  
REM = Responsible Environmental Manager  
RHSM = Responsible Health & Safety Manager  
SC = Safety Coordinator

## Attachment 2 CH2M HILL Serious Incident Notification



**LEGEND:**

- Direct line of communication
- ← - - - → Indirect line of communication

**DEFINITIONS:**

**Local Crisis Management Team:** Team comprised of key facility, project and/or business group personnel. Team is assembled as necessary and as appropriate to effectively manage and respond to a crisis situation (serious incident) at/on scene.

**Crisis Management Support Team:** Team comprised of key corporate personnel. Team is assembled as necessary and as appropriate to effectively support, direct, and /or supplement a Local Crisis Management Team.

**Crisis Manager:** Corporate based Crisis Manager, contactable by pager 24/7.

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## 10.0 Behavior Based Loss Prevention System

A Behavior Based Loss Prevention System (BBLPS) is a system to prevent or reduce losses using behavior-based tools and proven management techniques to focus on behaviors or acts that could lead to losses.

The four basic Loss Prevention tools that will be used CH2M HILL projects to implement the BBLPS include:

- Activity Hazard Analysis (AHA)
- Pre-Task Safety Plans (PTSP)
- Loss Prevention Observations (LPO)
- Loss and Near Loss Investigations (NLI)

The SC or designated CH2M HILL representative onsite is responsible for implementing the BBLPS on the project site. The Project Manager remains accountable for its implementation. The SC or designee shall only oversee the subcontractor's implementation of their AHAs and PTSPs processes on the project.

### 10.1 Activity Hazard Analysis

An Activity Hazard Analysis (AHA) defines the activity being performed, the hazards posed and control measures required to perform the work safely. Workers are briefed on the AHA before doing the work and their input is solicited prior, during and after the performance of work to further identify the hazards posed and control measures required.

Activity Hazard Analysis will be prepared before beginning each project activity posing H&S hazards to project personnel using the AHA form provided in Attachment 6. The AHA shall identify the work tasks required to perform each activity, along with potential H&S hazards and recommended control measures for each work task. In addition, a listing of the equipment to be used to perform the activity, inspection requirements and training requirements for the safe operation of the equipment listed must be identified.

An AHA shall be prepared for all field activities performed by CH2M HILL and subcontractor activities during the course of the project. Hazard Controls (found in Sections 2.0 and its subsections of the HSP), the Hazard Analysis Table (Table 1), and applicable CH2M HILL CSs and SOPs should be used as a basis for preparing AHAs.

CH2M HILL subcontractors are required to provide AHAs specific to their scope of work on the project for acceptance by CH2M HILL. Each subcontractor shall submit AHAs for their field activities, as defined in their work plan/scope of work, along with their project-specific safety plan/accident prevention plan. Additions or changes in CH2M HILL or subcontractor field activities, equipment, tools or material to perform work or additional/different hazard encountered that require additional/different hazard control measures requires either a new AHA to be prepared or an existing AHA to be revised.

### 10.2 Pre-Task Safety Plans

Daily safety meetings are held with all project personnel in attendance to review the hazards posed and required H&S procedures/AHAs, that apply for each day's project activities. The PTSPs serve the same purpose as these general assembly safety meetings, but the PTSPs are held between the crew supervisor and their work crews to focus on those hazards posed to individual work crews. At the start of each day's activities, the crew supervisor completes the PTSP, provided in Attachment 6, with input from the work crew, during their daily safety

meeting. The day's tasks, personnel, tools and equipment that will be used to perform these tasks are listed, along with the hazards posed and required H&S procedures, as identified in the AHA. The use of PTSPs, better promotes worker participation in the hazard recognition and control process, while reinforcing the task-specific hazard and required H&S procedures with the crew each day. The use of PTSPs is a common safety practice in the construction industry.

### **10.3 Loss Prevention Observations**

Loss Prevention Observations (LPO's) shall be conducted by SC or designee for specific work tasks or operations comparing the actual work process against established safe work procedures identified in the project-specific HSP and AHAs. LPO's are a tool to be used by supervisors to provide positive reinforcement for work practices performed correctly, while also identifying and eliminating deviations from safe work procedures that could result in a loss. The SC or designee shall perform at least one LPO each week for tasks/operations addressed in the project-specific HSP or AHA. The SC or designee shall complete the LPO form in **Attachment 6** for the task/operation being observed.

### **10.4 Loss/Near Loss Investigations**

Loss/Near Loss Investigations shall be performed for CH2M HILL and subcontractor incidents involving:

- Person injuries/illnesses and near miss injuries
- Equipment/property damage
- Spills, leaks, regulatory violations
- Motor vehicle accidents

The cause of loss and near loss incidents are similar, so by identifying and correcting the causes of near loss causes, future loss incidents may be prevented. The following is the Loss/Near Loss Investigation Process:

- Gather all relevant facts, focusing on fact-finding, not fault-finding, while answering the who, what, when, where and how questions.
- Draw conclusions, pitting facts together into a probable scenario.
- Determine incident root cause(s), which are basic causes on why an unsafe act/condition existed.
- Develop and implement solutions, matching all identified root causes with solutions.
- Communicate incident as a Lesson Learned to all project personnel.
- Filed follow-up on implemented corrective active action to confirm solution is appropriate.

The SC or designee shall perform an incident investigation, as soon as practical after incident occurrence during the day of the incident, for all Loss and Near Loss Incidents that occur on the project. Loss and Near Loss incident investigations shall be performed using the following incident investigation forms provided in **Attachment 6**:

- Incident Report Form (IRF)
- Root Cause Analysis Form

All Loss and Near Loss incident involving personal injury, property damage in excess of \$1,000 or near loss incidents that could have resulted in serious consequences shall be investigated by completing the incident investigation forms and submitting them to the PM and RHSM within

24 hours of incident occurrence. A preliminary Incident Investigation and Root Cause Analysis shall be submitted to the Project Manager and RHSM within 24 hours of incident occurs. The final Incident Investigation and Root Cause Analysis shall be submitted after completing a comprehensive investigation of the incident.

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## 11.0 Approval

This site-specific HSP 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.

### Original Plan

Written By: Keith Torre

Date: December 17, 2008

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Approved By: Michael Goldman

Date: December 17, 2008

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### Revisions

Revisions Made By:

Date:

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Revisions to Plan:

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Revisions Approved By:

Date:

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## **12.0 Attachments**

- Attachment 1: Employee Signoff Form – Health and Safety Plan
- Attachment 2: Chemical Inventory/Register Form
- Attachment 3: Chemical-Specific Training Form
- Attachment 4: Emergency Contacts
- Attachment 5: Project Activity Self-Assessment Checklists/Permits
- Attachment 6: Behavior Based Loss Prevention Forms
- Attachment 7: Material Safety Data Sheets

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**CH2M HILL Health and Safety Plan**  
**Attachment 1**

**Health and Safety Plan Employee Sign-off Form**



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**CH2M HILL Health and Safety Plan**  
**Attachment 2**

**Chemical Inventory/Register Form**



## CHEMICAL INVENTORY/REGISTER FORM

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Refer to Standard of Practice HSE-107 Attachment 1 for instructions on completing this form.

Location: _____
HCC: _____
<input type="checkbox"/> Office <input type="checkbox"/> Warehouse <input type="checkbox"/> Laboratory <input type="checkbox"/> Project: _____
Project No.: _____

Regulated Product	Location	Container labeled (✓if yes)	MSDS available (✓if yes)

MSDS for the listed products will be maintained at: _____
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**CH2M HILL Health and Safety Plan**  
**Attachment 3**

**Chemical-Specific Training Form**

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**CH2MHILL****CHEMICAL-SPECIFIC TRAINING FORM**

Refer to Standard Operating Procedure HSE-107 Attachment 1 for instructions on completing this 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.

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**CH2M HILL Health and Safety Plan**  
**Attachment 4**

**Emergency Contacts**

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## Emergency Contacts

**24-hour CH2M HILL Emergency Beeper – 720-286-4911**

**If injured on the job, notify your supervisor and then call**

**1-800-756-1130 to contact CH2M HILL'S Occupational Nurse**

**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**

Health Resources  
Dr. Jerry H. Berke, M.D., M.P.H.  
600 West Cummings Park, Suite 3400  
Woburn, MA 01801-6350  
781/938-4653  
After Hours 800/350-4511  
(After hours calls will be returned within 20 minutes)

**Local Occupational Physician**

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

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**Fire/Spill Emergency – 911 or**

Base Fire Response #: (910) 451-9111

**CH2M HILL Director Security Operations**

Thomas Horton/DEN  
720/273-3100 (cell) or 720/286-0022 (office)

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**Security & Police – 911 or**

Base Security #: (910) 451-2555

**Health and Safety Manager (HSM)**

Name: Michael Goldman/ATL  
Phone: (770) 604-9182 x 396

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**On-Scene Coordinator**

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

**Regional Human Resources Department**

Name: Mary Jo Jordan/GNV  
Phone: 352/355-2867

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**Utilities Emergency**

Water:  
Gas: Contact Base EMD  
Electric:

**Worker's Compensation:**

Contact Business Group HR dept. to have form completed or contact Albert Jerman after hours: 303/741-5927

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**Safety Coordinator (SC)**

Name: TBD  
Phone: TBD

**Media Inquiries Corporate Strategic Communications**

Name: John Corsi  
Phone: (720) 286-2087

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**Project Manager**

Name: Hope Oaks/CLT  
Phone: 704-543-3274

**Automobile Accidents:**

Rental: Linda Anderson/COR 720/286-2401  
CH2M HILL owned vehicle: Linda George 720-286-2057

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**Federal Express Dangerous Goods Shipping**

Phone: 800/238-5355

**CH2M HILL Dangerous Goods Shipping**

Phone: 800/255-3924

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**Facility Alarms:** TBD

**Evacuation Assembly Area(s):** TBD by the SC-HW.

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

## Directions to Local Hospital

### **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.

### **From Air Station and Camp Geiger**

Directions to Onslow County Memorial Hospital:

1. Proceed through the main gate, turn right, and head north on Ocean Highway 17.
2. Follow Ocean Highway 17 north to Highway 24 and head east.
3. Travel east until Western Boulevard, turn left 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 Activity Self-Assessment Checklists/Permits/Forms**

- **Drilling**
- **Waste Management and Sampling**

# CH2MHILL

## 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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<b>SECTION 2 (Continued)</b>				
<b>WASTE MANAGEMENT (4.2.3)</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>N/O</b>
13. Drill cuttings and purge water managed and disposed properly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>DRILLING AT HAZARDOUS WASTE SITES (4.2.4)</b>				
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"/>
<b>DRILLING AT ORDNANCE EXPLOSIVES (OE)/UNEXPLODED ORDNANCE (UXO) SITES (4.2.5)</b>				
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"/>
<b>SECTION 3 - DRILLING SAFETY REQUIREMENTS (4.3)</b>				
<b>GENERAL (4.3.1)</b>				
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"/>
<b>DRILL RIG PLACEMENT (4.3.2)</b>				
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"/>
<b>DRILL RIG TRAVEL (4.3.3)</b>				
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"/>
<b>DRILL RIG OPERATION (4.3.4)</b>				
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"/>
<b>DRILL RIG SITE CLOSURE (4.3.5)</b>				
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"/>
<b>DRILL RIG MAINTENANCE (4.3.6)</b>				
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"/>



# CH2MHILL

## HS&E Self-Assessment Checklist—Waste Characterization, Sampling and Analysis

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project’s HSP/FSI.

This checklist is to be used at locations where: 1) CH2M HILL employees will be managing wastes generated on project sites and/or 2) CH2M HILL provides oversight of subcontractor personnel who are managing wastes generated at project sites.

The Safety Coordinator (SC) may consult with subcontractors when completing this checklist, but shall not direct the means and methods of waste characterization, sampling and analysis operations nor direct the details of corrective actions. 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.

Completed checklists shall be sent to the HS&E Staff for review.

Project Name: \_\_\_\_\_ Project No.: \_\_\_\_\_  
 Location: \_\_\_\_\_ PM: \_\_\_\_\_  
 Person filling out checklist: \_\_\_\_\_ Title: \_\_\_\_\_ Date: \_\_\_\_\_

This specific checklist has been completed to:

- Evaluate CH2M HILL compliance with its waste characterization, sampling and analysis standard (SOP-79).
  - Evaluate a CH2M HILL subcontractor’s compliance with the waste characterization, sampling and analysis standard and its requirements
- 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 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 Standard of Practice HS-42.

	<u>Yes</u>	<u>No</u>	<u>N/A</u>
<b><u>N/O</u></b>			
<b>GENERAL WASTE CHARACTERIZATION INFORMATION (6.0)</b>			
1. Personnel told not to sign waste documentation (e.g., manifests) unless specifically authorized by the client in writing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Waste Management Plan developed and available to all project personnel (see HSE-78).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Waste characterized before it is generated.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Waste characterized by Client using generator information.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Waste volumes estimated.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Disposal facility sampling and analytical requirements identified.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Disposal facility evaluated (see HSE-78).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Waste stream characterization documented in project file.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>IDENTIFY ANALYTICAL TEST METHODS (7.1)</b>			
9. Nature and quantity of the waste determined.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Analyses required for transport, treatment, and disposal determined.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Detection limits identified.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Provide disposal facility with analytical results.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Analytical test methods identified.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**SAMPLING (7.2)**

- |   |                          |                          |                          |                          |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 14. Developed a sampling plan.  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 15. Field activities recorded in a logbook.   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 16. Exceptions to sampling plan documented in field logbook.  |                          |                          |                          |                          |
| 17. Each container labeled with the project name, number, sample ID number, date and time,  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 18. The label on the container is covered with clear tape to prevent loss.<br>collected sampler's name, sample preserves, analysis to be performed. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**CHAIN OF CUSTODY (COC)**

- |   |                          |                          |                          |                          |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 19. Sample shipping containers sealed with two custody seals.   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 20. Custody seals placed over the left and rights sides of the container's cover (cooler).  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 21. Each seal signed and dated (with time).   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 22. Seals are covered with clear tape to prevent loss.  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 23. Custody seals placed on sample container immediately after collection.  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 24. Custody seals must be placed in a manner that they must be broken to open sample container.   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 25. The sample is in custody ( in view or physical possession, it has not been tampered with, it is retained in a secured area with restricted access, it is placed in a container and secured with an official seal such that it cannot be reached without breaking the seal). | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**CHAIN OF CUSTODY FORM INSTRUCTIONS (7.2.5)**

- |  |                          |                          |                          |                          |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| 26. Chain of Custody form completed per instructions | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|--|--------------------------|--------------------------|--------------------------|--------------------------|

**RECORDS (7.2.6)**

- |   |                          |                          |                          |                          |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 27. Original COC submitted to the lab along with final data packages.                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 28. Official copy of COC form sent to the project chemist and lab with sample shipment.         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 29. Changes to analytical requests on COC form or the PO made in writing to the lab.            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 30. A copy of written change sent to PM, lab, and placed in project files.                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 31. Reasons for change are included in sample log and project file.                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 32. Sample logbooks, sample logs, and COC forms sent to PM at completion of project activities. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |



**CH2M HILL Health and Safety Plan**  
**Attachment 6**

**Behavior Based Loss Prevention System Forms**

**Activity Hazard Analysis**

**Pre-Task Safety Plans**

**Loss Prevention Observation**

**Incident Report and Investigation**

# CH2MHILL

## Pre-Task Safety Plan (PTSP)

Project: _____ Location: _____ Date: _____		
Supervisor: _____ Job Activity: _____ _____		
Task Personnel: _____ _____ _____		
List Tasks: _____ _____ _____		
Tools/Equipment Required for Tasks (ladders, scaffolds, fall protection, cranes/rigging, heavy equipment, power tools): _____ _____		
Potential H&S Hazards, including chemical, physical, safety, biological and environmental (check all that apply):		
<input type="checkbox"/> Chemical burns/contact	<input type="checkbox"/> Trench, excavations, cave-ins	<input type="checkbox"/> Ergonomics
<input type="checkbox"/> Pressurized lines/equipment	<input type="checkbox"/> Overexertion	<input type="checkbox"/> Chemical splash
<input type="checkbox"/> Thermal burns	<input type="checkbox"/> Pinch points	<input type="checkbox"/> Poisonous plants/insects
<input type="checkbox"/> Electrical	<input type="checkbox"/> Cuts/abrasions	<input type="checkbox"/> Eye hazards/flying projectile
<input type="checkbox"/> Weather conditions	<input type="checkbox"/> Spills	<input type="checkbox"/> Inhalation hazard
<input type="checkbox"/> Heights/fall > 6 feet	<input type="checkbox"/> Overhead Electrical hazards	<input type="checkbox"/> Heat/cold stress
<input type="checkbox"/> Noise	<input type="checkbox"/> Elevated loads	<input type="checkbox"/> Water/drowning hazard
<input type="checkbox"/> Explosion/fire	<input type="checkbox"/> Slips, trip and falls	<input type="checkbox"/> Heavy equipment
<input type="checkbox"/> Radiation	<input type="checkbox"/> Manual lifting	<input type="checkbox"/> Aerial lifts/platforms
<input type="checkbox"/> Confined space entry	<input type="checkbox"/> Welding/cutting	<input type="checkbox"/> Demolition
Other Potential Hazards (Describe): _____ _____ _____		

# CH2MHILL

## Hazard Control Measures (Check All That Apply):

<b>PPE</b> <input type="checkbox"/> Thermal/lined <input type="checkbox"/> Eye <input type="checkbox"/> Dermal/hand <input type="checkbox"/> Hearing <input type="checkbox"/> Respiratory <input type="checkbox"/> Reflective vests <input type="checkbox"/> Flotation device	<b>Protective Systems</b> <input type="checkbox"/> Sloping <input type="checkbox"/> Shoring <input type="checkbox"/> Trench box <input type="checkbox"/> Barricades <input type="checkbox"/> Competent person <input type="checkbox"/> Locate buried utilities <input type="checkbox"/> Daily inspections	<b>Fire Protection</b> <input type="checkbox"/> Fire extinguishers <input type="checkbox"/> Fire watch <input type="checkbox"/> Non-spark tools <input type="checkbox"/> Grounding/bonding <input type="checkbox"/> Intrinsically safe equipment	<b>Electrical</b> <input type="checkbox"/> Lockout/tagout <input type="checkbox"/> Grounded <input type="checkbox"/> Panels covered <input type="checkbox"/> GFCI/extension cords <input type="checkbox"/> Power tools/cord inspected
<b>Fall Protection</b> <input type="checkbox"/> Harness/lanyards <input type="checkbox"/> Adequate anchorage <input type="checkbox"/> Guardrail system <input type="checkbox"/> Covered opening <input type="checkbox"/> Fixed barricades <input type="checkbox"/> Warning system	<b>Air Monitoring</b> <input type="checkbox"/> PID/FID <input type="checkbox"/> Detector tubes <input type="checkbox"/> Radiation <input type="checkbox"/> Personnel sampling <input type="checkbox"/> LEL/O2 <input type="checkbox"/> Other	<b>Proper Equipment</b> <input type="checkbox"/> Aerial lift/ladders/scaffolds <input type="checkbox"/> Forklift/heavy equipment <input type="checkbox"/> Backup alarms <input type="checkbox"/> Hand/power tools <input type="checkbox"/> Crane with current inspection <input type="checkbox"/> Proper rigging <input type="checkbox"/> Operator qualified	<b>Welding &amp; Cutting</b> <input type="checkbox"/> Cylinders secured/capped <input type="checkbox"/> Cylinders separated/upright <input type="checkbox"/> Flash-back arrestors <input type="checkbox"/> No cylinders in CSE <input type="checkbox"/> Flame retardant clothing <input type="checkbox"/> Appropriate goggles
<b>Confined Space Entry</b> <input type="checkbox"/> Isolation <input type="checkbox"/> Air monitoring <input type="checkbox"/> Trained personnel <input type="checkbox"/> Permit completed <input type="checkbox"/> Rescue	<b>Medical/ER</b> <input type="checkbox"/> First-aid kit <input type="checkbox"/> Eye wash <input type="checkbox"/> FA-CPR trained personnel <input type="checkbox"/> Route to hospital	<b>Heat/Cold Stress</b> <input type="checkbox"/> Work/rest regime <input type="checkbox"/> Rest area <input type="checkbox"/> Liquids available <input type="checkbox"/> Monitoring <input type="checkbox"/> Training	<b>Vehicle/Traffic</b> <input type="checkbox"/> Traffic control <input type="checkbox"/> Barricades <input type="checkbox"/> Flags <input type="checkbox"/> Signs
<b>Permits</b> <input type="checkbox"/> Hot work <input type="checkbox"/> Confined space <input type="checkbox"/> Lockout/tagout <input type="checkbox"/> Excavation <input type="checkbox"/> Demolition <input type="checkbox"/> Energized work	<b>Demolition</b> <input type="checkbox"/> Pre-demolition survey <input type="checkbox"/> Structure condition <input type="checkbox"/> Isolate area/utilities <input type="checkbox"/> Competent person <input type="checkbox"/> Hazmat present	<b>Inspections:</b> <input type="checkbox"/> Ladders/aerial lifts <input type="checkbox"/> Lanyards/harness <input type="checkbox"/> Scaffolds <input type="checkbox"/> Heavy equipment <input type="checkbox"/> Cranes and rigging	<b>Training:</b> <input type="checkbox"/> Hazwaste <input type="checkbox"/> Construction <input type="checkbox"/> Competent person <input type="checkbox"/> Task-specific (THA) <input type="checkbox"/> Hazcom

Field Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Name (Print): \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

<b>Safe Work Observation Form</b>			
Project:	Observer:	Date:	
Position/Title of worker observed:	Background Information/ comments:		
Task/Observation Observed: _____			
<ul style="list-style-type: none"> <li>❖ Identify and reinforce safe work practices/behaviors</li> <li>❖ Identify and improve on at-risk practices/acts</li> <li>❖ Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards</li> <li>❖ Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)</li> <li>❖ Positive, corrective, cooperative, collaborative feedback/recommendations</li> </ul>			
Actions & Behaviors	Safe	At-Risk	Observations/Comments
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			<b>Positive Observations/Safe Work Practices:</b>
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			<b>Questionable Activity/Unsafe Condition Observed:</b>
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			<b>Observer's Corrective Actions/Comments:</b>
Focus/attentiveness			
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			<b>Observed Worker's Corrective Actions/Comments:</b>
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			
Other...			

<b>Activity:</b>	<b>Date:</b>
	<b>Project:</b>
<b>Description of the work:</b>	<b>Site Supervisor:</b>
	<b>Site Safety Officer:</b>
	<b>Review for latest use:</b> Before the job is performed.

<b>Work Activity Sequence</b> (Identify the principal steps involved and the sequence of work activities)	<b>Potential Health and Safety Hazards</b> (Analyze each principal step for potential hazards)	<b>Hazard Controls</b> (Develop specific controls for each potential hazard)

<b>Equipment to be used</b> (List equipment to be used in the work activity)	<b>Inspection Requirements</b> (List inspection requirements for the work activity)	<b>Training Requirements</b> (List training requirements including hazard communication)

PRINT NAME

SIGNATURE

Supervisor Name: \_\_\_\_\_

\_\_\_\_\_

Date/Time: \_\_\_\_\_

Safety Officer Name: \_\_\_\_\_

\_\_\_\_\_

Date/Time: \_\_\_\_\_

Employee Name(s): \_\_\_\_\_

\_\_\_\_\_

Date/Time: \_\_\_\_\_

**HITS Incident Report Hardcopy (Phase 1 – Initial Entry)**  
**Rev. 1, 12/03/2007**

**Phase 1 – Initial Entry**

**Type of Incident** (May select more than one)

- Injury/Illness
- Property Damage
- Spill/Release
- Environment/Permit
- Near Miss
- Other

**General Information Section**

**Preparer's Name:** \_\_\_\_\_ **Preparer's Phone Number:** \_\_\_\_\_

**Date of Incident:** \_\_\_\_\_ **Time of Incident:** \_\_\_\_\_ AM / PM

**What Business Group is accountable for this incident:** \_\_\_\_\_

**What Business Group SubGroup is accountable for this incident:** \_\_\_\_\_

**What CH2M HILL Company is accountable for this incident:** \_\_\_\_\_

**Where did the Incident occur?**

- United States, Geographic Region: \_\_\_\_\_
- Canada, Province/Territory: \_\_\_\_\_
- International, County: \_\_\_\_\_

**Location of Incident?**

Company Premises, CH2M HILL Office (use 3 letter office code if available): \_\_\_\_\_

Project, Project name: \_\_\_\_\_

In Transit

Traveling from: \_\_\_\_\_

Traveling to: \_\_\_\_\_

At Home

Other, Specify: \_\_\_\_\_

**Describe the incident:** \_\_\_\_\_

\_\_\_\_\_

**Describe how this event could have been prevented:** \_\_\_\_\_

\_\_\_\_\_

**Provide Witness Information:**

Name: \_\_\_\_\_ Phone: \_\_\_\_\_

Name: \_\_\_\_\_ Phone: \_\_\_\_\_

Name: \_\_\_\_\_ Phone: \_\_\_\_\_

**Personnel Notified of Incident (Provide name, date and time):**

CH2M HILL Personnel: \_\_\_\_\_

Client Personnel: \_\_\_\_\_

**Additional Comments:**

\_\_\_\_\_

\_\_\_\_\_

**Injury/Illness Section** [Complete only if Injury/Illness Incident type selected]

**Who was injured?**

- CH2M HILL Employee or CH2M HILL Temp Employee
- Subcontractor to CH2M HILL (Non-LLC Joint Venture Project)
- LLC Joint Venture Partner Employee
- LLC Joint Venture Project Subcontractor/Contractor
- Other

**Name of Injured:** \_\_\_\_\_ **Job Title:** \_\_\_\_\_

**Employer Name:** \_\_\_\_\_ **Supervisor of Employee:** \_\_\_\_\_

**Complete for CH2M HILL Employee Injuries**

Business Group of Injured Employee: \_\_\_\_\_

Has the employee called the Injury Management Administrator (1-800-756-1130)?

Yes       No       Not Sure

Has the injured employee's supervisor been notified of this incident?

Yes       No       Not Sure

**Complete for Non-CH2M HILL Employee Injuries**

Has the project safety coordinator been notified of this incident?

Yes       No       Not Sure

Project Safety Coordinator: \_\_\_\_\_

Body Part Affected: \_\_\_\_\_

Injury/Illness (Result): \_\_\_\_\_

Describe treatment provided (if medication provided, identify whether over-the-counter or prescription): \_\_\_\_\_

Describe any work restriction prescribed (include dates and number of days): \_\_\_\_\_

**Physician/Health Care Provider Information**

Name: \_\_\_\_\_ Phone: \_\_\_\_\_

Was treatment provided away from the worksite?

No  
 Yes

Facility Name: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ Phone Number: \_\_\_\_\_

Was injured treated in an emergency room?

No       Yes

Was injured hospitalized overnight as an in-patient?

No       Yes

**General Information Environmental Section [Complete only if Environment/Permit or Spill/Release Incident type selected]**

Who had control of the area during the incident?

- CH2M HILL, Company: \_\_\_\_\_
  - Subcontractor, Company: \_\_\_\_\_
  - Joint Venture Partner/Contractor/Subcontractor, Company: \_\_\_\_\_
  - Other, Company: \_\_\_\_\_
- Relationship to CH2M HILL: \_\_\_\_\_

**Property Damage Section [Complete only if Property Damage Incident type selected]**

Property Damaged: \_\_\_\_\_

Property Owner: \_\_\_\_\_

Damage Description: \_\_\_\_\_

Estimated US Dollar Amount: \_\_\_\_\_

**Spill or Release Section [Complete only if Spill/Release Incident type selected]**

Substance: \_\_\_\_\_

Estimated Quantity: \_\_\_\_\_

Did the spill/release move off the property?: \_\_\_\_\_

Spill/Release From: \_\_\_\_\_

Spill/Release To: \_\_\_\_\_

**Environment/Permit Section [Complete only if Environment/Permit Incident type selected]**

Describe Environmental or Permit Issue: \_\_\_\_\_

Permit Type: \_\_\_\_\_

Permitted Level or Criteria (e.g., discharge limit): \_\_\_\_\_

Permit Name and Number (e.g., NPDES No. ST1234): \_\_\_\_\_

Substance and Estimated Quantity: \_\_\_\_\_

Duration of Permit Exceedence: \_\_\_\_\_

**CH2M HILL Health and Safety Plan**  
**Attachment 7**

**Material Safety Data Sheets**

**Appendix C**  
**UFP-SAP Cross-Walk Table and QAPP**

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Project-Specific SAP

Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)

Site Location: MCB Camp Lejeune

Title: Preliminary Assessment/Site Inspection

Revision Number: 0

Revision Date: September 2009

UFP-QAPP Worksheet #	Required Information	Crosswalk to Related Information
<b>A. Project Management</b>		
<i>Documentation</i>		
1	Title and Approval Page	See attached
2	Table of Contents SAP Identifying Information	See attached Table of Contents not applicable
3	Distribution List	See attached
4	Project Personnel Sign-Off Sheet	See attached
<i>Project Organization</i>		
5	Project Organizational Chart	Table 2-1 of Work Plan Figure 3-1 of Master QAPP See attached
6	Communication Pathways	Section 4 of Work Plan Section 3.2 of Master QAPP
7	Personnel Responsibilities and Qualifications Table	Section 3.1 of Master QAPP
8	Special Personnel Training Requirements Table	Field personnel will meet requirements specified in Section 4.1 of Final Master HSP
<i>Project Planning/ Problem Definition</i>		
9	Project Planning Session Documentation (including Data Needs tables) Project Scoping Session Participants Sheet	Not applicable
10	Problem Definition, Site History, and Background. Site Maps (historical and present)	Section 1 of Work Plan Site Map – Figures 1-1 and 1-2 of Work Plan
11	Site-Specific Project Quality Objectives	Section 1.2 of Work Plan Section 4 of Master QAPP
12	Measurement Performance Criteria Table	See attached
13	Sources of Secondary Data and Information Secondary Data Criteria and Limitations Table	Not applicable
14	Summary of Project Tasks	Sections 1 and 3 of Work Plan
15	Reference Limits and Evaluation Table	
16	Project Schedule/Timeline Table	Figure 2-1 of Work Plan
<b>B. Measurement Data Acquisition</b>		
<i>Sampling Tasks</i>		
17	Sampling Design and Rationale	Sections 3.4 of Work Plan
18	Sampling Locations and Methods/ SOP Requirements Table Sample Location Map(s)	Figures 3-1 and 3-2 of Work Plan Sections 3.6 of Work Plan
19	Analytical Methods/SOP Requirements Table	Tables 3-1 and 3-2 of Work Plan See attached.
20	Field Quality Control Sample Summary Table	Table 3-3 of Work Plan
21	Project Sampling SOP References Table Sampling SOPs	Section 3 of Work Plan Section 3 of Master SAP Sections 7 and 12 of Master QAPP
22	Field Equipment Calibration, Maintenance, Testing, and Inspection Table	Sections 7 and 12 of Master QAPP
<i>Analytical Tasks</i>		
23	Analytical SOPs Analytical SOP References Table	See attached.

Project-Specific SAP

Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)

Site Location: MCB Camp Lejeune

Title: Preliminary Assessment/Site Inspection

Revision Number: 0

Revision Date: September 2009

<b>UFP-QAPP Worksheet #</b>	<b>Required Information</b>	<b>Crosswalk to Related Information</b>
<b>24</b>	Analytical Instrument Calibration Table	<b>See attached</b>
<b>25</b>	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	<b>See attached</b>
<i>Sample Collection</i>		
<b>26</b>	Sample Handling System, Documentation Collection, Tracking, Archiving and Disposal Sample Handling Flow Diagram	<b>Section 6 of the Master QAPP</b>
<b>27</b>	Sample Custody Requirements, Procedures/SOPs Sample Container Identification Example Chain-of-Custody Form and Seal	<b>Section 6 of Master QAPP Section 4.2 of Master SAP Attachment 6 of Master SAP</b>
<i>Quality Control Samples</i>		
<b>28</b>	QC Samples Table Screening/Confirmatory Analysis Decision Tree	<b>See attached</b>
<i>Data Management Tasks</i>		
<b>29</b>	Project Documents and Records Table	<b>Section 3 of Work Plan Sections 6 and 9 of Master QAPP</b>
<b>30</b>	Analytical Services Table Analytical and Data Management SOPs	<b>See attached</b>
<b>C. Assessment Oversight</b>		
<b>31</b>	Planned Project Assessments Table Audit Checklists	<b>Section 11 of Master QAPP</b>
<b>32</b>	Assessment Findings and Corrective Action Responses Table	<b>Section 14 of Master QAPP</b>
<b>33</b>	QA Management Reports Table	<b>Section 11 of Master QAPP Data will be validated externally and reviewed by the chemist prior to loading to database.</b>
<b>D. Data Review</b>		
<b>34</b>	Verification (Step I) Process Table	<b>Section 9 of Master QAPP</b>
<b>35</b>	Validation (Steps IIa and IIb) Process Table	<b>Section 9 of Master QAPP</b>
<b>36</b>	Validation (Steps IIa and IIb) Summary Table	<b>Section 9 of Master QAPP</b>
<b>37</b>	Usability Assessment	<b>Section 2 of Work Plan Section 9 of Master QAPP</b>

Final

# Quality Assurance Project Plan Attachment

## Marine Corps Base Camp Lejeune Jacksonville, North Carolina

Contract Task Order 040

September 2009

Prepared for

Department of the Navy  
Naval Facilities Engineering Command  
Atlantic

Under the

NAVFAC CLEAN 1000 Program  
Contract N62470-08-D-1000

Prepared by



**CH2MHILL**

Charlotte, North Carolina

**Project-Specific SAP**

**Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Site Location: MCB Camp Lejeune**

**Title: Preliminary Assessment/Site Inspection**

**Revision Number: 0**

**Revision Date: September 2009**

Worksheet #2: SAP Identifying Information

**Site Name/Number: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Operable Unit: N/A**

**Contractor Name: CH2M HILL**

**Contract Number: N62470-08-D-1000**

**Contract Title: NAVFAC Clean 1000 Contract Task Order 040**

**Work Assignment Number (optional):**

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

2. Identify regulatory program: CERCLA

3. This SAP is a project-specific SAP.

4. List dates of scoping sessions that were held:  
Date

Scoping Session

NAVFAC RFP	9/22/08
CH2M HILL IP/FP	9/25/08
_____	_____

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

Title	Date
N/A	_____
_____	_____

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

USEPA Region IV, NC DENR, NAVFAC Mid-Atlantic, MCB Camp Lejeune

7. Lead organization NAVFAC Mid-Atlantic

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

Worksheet #2 – Not applicable. This work is activity-funded. A table of contents is not necessary.

Worksheet #9 – Not applicable. Scope was issued by NAVFAC.

Worksheet #13 – Not applicable. No secondary data used in developing this SAP.

**Project-Specific SAP**

**Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Site Location: MCB Camp Lejeune**

**Title: Preliminary Assessment/Site Inspection**

**Revision Number: 0**

**Revision Date: September 2009**

Worksheet #3: Distribution List

<b>Name</b>	<b>Role/Title</b>	<b>Organization</b>	<b>Email Address</b>
Bob Lowder	Environmental Management Department/Installation Restoration	MCB Camp Lejeune	Robert.A.Lowder@usmc.mil
Bryan Beck	Navy Environmental Technical Representative (Activity)	NAVFAC Mid-Atlantic	Bryan.Beck@navy.mil
Gena Townsend	EPA Regulator	US EPA	Townsend.Gena@epa.gov
Marti Morgan	NCDENR regulator	NCDENR	Martha.Morgan@ncmail.net
Hope Oaks	Project Manager	CH2M HILL	Hope.Oaks@ch2m.com
Aretha Francois	Administrator	CH2M HILL	Aretha.francois@ch2m.com
Matt Louth	Activity Manager	CH2M HILL	Matt.Louth@ch2m.com

**Project-Specific SAP**

**Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Site Location: MCB Camp Lejeune**

**Title: Preliminary Assessment/Site Inspection**

**Revision Number: 0**

**Revision Date: September 2009**

Worksheet #4 Project Personnel Sign-Off

<b>Name</b>	<b>Role/Title</b>	<b>Signature/Email Receipt</b>	<b>SAP Section Reviewed</b>	<b>Date Read</b>
Bob Lowder	Environmental Management Department/Installation Restoration			
Bryan Beck	NAVFAC Mid-Atlantic			
Gena Townsend	EPA Regulator			
Marti Morgan	NCDENR Regulator			
Hope Oaks	Project Manager			
Aretha Francois	Administrator			
Matt Louth	Activity Manager			

Project-Specific SAP

Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)

Site Location: MCB Camp Lejeune

Title: Preliminary Assessment/Site Inspection

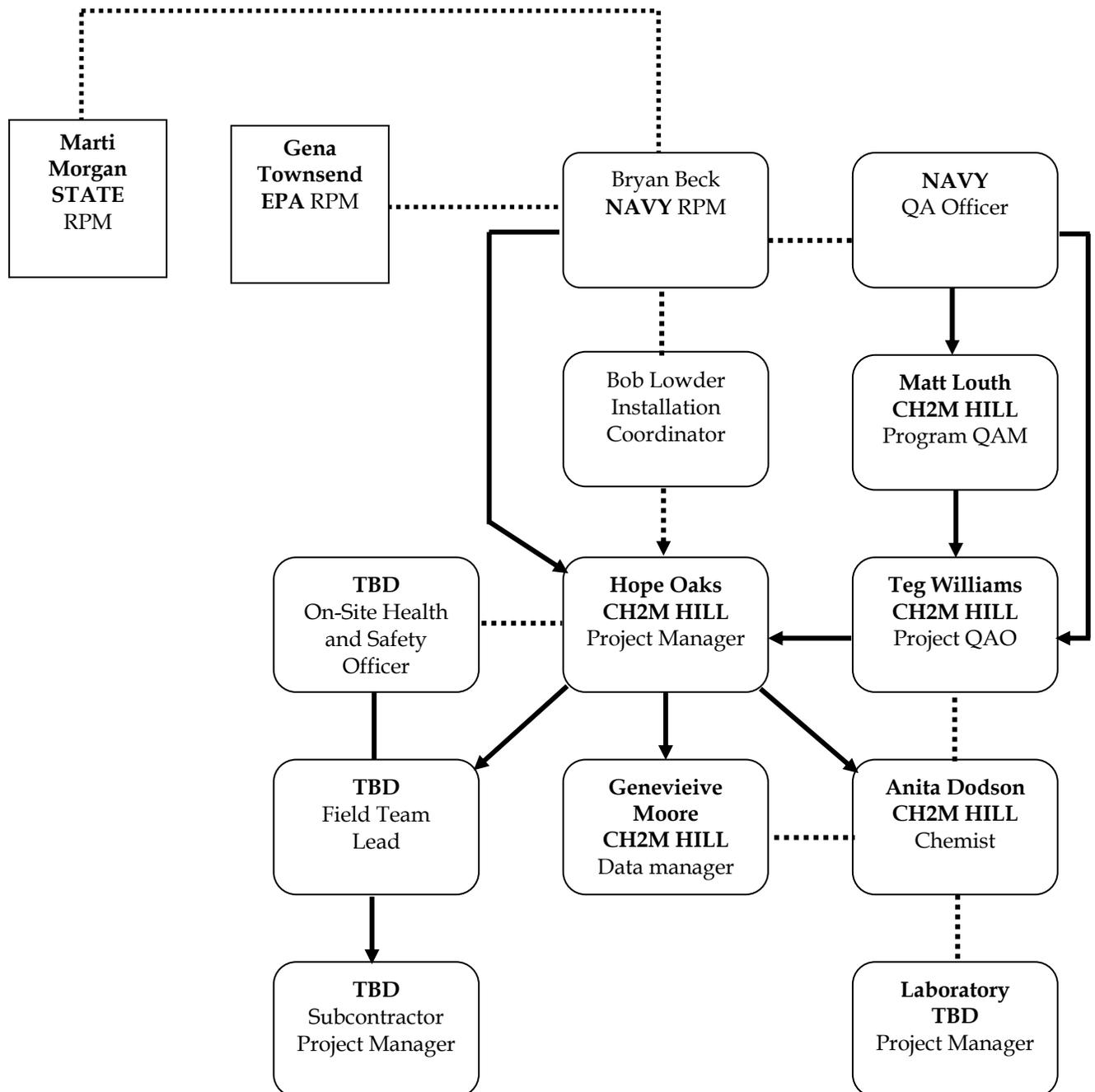
Revision Number: 0

Revision Date: September 2009

Worksheet #5 Project Organization

Lines of Authority —————

Lines of Communication ···········



**Project-Specific SAP**

**Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Site Location: MCB Camp Lejeune**

**Title: Preliminary Assessment/Site Inspection**

**Revision Number: 0**

**Revision Date: September 2009**

**SAP Worksheet #12 -- Measurement Performance Criteria Table – Field QC Samples**

[\(UFP-QAPP Manual Section 2.6.2\)](#)

<b>QC Sample</b>	<b>Analytical Group</b>	<b>Frequency</b>	<b>Data Quality Indicators (DQIs)</b>	<b>Measurement Performance Criteria</b>	<b>QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&amp;A)</b>
Matrix Spike Sample	SW-846 6010B/7470A Water/ Empirical SOP-100/105/103	One per digestion batch	Accuracy / Bias	± 25% of true value if sample < 4x spike added	A
Field Duplicates		As required per sampling event	Precision	Values ≥ 5X QL: RPD ≤ 50%	S & A
Equipment/Rinsate Blanks		As required per sampling event	Bias / Contamination	No target analytes ≥ QL; with the exception of common field/laboratory contaminants and/or Na,K, and Ca	S
Cooler Temperature Indicator		One per cooler	Accuracy / Representativeness	Between 2 and 6 degrees C.	S
Data Completeness Check			Data Completeness	85% Overall	S & A
Comparability Check		As required per sampling event	Comparability	Values ≥ 5X QL: Field Duplicates; RPD ≤ 50%+	S & A

**Project-Specific SAP**

**Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Site Location: MCB Camp Lejeune**

**Title: Preliminary Assessment/Site Inspection**

**Revision Number: 0**

**Revision Date: September 2009**

**SAP Worksheet #12 -- Measurement Performance Criteria Table – Field QC Samples**  
[\(UFP-QAPP Manual Section 2.6.2\)](#)

<b>QC Sample</b>	<b>Analytical Group</b>	<b>Frequency</b>	<b>Data Quality Indicators (DQIs)</b>	<b>Measurement Performance Criteria</b>	<b>QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&amp;A)</b>
Matrix Spike Sample	SW-846 6010B/7470A Soil/ Empirical SOP-100/105/103	One per digestion batch	Accuracy / Bias	± 25% of true value if sample < 4x spike added	A
Field Duplicates		As required per sampling event	Precision	Values ≥ 5X QL: RPD ≤ 50%	S & A
Equipment/Rinsate Blanks		As required per sampling event	Bias / Contamination	No target analytes ≥ QL; with the exception of common field/laboratory contaminants and/or Na,K, and Ca	S
Cooler Temperature Indicator		One per cooler	Accuracy / Representativeness	Between 2 and 6 degrees C.	S
Data Completeness Check			Data Completeness	85% Overall	S & A
Comparability Check		As required per sampling event	Comparability	Values ≥ 5X QL: Field Duplicates; RPD ≤ 50%+	S & A

Project-Specific SAP

Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)

Site Location: MCB Camp Lejeune

Title: Preliminary Assessment/Site Inspection

Revision Number: 0

Revision Date: September 2009

SAP Worksheet #15 -- Reference Limits and Evaluation Table

[\(UFP-QAPP Manual Section 2.8.1\)](#)

Matrix: Groundwater

Analytical Group: Metals

Analyte	CAS Number	Project Action Limit (mg/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (ug/L)	Laboratory-specific	
					QLs ug/L	MDLs ug/L
Antimony	7440-36-0	1.5	RSL	15	15	5
Arsenic	7440-38-2	0.045	RSL	10	10	3
Copper	7440-50-8	150	RSL	25	25	5
Lead	7439-92-1	15	NC2LGW	3	3	1
Zinc	7440-66-6	1050	NC2LGW	20	20	5

Project-Specific SAP

Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and  
UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)

Site Location: MCB Camp Lejeune

Title: Preliminary Assessment/Site Inspection

Revision Number: 0

Revision Date: September 2009

Matrix: Soil  
Analytical Group: Metals

Analyte	CAS Number	Project Action Limit (mg/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific	
					QLs mg/KG	MDLs mg/KG
Antimony	7440-36-0	3.1	Residential RSL	2	1	0.3
Arsenic	7440-38-2	0.39	Residential RSL	0.5	0.5	0.15
Copper	7440-50-8	310	Residential RSL	5	1	0.25
Lead	7439-92-1	270	NCSSL	0.6	0.25	0.08
Zinc	7440-66-6	550	NCSSL	4	1	0.25

**Project-Specific SAP**

**Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Site Location: MCB Camp Lejeune**

**Title: Preliminary Assessment/Site Inspection**

**Revision Number: 0**

**Revision Date: September 2009**

**SAP Worksheet #19 -- Analytical SOP Requirements Table**  
[\(UFP-QAPP Manual Section 3.1.1\)](#)

<b>Matrix</b>	<b>Analytical Group</b>	<b>Analytical and Preparation Method / SOP Reference</b>	<b>Containers</b> (number, size, and type)	<b>Sample volume</b> (units)	<b>Preservation Requirements</b> (chemical, temperature, light protected)	<b>Maximum Holding Time</b> (preparation / analysis)
Water	Metals	SW-846 3005A/6010B/7470A, SOP-100/103/105	500 ml plastic	50 ml/30 mlmercury	HNO3 to a pH<2; Cool to 4°C	180 days to analysis, 28 days mercury
Soil	Metals	SW-846 3050B/6010B/7471A, SOP-100/104/105	4 ounce glass	1-2 grams/ 0.3 grams mercury	Cool to 4 degrees Centigrade	180 days to analysis, 28 days mercury
Aqueous	Semivolatiles TCLP	SW-846 3510C, 8270 / SOP-201	1 L amber glass	100 mL	Cool to 4°C	14 days to TCLP/7 days / 40 days
Aqueous	Volatiles TCLP	SW-846 8260 / SOP-202	2 X 40 mL amber glass vial	40 mL	Cool to 4°C, HCl to pH < 2	14 days to TCLP/14 days
Aqueous	Pesticides TCLP	SW-846 3510, 8081A / SOP-211	1 L amber glass	100 mL	Cool to 4°C	14 days to TCLP/7 days / 40 days
Aqueous	Herbicides TCLP	SW-846 8151A / SOP-208/304	1 L amber glass	100 mL	Cool to 4°C	14 days to TCLP/7 days / 40 days
Aqueous	Metals TCLP	SW-846 6010, 7470 /SOP-103	250 mL plastic	150 mL	Cool to 4°C	180 days,28 days(Hg) to TCLP/6 months (metals), 28 days (Hg)
Aqueous	Corrosivity	SW-846 9045 / SOP-187	250 mL plastic	50 mL	Cool to 4°C	

**Project-Specific SAP**

**Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Site Location: MCB Camp Lejeune**

**Title: Preliminary Assessment/Site Inspection**

**Revision Number: 0**

**Revision Date: September 2009**

Aqueous	Reactive Cyanide	SW-846 9012A/SOP-164/175	250 mL plastic	100 mL	Cool to 4°C, NaOH to pH > 12	
Aqueous	Reactive Sulfide	SW-846 , Chap. 7, Sect. 7.3.4/ SOP-156	250 mL plastic	100 mL	Cool to 4°C, NaOH to pH >2, ZnAce	
Aqueous	Ignitability	Pensky Martens / SOP-149	250 mL plastic	50 mL	Cool to 4°C	

**Project-Specific SAP**

**Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Site Location: MCB Camp Lejeune**

**Title: Preliminary Assessment/Site Inspection**

**Revision Number: 0**

**Revision Date: September 2009**

**SAP Worksheet #23 -- Analytical SOP References Table**

[\(UFP-QAPP Manual Section 3.2.1\)](#)

<b>Lab SOP Number</b>	<b>Title, Revision Date, and / or Number</b>	<b>Definitive or Screening Data</b>	<b>Matrix and Analytical Group</b>	<b>Instrument</b>	<b>Organization Performing Analysis</b>	<b>Modified for Project Work? (Y/N)</b>
Empirical SOP-100	Metals Digestion/Preparation Methods 3005A,3010A, 3020A, 3030, 3040A, 3050B, USEPA CLP ILMO 4.1 Aqueous & Soil/Sediment, USEPA Method 200.7 (Standard Methods) 3030C. Rev. 19	Definitive	Inorganic/Metals	NA/ Metals	Empirical	N
Empirical SOP-105	Metals Analysis by ICP Technique Methods 200.7, SW846 6010B, SM 19 <sup>th</sup> Edition 2340B, USEPA ILMO 4.1, Rev. 14	Definitive	Inorganic/Metals	ICP	Empirical	N
Empirical SOP-103	Mercury Analysis in Water by Manual Cold Vapor Technique Methods SW846 7470A & 245.1, CLP-M 4.1, Rev. 14	Definitive	Inorganic/Metals	FIMS	Empirical	N
Empirical SOP-104	Mercury Analysis in Soil/Sediment by Manual Cold Vapor Technique Methods SW846 7471A , 245.5 & CLPILM 04.1, Rev. 16	Definitive	Inorganic/Metals	FIMS	Empirical	N
Empirical SOP-404	Laboratory Sample Receiving Log-in and Storage Standard Operating Procedures, Rev. 11	Definitive	Log-in	NA/ Log-in	Empirical	N
Empirical SOP-405	Analytical Laboratory Waste Disposal, Rev. 4	Definitive	Log-in	NA/ Log-in	Empirical	N
Empirical SOP-410	Standard Operating Procedures for Laboratory Sample Storage, Secure Areas, and Sample Custody, Rev. 6	Definitive	Log-in	NA/ Log-in	Empirical	N

Project-Specific SAP

Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)

Site Location: MCB Camp Lejeune

Title: Preliminary Assessment/Site Inspection

Revision Number: 0

Revision Date: September 2009

**SAP Worksheet #24 -- Analytical Instrument Calibration Table**

[\(UFP-QAPP Manual Section 3.2.2\)](#)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gas Chromatograph/ Mass Spectrometer Volatiles	Initial Calibration	Calibrate the instrument when it is received and after a major change or if the daily calibration fails. A minimum 5 point calibration is required.	The percent relative standard deviation(RSD) for each Calibration Check Compound(CCCs) must be $\leq 30\%$ . The minimum mean response factor(RF) for each System Performance Check Compound(SPCCs) must meet that stated in 8260B. If theRSD for an analyte is $> 15\%$ use a linear curve ( $\geq 0.995$ correlation) or quadratic curve( $\geq 0.99$ correlation, minimum 6 points) for quantitation	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/Supervisor	Empirical SOP-202

**Project-Specific SAP**

**Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Site Location: MCB Camp Lejeune**

**Title: Preliminary Assessment/Site Inspection**

**Revision Number: 0**

**Revision Date: September 2009**

<b>Instrument</b>	<b>Calibration Procedure</b>	<b>Frequency of Calibration</b>	<b>Acceptance Criteria</b>	<b>Corrective Action (CA)</b>	<b>Person Responsible for CA</b>	<b>SOP Reference</b>
Gas Chromatograph/ Mass Spectrometer Volatiles	Continuing Calibration(CCV)	Analyze a standard at the beginning of each 12 hour shift after a BFB tune.	The minimum RF for SPCCs must meet that stated in method. The CCCs must be < 20 percent difference.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/Supervisor	Empirical SOP-202
Gas Chromatograph/ Mass Spectrometer Volatiles	Initial calibration Verification (ICV)	Once after each initial calibration	±25% Individual Compounds	Identify source of problem, correct, repeat calibration, rerun samples	Analyst/Supervisor	Empirical SOP-202
Gas Chromatograph/ Mass Spectrometer Semivolatiles	Initial Calibration	Calibrate the instrument when it is received and after a major change or if the daily calibration fails. A minimum 5 point calibration is required.	The percent relative standard deviation(RSD) for each Calibration Check Compound(CCCs) must be ≤ 30%. The minimum mean response factor(RF) for each System Performance Check Compound(SPCCs) must meet that stated in 8270C. If the RSD for an analyte is > 15% use a linear curve (≥ 0.995 correlation) or quadratic curve(≥0.99 correlation, minimum 6 points) for quantitation	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/Supervisor	Empirical SOP-201

**Project-Specific SAP**

**Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Site Location: MCB Camp Lejeune**

**Title: Preliminary Assessment/Site Inspection**

**Revision Number: 0**

**Revision Date: September 2009**

<b>Instrument</b>	<b>Calibration Procedure</b>	<b>Frequency of Calibration</b>	<b>Acceptance Criteria</b>	<b>Corrective Action (CA)</b>	<b>Person Responsible for CA</b>	<b>SOP Reference</b>
Gas Chromatograph/ Mass Spectrometer Semivolatiles	Continuing Calibration(CCV)	Analyze a standard at the beginning of each 12 hour shift after a DF1PP tune.	The minimum RF for SPCCs must meet that stated in method. The CCCs must be < 20 percent difference.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/Supervisor	Empirical SOP-201
Gas Chromatograph/ Mass Spectrometer Semivolatiles	Initial calibration Verification (ICV)	Once after each initial calibration	±25% Individual Compounds	Identify source of problem, correct, repeat calibration, rerun samples	Analyst/Supervisor	Empirical SOP-201
Pesticides/PCBs\Herbicides GC/ECD	Initial calibration	Calibrate the instrument when it is received and after a major change or if the daily calibration fails. A minimum 5 point calibration is required.	Min. 5 pt cal., 20% RSD, Linear corr >0.995, Quadratic corr >0.99 min. 6 pts for all except toxaphene and chlordane. One pt for toxaphene and chlordane	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst/Supervisor	Empirical SOP-211
Pesticides/PCBs\Herbicides GC/ECD	Continuing Calibration(CCV)	Analyze standard at the beginning and end of sequence and every 10 samples.	≤ 15% difference	If % D >+ 15% and samples are < PQL, narrate, If %D > ± 15% only on one column, narrate, If % D > ± 15% for closing CCV, and is likely due to matrix interference, narrate Otherwise reanalyze all samples back to the last acceptable CCV.	Analyst/Supervisor	Empirical SOP-211
Pesticides/PCBs/Herbicides. GC/ECD	Initial calibration Verification (ICV)	Once after each initial calibration	±20% Individual Compounds	Identify source of problem, correct, repeat calibration, rerun samples	Analyst/Supervisor	Empirical SOP-211/208

**Project-Specific SAP**

**Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Site Location: MCB Camp Lejeune**

**Title: Preliminary Assessment/Site Inspection**

**Revision Number: 0**

**Revision Date: September 2009**

<b>Instrument</b>	<b>Calibration Procedure</b>	<b>Frequency of Calibration</b>	<b>Acceptance Criteria</b>	<b>Corrective Action (CA)</b>	<b>Person Responsible for CA</b>	<b>SOP Reference</b>
Inductively Coupled Plasma Spectrometer	Initial Calibration	The instrument is calibrated at the beginning of each day or if the QC is out of criteria.	The instrument is calibrated by a one point calibration per manufacturer's guidelines. Analytes ran at their calibration levels must fall within 90-110% of the true values.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/Supervisor	Empirical SOP-105
Inductively Coupled Plasma Spectrometer	Continuing Calibration(CCV)	Analyze a standard at the beginning and end of the sequence and after every 10 samples	The acceptance criteria for the continuing calibration standard is 90-110% of true value	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/Supervisor	Empirical SOP-105
Inductively Coupled Plasma Spectrometer	Initial Calibration Blank (ICB)	Before beginning a sample sequence	No analytes detected > 2x MDL	Correct the problem, then reprep and reanalyze.	Analyst/Supervisor	Empirical SOP-105
Inductively Coupled Plasma Spectrometer	Continuing Calibration Blank (CCB)	After every ten samples and at the end of the sequence	No analytes detected > 2x MDL	Correct the problem, then reprep and reanalyze calibration blank and previous ten samples	Analyst/Supervisor	Empirical SOP-105
Flow Injection Mercury System	Initial Calibration	The instrument is calibrated at the beginning of each day or if the QC is out of criteria.	The calibration correlation coefficient is $\geq 0.995$	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/Supervisor	Empirical SOP-103/104

**Project-Specific SAP**

**Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Site Location: MCB Camp Lejeune**

**Title: Preliminary Assessment/Site Inspection**

**Revision Number: 0**

**Revision Date: September 2009**

<b>Instrument</b>	<b>Calibration Procedure</b>	<b>Frequency of Calibration</b>	<b>Acceptance Criteria</b>	<b>Corrective Action (CA)</b>	<b>Person Responsible for CA</b>	<b>SOP Reference</b>
Flow Injection Mercury System	Continuing Calibration (CCV)	The CCV is analyzed at the beginning and end of the sequence and after every 10 samples.	The acceptance criteria is 80-120% of the true value	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/Supervisor	Empirical SOP-103/104
Flow Injection Mercury System	Initial Calibration Blank (ICB)	Before beginning a sample sequence	No analytes detected > 2x MDL	Correct the problem, then reprep and reanalyze.	Analyst/Supervisor	Empirical SOP-103/104
Flow Injection Mercury System	Continuing Calibration Blank (CCB)	After every ten samples and at the end of the sequence	No analytes detected > 2x MDL	Correct the problem, then reprep and reanalyze calibration blank and previous ten samples	Analyst/Supervisor	Empirical SOP-103/104
Lachat	Initial calibration	The instrument is calibrated after an instrument change or if QC is outside criteria.	The correlation coefficient is $\geq 0.995$	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst/Supervisor	Empirical SOP-175
Lachat	Continuing calibration	The CCV is analyzed at the beginning and end of the sequence and after every 10 samples.	The acceptance criteria is 90-110% of the true value	Recalibrate and/or perform necessary equipment maintenance. Reanalyze samples not bracketed by passing CCVs	Analyst/Supervisor	Empirical SOP-175
Flashpoint Tester	Flashpoint of p-xylene	Calibrate at the beginning and end of each set of 20 samples or less	Flash at 27 degrees C $\pm$ 2.2 degrees C	Check standard	Analyst/Supervisor	Empirical SOP-149
pH Meter	Calibration	Calibrate before use with two buffers in the area to be measured. Check with a third buffer	0.05 pH units	Recalibrate and/or perform necessary equipment maintenance.	Analyst/Supervisor	Empirical SOP-187

Project-Specific SAP

Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)

Site Location: MCB Camp Lejeune

Title: Preliminary Assessment/Site Inspection

Revision Number: 0

Revision Date: September 2009

**SAP Worksheet #25 -- Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table**  
(UFP-QAPP Manual Section 3.2.3)

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Inductively Coupled Plasma Spectrometer	Clean the torch assembly and the spray chamber when they become discolored or when degradation in data quality is observed. Clean the nebulizer, and check the argon supply. Replace the peristaltic pump tubing as needed	TAL Metals	Inspect the torch, nebulizer chamber, pump, and tubing	Maintenance is performed prior to initial calibration or as necessary.	The acceptance criteria for the continuing calibration standard is 90-110% of true value	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	Empirical SOP-105
Flow Injection Mercury System	Change the tubing, filter, clean windows, and check gas flow. Check the reagents and standards.	Mercury	Inspect the tubing, filter, and the optical cell	Maintenance is performed prior to initial calibration or as necessary.	The acceptance criteria is 80-120% of the true value	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	Empirical SOP-103
HPLC/ESI/MS	Check pressure and gas supply daily – change when <200psi, change analytical column as needed, change mobile phase when insufficient for run or contamination, change inlet filters as needed for contamination	Perchlorate	Check pump pressure, check for leaks, check for adequate mobile phase	Instrument receipt, instrument change (new column, etc.), when CCV does not meet criteria	ICV 15% Diff, Linear Corr $\geq 0.995$ , RSD $\leq 20\%$	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data	Analyst/ Supervisor	CAS HPLC-6850

Project-Specific SAP

Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)

Site Location: MCB Camp Lejeune

Title: Preliminary Assessment/Site Inspection

Revision Number: 0

Revision Date: September 2009

SAP Worksheet #28 -- Laboratory QC Samples Table

(UFP-QAPP Manual Section 3.4)

QC Sample:	Frequency/ Number	Method/ SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per batch of 20 or less	No perchlorate $\geq 1/2$ CRQL	Reclean, retest, re-extract, reanalyze, and/or qualify data	Analyst, Laboratory Supervisor and Data Validator	Bias / Contamination	No target compounds $\geq 1/2$ CRQL
Reagent Blank	Prior to calibration and after each batch analyzed	No perchlorate $\geq 1/2$ CRQL	If contaminated, reanalyze reagent blanks until no carryover is observed ( $< 1/2$ the reporting limit). Reanalyze all samples processed since the last clean reagent blank or flag.	Analyst, Laboratory Supervisor and Data Validator	Contamination	No target compounds $\geq 1/2$ CRQL
Laboratory Control Spike	One per batch of 20 field samples or less	Spike Recovery within 80-120%.	(1) Re-extract and reanalyze if possible (2) If the LCS recoveries are high but the sample results are $< QL$ narrate otherwise reprep and reanalyze	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Bias	Spike Recovery limits must be within 80-120%.
ICS (Interference Check Standard)	1/batch	Spike Recovery must be within the range of 70-130%	Correct problem and reextract and reanalyze associated samples	Analyst, Laboratory Supervisor and Data Validator	Interference	Spike Recovery must be within the range of 70-130%
LODV	At beginning and end of each batch	70-130% Recovery	Reanalyze samples in associated batch which are $< MRL$	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Bias	70-130% Recovery

**Project-Specific SAP**

**Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Site Location: MCB Camp Lejeune**

**Title: Preliminary Assessment/Site Inspection**

**Revision Number: 0**

**Revision Date: September 2009**

Matrix	Water					
Analytical Group	Perchlorate					
Analytical Method/ SOP Reference	SW-846 6850/ CAS HPLC-6850					
<b>QC Sample:</b>	<b>Frequency/ Number</b>	<b>Method/ SOP QC Acceptance Limits</b>	<b>Corrective Action</b>	<b>Person(s) Responsible for Corrective Action</b>	<b>Data Quality Indicator (DQI)</b>	<b>Measurement Performance Criteria</b>
Matrix spike / Matrix spike duplicate	If requested, one per SDG or every 20 samples.	Spike Recovery within 80-120%; RPD limits are 15%.	Evaluate LCS; may report with qualifier and note outliers in case narrative.	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	Spike Recovery within 80-120%; RPD limits are 15%

Matrix	Soil					
Analytical Group	Perchlorate					
Analytical Method/ SOP Reference	SW-846 6850/ CAS HPLC-6850					
<b>QC Sample:</b>	<b>Frequency/ Number</b>	<b>Method/SOP QC Acceptance Limits</b>	<b>Corrective Action</b>	<b>Person(s) Responsible for Corrective Action</b>	<b>Data Quality Indicator (DQI)</b>	<b>Measurement Performance Criteria</b>
Method Blank	One per batch of 20 or less	No perchlorate $\geq 1/2$ CRQL	Reclean, retest, re-extract, reanalyze, and/or qualify data	Analyst, Laboratory Supervisor and Data Validator	Bias / Contamination	No target compounds $\geq 1/2$ CRQL
Reagent Blank	Prior to calibration and after each batch analyzed	No perchlorate $\geq 1/2$ CRQL	If contaminated, reanalyze reagent blanks until no carryover is observed ( $< 1/2$ the reporting limit). Reanalyze all samples processed since the last clean reagent blank or flag.	Analyst, Laboratory Supervisor and Data Validator	Contamination	No target compounds $\geq 1/2$ CRQL

**Project-Specific SAP**

**Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Site Location: MCB Camp Lejeune**

**Title: Preliminary Assessment/Site Inspection**

**Revision Number: 0**

**Revision Date: September 2009**

Matrix	Soil					
Analytical Group	Perchlorate					
Analytical Method/ SOP Reference	SW-846 6850/ CAS HPLC-6850					
<b>QC Sample:</b>	<b>Frequency/ Number</b>	<b>Method/SOP QC Acceptance Limits</b>	<b>Corrective Action</b>	<b>Person(s) Responsible for Corrective Action</b>	<b>Data Quality Indicator (DQI)</b>	<b>Measurement Performance Criteria</b>
Laboratory Control Spike	One per batch of 20 field samples or less	Spike Recovery within 80-120%.	(1) Re-extract and reanalyze if possible (2) If the LCS recoveries are high but the sample results are <QL narrate otherwise reprep and reanalyze	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Bias	Spike Recovery limits must be within 80-120%.
ICS (Interference Check Standard)	1/batch	Spike Recovery must be within the range of 70-130%	Correct problem and reextract and reanalyze associated samples	Analyst, Laboratory Supervisor and Data Validator	Interference	Spike Recovery must be within the range of 70-130%
LODV	At beginning and end of each batch	70-130% Recovery	Reanalyze samples in associated batch which are < MRL	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Bias	70-130% Recovery
Matrix spike / Matrix spike duplicate	If requested, one per SDG or every 20 samples.	Spike Recovery within 80-120%; RPD limits are 15%.	Evaluate LCS; may report with qualifier and note outliers in case narrative.	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	Spike Recovery within 80-120%; RPD limits are 15%

Matrix	Water					
Analytical Group	TAL Metals					
Analytical Method / SOP Reference	SW-846 3005A, 6010B/7470A/ SOP- 100/103/105					
<b>QC Sample</b>	<b>Frequency / Number</b>	<b>Method / SOP QC Acceptance Limits</b>	<b>Corrective Action</b>	<b>Person(s) Responsible for Corrective Action</b>	<b>Data Quality Indicator (DQI)</b>	<b>Measurement Performance Criteria</b>
Method Blank	One per	Contaminants in the method	1) Investigate	Analyst, Laboratory Supervisor and	Bias / Contamination	Contaminants in the method

**Project-Specific SAP**

**Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Site Location: MCB Camp Lejeune**

**Title: Preliminary Assessment/Site Inspection**

**Revision Number: 0**

**Revision Date: September 2009**

Matrix	Water					
	digestion batch of 20 or fewer samples.	blank must be less than ½ the reporting limit.	the source of the contamination. Redigest and reanalyze all associated samples if the sample concentration ≥ the reporting limit and <10x the blank concentration.	Data Validator		blank must be less than ½ the reporting limit.
Laboratory Control Sample(LCS)	One per digestion batch of 20 or fewer samples.	Recovery must be within ± 20% of the true value, unless vendor-supplied or statistical limits have been established.	1) Investigate source of problem. 2) Redigest and reanalyze all associated samples.	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Bias / Contamination	Recovery must be within ± 20% of the true value, unless vendor-supplied or statistical limits have been established
Duplicate Sample	One per digestion batch of 20 or fewer samples.	The relative percent difference should be within ≤20% for duplicate spikes.	Flag results	Analyst, Laboratory Supervisor and Data Validator	Precision	The relative percent difference should be within ≤20% for duplicate spikes.
Matrix Spike	One per digestion batch of 20 or fewer samples.	Recovery should be ± 25% of the true value, if sample < 4x spike added.	Flag results.	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Bias	Recovery should be ± 25% of the true value, if sample < 4x spike added.
ICP Serial Dilution	One per digestion batch.	If original sample result is at least 50x the instrument detection limit, 5-fold dilution must agree within ± 10% of the original result.	Flag result or dilute and reanalyze sample to eliminate interference.	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Bias	If original sample result is at least 50x the instrument detection limit, 5-fold dilution must agree within ± 10% of the original result.

Matrix	Soil
Analytical Group	TAL Metals
Analytical Method	SW-846 3050B,

**Project-Specific SAP**

**Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Site Location: MCB Camp Lejeune**

**Title: Preliminary Assessment/Site Inspection**

**Revision Number: 0**

**Revision Date: September 2009**

Matrix	Soil					
SOP Reference	6010B/7471A/ SOP- 100/104/105					
QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per digestion batch of 20 or fewer samples.	Contaminants in the method blank must be less than ½ the reporting limit.	1) Investigate the source of the contamination. Redigest and reanalyze all associated samples if the sample concentration ≥ the reporting limit and <10x the blank concentration.	Analyst, Laboratory Supervisor and Data Validator	Bias / Contamination	Contaminants in the method blank must be less than ½ the reporting limit.
Laboratory Control Sample(LCS)	One per digestion batch of 20 or fewer samples.	Recovery must be within ± 20% of the true value, unless vendor-supplied or statistical limits have been established.	3) Investigate source of problem. 4) Redigest and reanalyze all associated samples.	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Bias / Contamination	Recovery must be within ± 20% of the true value, unless vendor-supplied or statistical limits have been established
Duplicate Sample	One per digestion batch of 20 or fewer samples.	The relative percent difference should be within ≤20% for duplicate spikes.	Flag results	Analyst, Laboratory Supervisor and Data Validator	Precision	The relative percent difference should be within ≤20% for duplicate spikes.
Matrix Spike	One per digestion batch of 20 or fewer samples.	Recovery should be ± 25% of the true value, if sample < 4x spike added.	Flag results.	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Bias	Recovery should be ± 25% of the true value, if sample < 4x spike added.
ICP Serial Dilution	One per digestion batch.	If original sample result is at least 50x the instrument detection limit, 5-fold dilution must agree within ± 10% of the original result.	Flag result or dilute and reanalyze sample to eliminate interference.	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Bias	If original sample result is at least 50x the instrument detection limit, 5-fold dilution must agree within ± 10% of the original result.

**Project-Specific SAP**

**Site Name/Project Name: UXO-12 New River 1000-inch Range (ASR #2.5) and UXO-18 B-6, 50-foot Small Bore Range (ASR #2.44)**

**Site Location: MCB Camp Lejeune**

**Title: Preliminary Assessment/Site Inspection**

**Revision Number: 0**

**Revision Date: September 2009**

**SAP Worksheet #30 -- Analytical Services Table**

[\(UFP-QAPP Manual Section 3.5.2.3\)](#)

<b>Matrix</b>	<b>Analytical Group</b>	<b>Sample Locations/ID Number</b>	<b>Analytical Method</b>	<b>Data Package Turnaround Time</b>	<b>Laboratory / Organization</b>	<b>Backup Laboratory / Organization</b>
Water	Metals/Mercury		6010B/7470A		Empirical Laboratories, LLC 227 French Landing Dr. Nashville, TN 37228 Marcia McGinnity 615-345-1115	
Soil	Metals/Mercury		6010B/7471A			
Water	Perchlorate		6850		Columbia Analytical Services 1 Mustard Street, Suite 250 Rochester, NY 14609 Deb Patton 585-288-5380	
Soil	Perchlorate		6850			