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Final

Confirmatory Sampling Plan
Site 67 Engineer's TNT Burn Site

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Prepared for

Department of the Navy

Naval Facilities Engineering Command
Mid-Atlantic Division

Contract No.
N62470-08-D-1000
CTO-0040

February 2010

Prepared by

CH2MHILL

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Task Order 040

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Department of the Navy
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Atlantic

Under the

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Contract N62470-08-D-1000

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CH2MHILL

Charlotte, North Carolina

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Acronyms and Abbreviations

AHA	activity hazard analysis
ARSR	Archival Records Search Report
ASTM	American Society for Testing and Materials
bgs	below ground surface
BMP	Best Management Practice
CAMA	Coastal Area Management Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action - Navy
COC	chain-of-custody
CTO	Contract Task Order
CWM	Chemical Warfare Materiel
DCM	Division of Coastal Management
DFOW	definable feature of work
DoD	Department of Defense
DPT	direct-push technology
ESV	Ecological Screening Value
ETA	Engineer Training Area
ft	feet or foot
FTL	Field Team Leader
GIS	Geographical Information System
HSP	Health and Safety Plan
IAS	Initial Assessment Study
IDW	investigation-derived waste
INRMP	Integrated Natural Resource Management Plan
IR	Installation Restoration
MBTA	Migratory Bird Treaty Act
MC	munitions constituents
MCB	Marine Corps Base
MEC	munitions and explosives of concern
mg/kg	milligram per kilogram
MRP	Munitions Response Program
MS/MSD	matrix spike/matrix spike duplicate
NAVFAC	Naval Facilities Engineering Command
NC SSL	North Carolina Soil Screening Level
NCAC	North Carolina Administrative Code
NCDENR	North Carolina Department of Environment and Natural Resources

NCGWQS	North Carolina Groundwater Quality Standards
NEPA	National Environmental Policy Act of 1969
NRHP	National Register of Historic Places
PM	Project Manager
QA	Quality Assurance
QC	Quality Control
QCP	Quality Control Plan
RCRA	Resource Conservation and Recovery Act
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan
SHPO	State Historic Preservation Office
SLERA	Screening-level Ecological Risk Assessment
SOP	Standard Operating Procedure
TNT	2,4,6-trinitrotoluene
UFP	Unified Federal Policy
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USMC	United States Marine Corps
UXO	Unexploded Ordnance
WP	Work Plan

SECTION 1

Introduction

Marine Corps Base (MCB) Camp Lejeune is planning to conduct confirmatory sampling at Site 67 Engineer's TNT (2,4,6-Trinitrotoluene) Burn Site (Site 67). Due to the historical activities at Site 67, the potential presence of munitions and explosives of concern (MEC) and their impact upon soil and groundwater will be assessed under the munitions response program (MRP). This investigation will be conducted by CH2M HILL under the Naval Facilities Engineering Command (NAVFAC) Comprehensive Long-Term Environmental Action – Navy (CLEAN) Contract N62470-08-D-1000, Contract Task Order (CTO) 40.

1.1 Project Objectives

The primary objective of the Site 67 confirmatory sampling is to evaluate the potential presence and nature of impacts to environmental media related to reported past use of Site 67 as a TNT burn site and to evaluate whether additional investigation is necessary. Accordingly, this investigation will focus upon munitions constituents (MC) impacts to soil and groundwater. The following activities will be performed in accordance with methods and procedures detailed in the MCB Camp Lejeune MRP Master Project Plans (CH2M HILL, 2008) (referred to herein as the MRP Master Project Plans) to accomplish the project objectives:

- Conduct research to identify historical activities that may have resulted in environmental contamination or MEC being present at the site, including review of archival records and interviewing current and former installation personnel
- Evaluate the presence and nature of impacts to the environment by conducting an investigation of soil and groundwater
- Conduct ecological and human health risk screenings using analytical data collected at Site 67
- Prepare a Confirmatory Sampling Report

Several historical and operational range fans overlap Site 67. For this reason, MEC related to other range activities may have impacted this site. Only those potential impacts related to the use of Site 67 for TNT burning in pits are being investigated during this confirmation study. Strict MEC avoidance procedures will be employed during field activities in accordance with the appended Health and Safety Plan (HSP) (**Appendix A**).

1.2 Work Plan Organization

This Work Plan (WP) is divided into sections providing information on the detailed approach including procedures to be employed during the execution of the project.

This WP is organized as follows:

- **Section 1, Introduction,** provides general information about this WP, describes Site 67, 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 Confirmatory Sampling.
- **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, direct push technology (DPT) boring 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) of the Confirmatory Sampling activities at Site 67.
- **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 at Site 67.
- **Section 6, References,** lists the references cited in the preceding sections.
- **Appendix A, Health and Safety Plan (HSP),** provides an interface with CH2M HILL's overall health and safety program. The HSP also includes the MEC avoidance procedures that will be used to ensure that onsite personnel are protected from MEC that may be present at the site.
- **Appendix B, 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 C, Sampling Analysis Plan (SAP) Cross-Walk Table,** presents the Unified Federal Policy (UFP) SAP cross-walk table and applicable worksheets for the proposed investigation activities.

1.3 Site Location and Description

Site 67 comprises approximately 4 acres immediately north of Traps Bay on MCB Camp Lejeune (**Figure 1-1**). Based on the current aerial imagery (**Figure 1-1**), the area is heavily vegetated and with approximately 2.5 acres of the site being classified as jurisdictional wetland. The area to the west of Site 67 is located within a currently operational range, Engineer Training Area (ETA)-1D. Access to Site 67 may be limited when ETA-1D is in use.

1.4 Site History

Site 67 was identified in a Base-wide Initial Assessment Study (IAS) as the Engineer's TNT Burn Site, used for TNT disposal in 1951. The study claims that "2- to 3-foot pits were dug and unwanted TNT was opened and burned. Complete consumption of all TNT was reported during these procedures" (Water and Air Research, 1983). The IAS concluded that the quantity of any waste disposed at Site 67 was insignificant and did not warrant further investigation.

In May 2009, CH2M HILL completed a detailed investigative review of information relating to Site 67 and conducted interviews with current and former Base personnel. The investigative review emphasized obtaining information identifying historical activities that may have resulted in environmental contamination of the project area. Information obtained during this effort is presented in the Archival Records Search Report (ARSR) provided in **Appendix B**. Historical range maps and other site features are shown in the ARSR figures.

Based on the historical records review, three historic ranges (the Engineer Firing Range, Engineer Demolition Area I-1, and the I-2 Demolition Area) and one operational range (ETA 1D) overlap the boundary of Site 67.

The Engineer Firing Range was used in 1947 by the Engineer School for combat engineer training. Munitions authorized for use at this range include anti-tank and rocket grenades, demolitions, and flame throwers. The area used as the Engineering Firing Range was also in the same location as the Engineer Demolition Area I-1 which appears on a 1947 map of Camp Lejeune. Records indicate that a demolitions course was taught at the Engineer School through the 1950's, however there are no maps available from the 1950's showing a demolitions area. Based on historical records review, it is assumed that the Engineer Firing Range and Engineer Demolition Area I-1 were in use from 1947 through approximately 1960. The boundary of both of these ranges/areas fully encompasses Site 67 (USACE, 2001).

Records indicate that the I-2 Demolitions Area was in use from 1960 to 1988. It appears on one range map in 1987. A 1962 aerial photograph shows a cleared area in the western portion of Site 67 just outside of the wetland area. This area was likely part of the I-2 Demolitions Area. The next available aerial imagery from 1989 shows significant vegetation growth at Site 67, indicating the area may not have been in use as a demolitions area at this time.

ETA–1 appears on the 1993 range map, and does not appear to overlap Site 67. However, a base map showing 2005 existing conditions identifies the ETA-1D range encompassing Site 67. The ammunition authorized for use at ETA-1 includes demolitions, claymore mines, antitank mines, Bangalore torpedoes, and pyrotechnics (USMC, 2006a).

According to the *Range Identification Preliminary Range Assessment* report (USACE, 2001) by the United States Army Corps of Engineers (USACE), the following munitions were reportedly used in the vicinity of Site 67 between 1946 and the present include:

- Demolitions
- 2.36-inch anti-tank rockets
- Rifle grenades
- Flamethrowers

- Antitank mines
- Claymore mines
- Mine clearing line charges
- Bangalore torpedoes.

1.5 Climate

The climate in the MCB Camp Lejeune area is discussed in **Section 1.4** of the MRP Master Project Plans (CH2M HILL, 2008).

1.6 Geology and Hydrogeology

The regional geology and hydrogeology at MCB Camp Lejeune is discussed in **Section 1.6 and 1.7** of the MRP Master Project Plans. Site-specific geologic and hydrogeologic data is not available for this site, but will be evaluated during the confirmatory sampling activities and presented in the Confirmatory Sampling Report.

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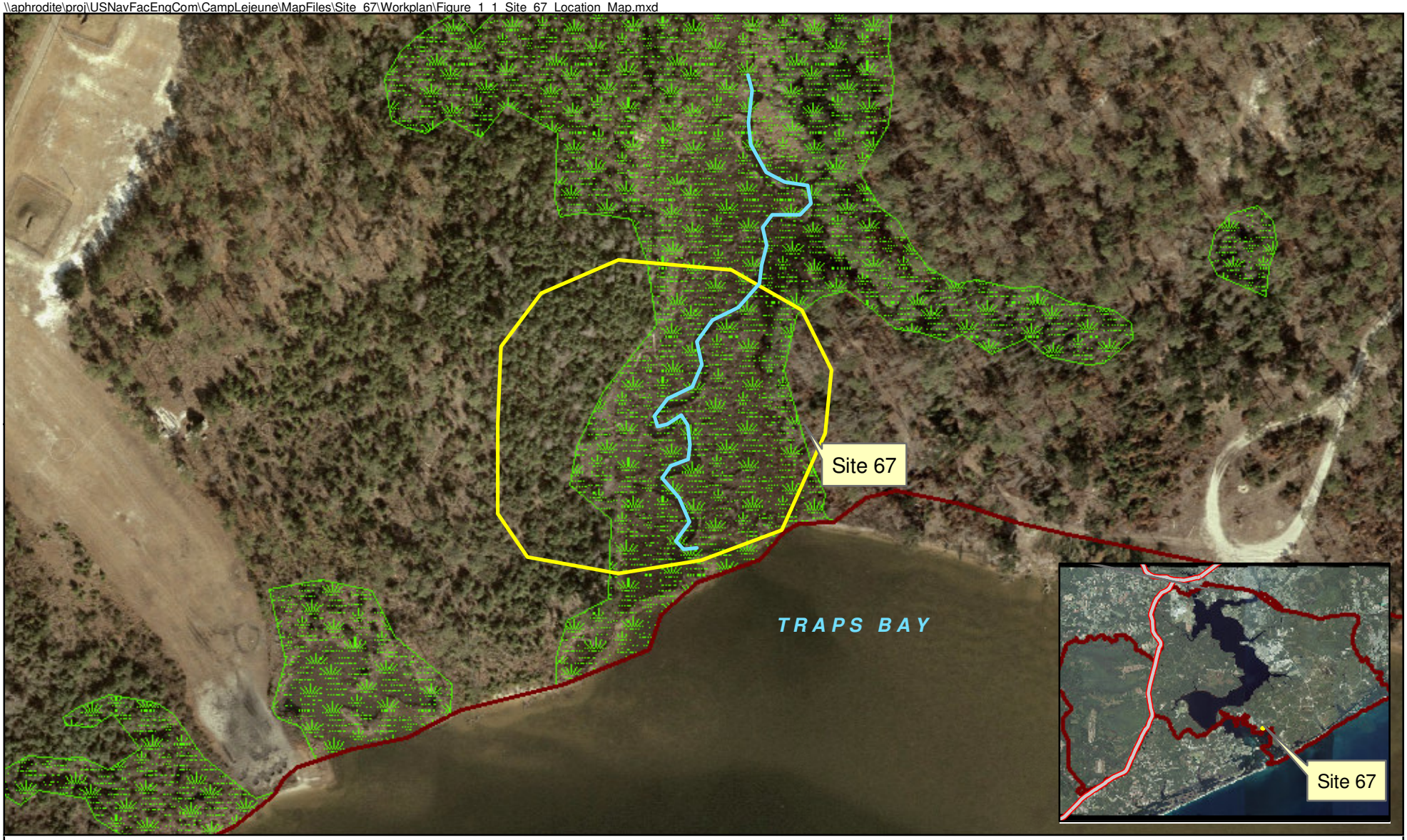


Legend
- Creek
- Site 67
- Installation Boundary
- Jurisdictional Wetlands

N

0 100 200 400 Feet

1 inch = 200 feet

Figure 1-1
Site Location Map
Site 67 Confirmatory Sampling Work Plan
MCB Camp Lejeune
North Carolina

CH2MHILL

SECTION 2

Technical Management Plan

2.1 Guidance, Regulations, and Policies

The confirmatory sampling investigation at Site 67 will be conducted under the guidance documents, regulations, and polices described in **Section 2.1** of the MRP Master Project Plans.

2.2 MEC Contingency Procedures

Strict MEC avoidance procedures will be adhered to at all times during the Site 67 site investigation. Though no MEC is anticipated in relation to past use of Site 67 for TNT burning, other historical or operational range activities may have impacted the site. MEC avoidance and contingency procedures are detailed in the HSP provided in **Appendix A** and MEC contingency procedures of **Section 2.2** of the MRP Master Project Plans.

2.3 Chemical Warfare Materiel Contingency Procedures

Based on the documented history of Department of Defense (DoD) activities at the Site 67, it is not anticipated that chemical warfare materiel (CWM) will be discovered. However, if CWM is encountered, all work will immediately cease and CWM contingency procedures will be conducted in accordance with **Section 2.3** of the MRP Master Project Plans.

2.4 Project Organization, Personnel, Reporting, and Schedule

2.4.1 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.

2.4.2 Project Personnel

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

2.4.3 Project Schedule

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

2.5 Technical Approach

2.5.1 Project Planning

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

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

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

Subcontractor procurement is also included under this task. Anticipated subcontractor services include buried utility locating, land surveying, vegetation clearing, DPT groundwater sampling, laboratory analysis, data validation, and investigation-derived waste (IDW) management.

2.5.2 Archive Records Search Review

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

2.5.3 Site Investigation

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

- MEC avoidance
- Land surveying
- Buried utility locating
- Vegetation clearance
- DPT boring installation and abandonment
- Environmental sampling
- IDW management

2.5.4 Sample Management, Analysis, and Validation

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

2.5.5 Geographical Information System

All environmental data will be collected in preparation for the creation of a geographical information system (GIS) tailored for the investigative needs of Site 67. All digital data will be created using a software platform that will allow it to be loaded directly into the GIS. The

GIS tools are used to manage the project, assemble data, and help determine areas requiring further investigation.

CH2M HILL will also provide the Site 67 GIS data for upload into the existing MCB Camp Lejeune GIS. This data will include ArcView project and shape files that best delineate the area on the basis of uses, site conditions, and other information gathered during the study.

2.5.6 Confirmatory Sampling Report

A draft Confirmatory Sampling Report will be prepared to document the findings of the field investigation. The draft Confirmatory Sampling 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.

The preliminary ecological risk screening will include a brief description of the ecosystems potentially at risk, a figure depicting the ecosystems, results of a comparison of maximum detected concentrations to ecological screening values (ESVs) in tabular form and recommendations for further evaluation, if required. This preliminary ecological risk screening will not constitute a full Screening Level Ecological Risk Assessment (SLERA).

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

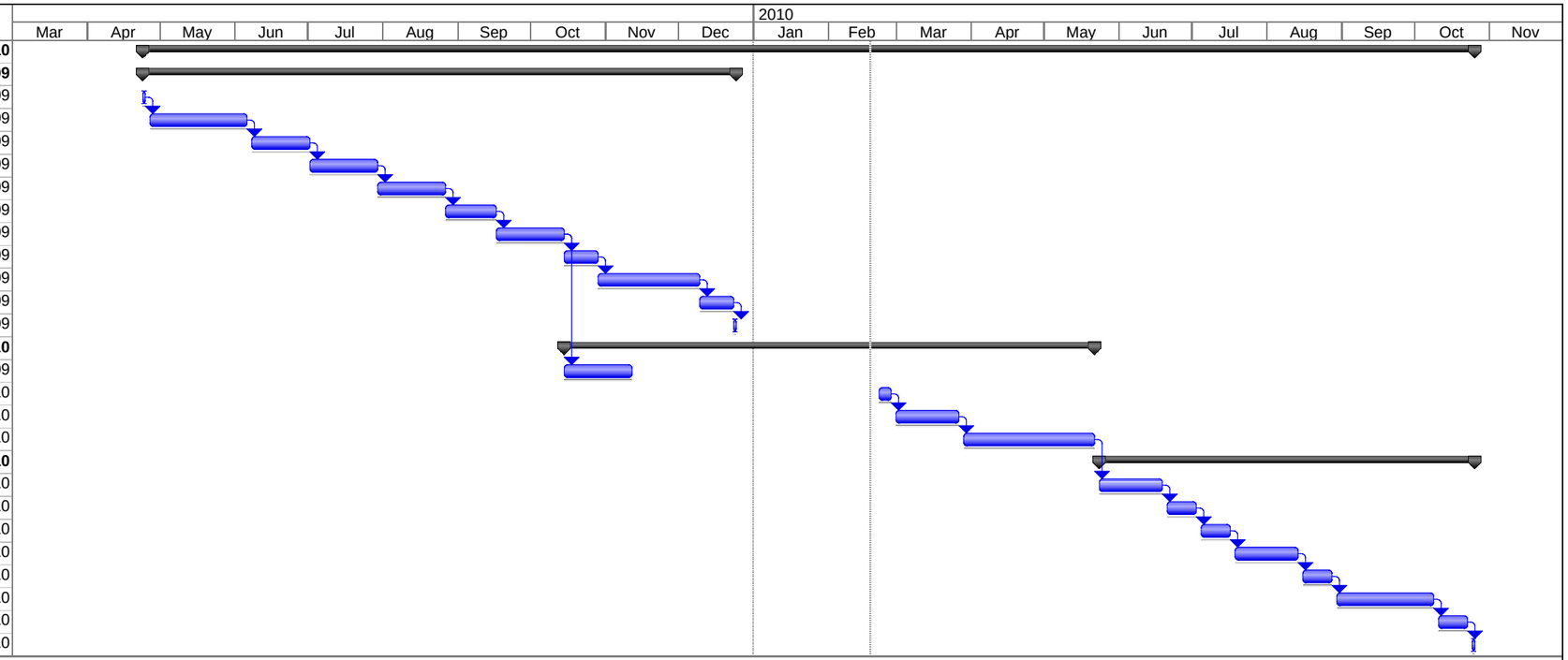
- Soil data will be compared to USEPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites (USEPA, 2009) and the NCDENR Hazardous Waste Section (HWS) Soil Screening Levels (SSLs) (NCDENR, 2009).
- Groundwater data will be compared to USEPA RSLs for Chemical Contaminants at Superfund Sites (USEPA, 2009) and North Carolina Groundwater Quality Standards (NCGWQS) (NCAC, 2010).

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
Site 67 Confirmatory Sampling Work Plan, Engineer's TNT Burn Pit
MCB Camp Lejeune
Jacksonville, North Carolina

Name/Title/Organization	Mailing Address	Telephone/Fax/E-mail
Hope Oaks Project Manager	CH2M HILL 1000 Abernathy Road Suite 1600 Atlanta, GA 30328	678-530-4226 (office) 678-656-5411 (fax) Hope.Oaks@ch2m.com
Renee Clore, P.E. Task Manager	CH2M HILL 125 S. Wacker Drive Suite 3000 Chicago, IL 60606	312-873-9758 (office) 312-873-9801 (fax) Renee.Clore@ch2m.com
Matt Louth, P.G. Activity Manager	CH2M HILL 5700 Cleveland Street Suite 101 Virginia Beach, VA 23462	757-518-9666 (office) 757-460-4592 (fax) Matt.Louth@ch2m.com
Kyra Donnell Senior Consultant	CH2M HILL 2095 Lakeside Centre Way Suite 200 Knoxville, TN 37922	865-560-2883 (office) 865-607-0502 (cell) Kyra.Donnell@ch2m.com
Thomas M. Roth, P.E. Senior Consultant	CH2M HILL 2607 Lavista Road Decatur, GA 30033-1725	404-474-7640 (office) 404-259-6674 (cell) 770-604-9183 (fax) Tom.Roth@ch2m.com
Mark Orman Program H&S Manager	CH2M HILL 135 South 84th Street Suite 325 Milwaukee, WI 53214	414-847-0597 (office) 414-712-4138 (cell) Mark.Orman@ch2m.com
Ben Redmond Munitions Response Market Segment Director	CH2M HILL 2035 Lakeside Centre Way Suite 200 Knoxville, TN 37922	865-560-2801 (office) 865-560-2802 (fax) bredmond@ch2m.com
Tim Garretson MEC Integrator/Senior MEC Technical Consultant	CH2M HILL 5700 Cleveland Street Suite 101 Virginia Beach, VA 23462	757-671-8311 (office) 757-460-4592 (fax) timothy.garretson@ch2m.com
Dan Young, CSP, CSRP Corporate MEC H&S Manager	CH2M HILL 10687 Aloe Lane Lillian, AL 36549	251-962-2963 (home office) 251-752-0148 (cell) Dan.Young@ch2m.com
Kevin Lombardo MR Operations Manager	CH2M HILL 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703-376-5175 (office) 703-608-8247 (cell) Kevin.Lombardo@ch2m.com

ID	Task Name	Duration	Start	Finish
1	**Site 67 (Subproject 12)**	**392 days**	**Fri 4/24/09**	**Mon 10/25/10**
2	**Work Plan Addendum**	**175 days**	**Fri 4/24/09**	**Thu 12/24/09**
3	Mod 2	1 day	Fri 4/24/09	Fri 4/24/09
4	ASR	30 days	Mon 4/27/09	Fri 6/5/09
5	Active demo area resolution	18 days	Mon 6/8/09	Wed 7/1/09
6	Draft	20 days	Thu 7/2/09	Wed 7/29/09
7	Senior Review	20 days	Thu 7/30/09	Wed 8/26/09
8	Incorporate Comments	15 days	Thu 8/27/09	Wed 9/16/09
9	Navy and Base Review	20 days	Thu 9/17/09	Wed 10/14/09
10	RTC	10 days	Thu 10/15/09	Wed 10/28/09
11	Team Review	30 days	Thu 10/29/09	Wed 12/9/09
12	RTC	10 days	Thu 12/10/09	Wed 12/23/09
13	Final	1 day	Thu 12/24/09	Thu 12/24/09
14	**Field Work**	**157 days**	**Thu 10/15/09**	**Fri 5/21/10**
15	Field Prep and Sub Procurement	20 days	Thu 10/15/09	Wed 11/11/09
16	Environmental Sampling	5 days	Mon 2/22/10	Fri 2/26/10
17	Laboratory Analysis	20 days	Mon 3/1/10	Fri 3/26/10
18	Data Management	40 days	Mon 3/29/10	Fri 5/21/10
19	**Reporting**	**111 days**	**Mon 5/24/10**	**Mon 10/25/10**
20	Draft	20 days	Mon 5/24/10	Fri 6/18/10
21	Senior Review	10 days	Mon 6/21/10	Fri 7/2/10
22	Incorporate Comments	10 days	Mon 7/5/10	Fri 7/16/10
23	Navy and Base Review	20 days	Mon 7/19/10	Fri 8/13/10
24	RTC	10 days	Mon 8/16/10	Fri 8/27/10
25	Team Review	30 days	Mon 8/30/10	Fri 10/8/10
26	RTC	10 days	Mon 10/11/10	Fri 10/22/10
27	Final	1 day	Mon 10/25/10	Mon 10/25/10



Project: Site 67 Project Schedule
Date: Thu 2/18/10

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Figure 2-1
Site 67 Project Schedule
Site 67 Confirmatory Sampling Work Plan

SECTION 3

Field Investigation Plan

3.1 Overall Approach

The objectives for this field investigation are to evaluate the presence and nature of MC contamination that may exist within the 4-acre Site 67. All field activities will be conducted in accordance with the Standard Operating Procedures (SOPs) provided in the MRP Master Project Plans (CH2M HILL, 2008). The field investigation will include the following activities:

- Field screening of site soils will be performed with the Expray™ colorimetric field method to assess whether explosive soil is present at site sampling locations prior to soil and groundwater sampling.
- Surface soil samples will be collected at a minimum of three sampling locations at a depth interval of 0-1 feet below ground surface (bgs).
- Subsurface soil samples will be collected from eight locations at depth intervals of 1-2 feet, 2-3 feet, and 3-4 feet bgs. Subsurface soil samples may be combined into composite samples at each sample location. This determination will be made in the field based on observed site conditions.
- Three groundwater samples will be collected from DPT borings within the surficial aquifer.
- Sampling locations may be modified or added based on observed site conditions such as evidence of soil disturbance or soil staining.

The field investigation activities are detailed below and reference the MRP Master Project Plans.

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 intrusive site investigation activities.

3.2.1 Mobilization

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

General Activities

- Identify/procure, package, ship, and inventory project equipment, including hand tools and supplies
- Coordinate with local agencies, including MCB Camp Lejeune, Base Range Control, and other agencies, as appropriate
- Coordinate communications and other logistical support
- Test and inspect equipment
- Conduct site-specific training on this WP and MEC hazards and avoidance procedures
- 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. This meeting will include a review of this WP and a review and acknowledgment of the HSP by all site personnel. Additional meetings will occur as needed, as new personnel, visitors, and/or subcontractors arrive at the site.

3.2.2 Buried Utility Clearance

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

3.2.3 Site Survey

Land surveying services will be conducted in accordance with **Section 7.4** of the MRP Master Project Plans (CH2M HILL, 2008). The surveying at Site 67 will consist of two phases:

- **Phase 1** will be a survey of the proposed sampling locations and vegetation clearance paths.
- **Phase 2** of the land surveying will occur after environmental sampling activities have concluded at the site and will entail surveying of the coordinates and elevations of the soil and groundwater sampling locations.

MEC avoidance will be performed during all phases of surveying activities in accordance with the MEC avoidance procedures included in the HSP. Unexploded Ordnance (UXO) technicians will escort surveying personnel while onsite and will clear all locations where stakes are driven. Procedures in the event MEC is encountered are detailed in the HSP (**Appendix A**).

3.2.4 Vegetation Removal

Vegetation less than 6 inches in diameter will be removed to provide unimpeded access to the selected sampling locations. Vegetation clearing will be accomplished using a

combination of mechanical and manual methods. Felled brush and trees will be mulched and left in place. Trees greater than 6 inches in diameter will not be removed unless absolutely necessary.

Personnel using tools such as hand saws, chainsaws, and string trimmers/brush cutters must use appropriate personal protective equipment. To prevent accidental contact with exposed MEC, string trimmers/brush cutters with a metal blade and chainsaws shall be used only in areas where there is a clear view of the cutting path of the blade.

During the vegetation removal process, UXO technicians will conduct MEC avoidance activities in accordance with the MEC avoidance procedures included in the HSP (**Appendix A**). Procedures in the event MEC is encountered are also detailed in the HSP.

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 as detailed in **Section 5**.

3.2.5 Site Restoration and Demobilization

Site Restoration

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

3.4 Field Sampling Plan

3.4.1 Field Operations

In order to assess the presence and nature of MC contamination that may exist at the 4-acre investigation area, the project team will investigate soil and groundwater at Site 67. This will include collecting surface and subsurface soil samples using a hand auger and groundwater samples from DPT borings. QA/QC samples will be collected per **Section 3.6.2**. Non-sparking hand augers and other tools will be used during the field investigation. Planned

sampling locations are shown in **Figure 3-1**, but may be modified based on field conditions. Sample locations have been focused in the western portion of Site 67 based the IAS site description and the ARSR findings. Groundwater sample locations are co-located with the surface and subsurface soil samples.

MEC and anomaly avoidance will be practiced during soil sampling as described in **Section 2.5** of the HSP (**Appendix A**). A UXO technician will scan each sample locations with a downhole magnetometer at 1-foot increments. The UXO technician will also observe the cuttings generated with the hand auger for evidence of unburned propellant and other hazards.

Explosive Soil Screening

As the reported past use of the site involved burning of TNT in pits, field screening of site soils will be employed to ensure no explosives soils are present prior to sampling. The U.S. Army Environmental Command has established a level of 10% as the concentration of secondary explosives in soil at which a detonation would not propagate. The Corps and USEPA have adopted the findings, and soils containing more than 10% secondary explosives by weight should be considered explosive. It should be noted that concentrations as high as 100,000 milligrams per kilogram (mg/kg) of secondary explosives are rarely encountered on training ranges and are more typically associated with explosive production sites where production waste was dumped directly in the ground or in lagoons.

To minimize potential impact to body and limb, the field team will be limited to one UXO technician and two field technicians, as necessary. All non-essential personnel will be evacuated from the site. Following surface and near surface clearance by the UXO technician, the field technician will use a non-sparking hand auger to sample soils at the 1-2 foot, 2-3 foot, and 3-4 foot depth intervals at the eight subsurface sampling locations (designated IR67-IS01 through IR67–IS08) and shown in **Figure 3-1**. The 1-2 foot, 2-3 foot, and 3-4 foot depth intervals are the intervals that would have likely been impacted by the 2-3 foot deep TNT burn pits reported at Site 67. Additionally three surface soil samples (designated IR67-SS01 through IR67-SS03) will be collected at the 0-1 foot depth interval. Sample locations have been focused in the western portion of Site 67 based the IAS site description and the ARSR findings.

Soils will be screened using the Expray™ colorimetric field method, by placing 0.5 to 1 gram of soil onto the provided filter paper and proceeding with the kit-specific directions. Field screening will be limited to TNT only. Soil samples should <u>not</u> be homogenized prior to testing with the Expray method. Rather, soil should be selected from discrete intervals of handauger cuttings for testing. Upon application of the Expray 1 aerosol, a faint dark brown color will indicate the presence of TNT and sampling may continue. An intense dark brown color will indicate a concentration of TNT greater than approximately 500 ppm. This high concentration may or may not be accompanied by a discoloration in site soils.

In the event that high concentrations of TNT are indicated, the sampling point will be flagged, site work will cease and sampling procedures will be re-evaluated.

Surface and Subsurface Soil Sampling

If field screening indicates that no explosive soils are present, surface and subsurface soil samples will be collected within the intervals indicated above. Soil collected at each sample interval will be homogenized in a stainless steel bowl prior to filling the appropriate sample containers. Soil samples will not be collected below the water table. Soil sampling locations have been focused in the western portion of Site 67 based the IAS site description and the ARSR findings.

Soil types encountered will be classified according to the American Society for Testing and Materials (ASTM) Standard D2488-69, "Description of Soils (Visual-Manual Procedure)." Soil descriptions will comply with the Unified Soil Classification System (USCS).

Samples will be analyzed by a fixed base laboratory using SW-846 USEPA Method 8330 for the following explosives residue compounds (refer to **Tables 3-1** through **3-3**):

- 2,4,6-Trinitrotoluene
- 4-Amino-2,6-Dinitrotoluene
- 2-Amino-4,6-Dinitrotoluene

Groundwater Sampling

Groundwater grab samples will be collected at the three locations as shown on **Figure 3-1.** A UXO technician will scan each DPT groundwater sampling location with a downhole magnetometer at 1-foot increments. The UXO technician will also observe the cuttings generated from the DPT rig for evidence of unburned propellant and other hazards. Shallow groundwater samples will be collected from the DPT rods.

Samples will be analyzed by a fixed base laboratory using SW-846 USEPA Method 8330 for the following explosives residue compounds (refer to **Tables 3-1** through **3-3**):

- 2,4,6-Trinitrotoluene
- 4-Amino-2,6-Dinitrotoluene
- 2-Amino-4,6-Dinitrotoluene

Following sampling, all boreholes will be abandoned by the DPT subcontractor in accordance with North Carolina Well Construction Standards (NCAC, 2001).

A summary of the sampling program for Confirmatory Sampling activities at Site 67 are presented in **Table 3-1**.

3.4.2 Analytical Requirements and Sample Handling

Sample Preservation and Handling

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

Quality Assurance and Quality Control

QA/QC requirements for environmental sampling, handling, and management are detailed in **Section 8** 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.

For each sample collected, the sampling team will record the sample identification, analytical requirements, date and time of collection, and other pertinent information in the field logbook.

Labels for samples sent to a laboratory for analysis will be produced electronically. If they cannot be produced electronically, they must be written in indelible ink.

The following information typically is included on the sample label:

- Site name or identifier
- 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#: Site 67 is included in the Installation Restoration (IR) program. Therefore, the prefix "IR67-" will be used

Station#: GW = Groundwater from DPT rods
IS = Subsurface soil
SS = Surface soil

Each groundwater sampling 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
MS = Matrix Spike
SD = Matrix Spike Duplicate

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

"10" = year 2010
"A" = Sampling during the first quarter of the year

Depth Interval: Depth indicators will be used for soil samples collected. The number will reference the depth interval of the sample:

2–3 = 2 to 3 feet (ft) bgs

Under this sample designation format, "IR67-GW01-09A" would mean the following:

IR67-GW01-10A	Site 67
IR67-GW01-10A	Groundwater from sampling location #1
IR67-GW01-10A	Sampled during the first quarter of 2010

Under this sample designation format, "IR67-IS01-09A" would mean the following:

IR67-IS01-2-3-10A	Site 67
IR67-IS01-2-3-10A	Subsurface soil sample from sampling location 1
IR67-IS01-2-3-10A	Sample collected from the 2-3 foot depth interval
IR67-IS01-2-3-10A	Sampled during the first quarter of 2010

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. IDW includes soil cuttings from the DPT and hand augered borings and liquid waste (e.g., purged groundwater or decontamination fluids) generated during groundwater sampling.

3.5 Health and Safety Plan

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

3.6 Data Documentation and Processing Procedures

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

3.7 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.

TABLE 3-1
Summary of Sampling Program
Site 67 Confirmatory Sampling Work Plan, Engineer's TNT Burn Pit
MCB Camp Lejeune
Jacksonville, North Carolina

Sample Media	Sample ID Number	Sample Depth/Location and Rationale	Analysis
			Explosives Residue
Surface Soil	IR67-SS01-0-1 through IR67-SS03-0-1	Surface soil samples will be collected at a depth of 0-1 foot at each location shown on **Figure 3-1** to allow for characterization of surface soil.	X
Subsurface Soil	IR67-IS01-T-B through IR67-IS08-T-B	Subsurface soil samples will be collected from the 1-2 foot 2-3 foot, and 3-4 foot depth intervals at each location shown on **Figure 3-1** to allow for characterization of subsurface soil.	X
Groundwater	IR67-GW01 through IR67-GW03	Samples will be collected from DPT rods at each location shown on **Figure 3-1** to allow for characterization of site groundwater.	X

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

TABLE 3-2
Analyses, Bottleware, Preservation, and Holding Time Requirements
Site 67 Confirmatory Sampling Work Plan, Engineer's TNT Burn Pit
MCB Camp Lejeune
Jacksonville, North Carolina

Media	Analysis	Method	Container	Preservation & Storage	Holding Times
Soil	Explosives Residue	SW-846 Method 8330	1x8-oz bottle, Teflon cap(8330) or 2x16 oz wide mouth glass jars (8330B)	4ºC	7 days to extraction, 40 days from extraction to analysis
Groundwater	Explosive Residues	SW-846 Method 8330	2x1-L amber jar	4ºC	7 days to extraction, 40 days from extraction to analysis

Notes: L = Liter, oz = ounce, HNO_3 = nitric acid

TABLE 3-3
Required QA/QC Samples
Site 67 Confirmatory Sampling Work Plan, Engineer's TNT Burn Pit
MCB Camp Lejeune
Jacksonville, North Carolina

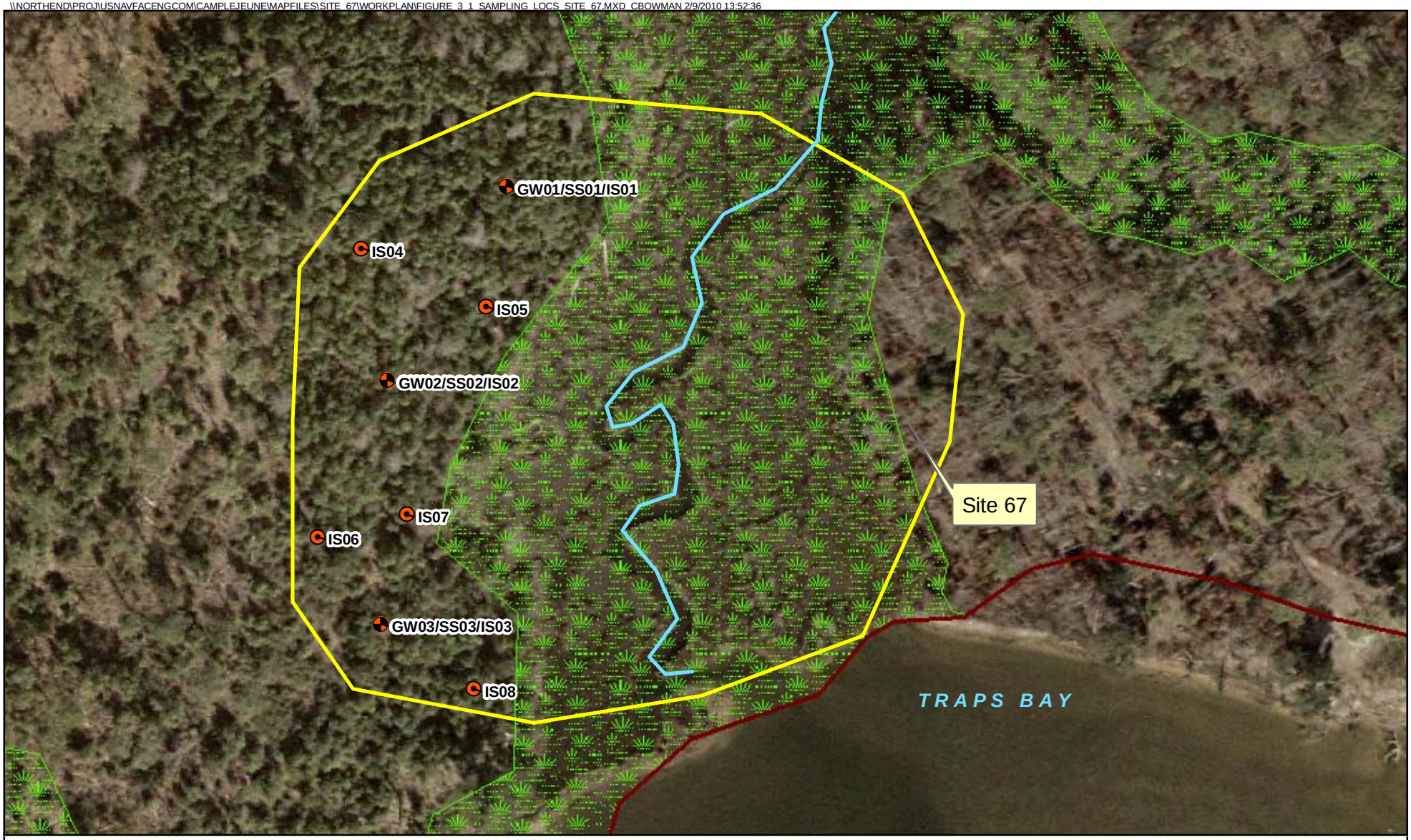
Sample Type	Description	Frequency	Analytes
Field Blank	Designed to detect contamination in the decontamination water. A field blank is decontamination water collected directly in the sample bottle. It shall be handled like a sample and transported to the laboratory for analysis.	One field blank from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

TABLE 3-4
Sample Collection Frequencies
Site 67 Confirmatory Sampling Work Plan, Engineer's TNT Burn Pit
MCB Camp Lejeune
Jacksonville, North Carolina

Analysis	Sample Matrix	Field Samples	Field Duplicates	Equipment Blanks	Field Blanks	MS/MSDs
Subsurface Soil Samples						
Explosives Residue	Solid	24	3	2	1	2
Temporary Well Groundwater Samples						
Explosives Residue	Aqueous	3	1	1	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

\\NORTHEND\PROJ\USNAVFACENGCOM\CAMPLEJEUNE\MAPFILES\SITE_67\WORKPLAN\FIGURE_3_1_SAMPLING_LOCS_SITE_67.MXD CBOWMAN 2/9/2010 13:52:36



Legend

- Subsurface Soil Sampling Location
- Surface and Subsurface Soil/Groundwater Sampling Locations
- Creek
- Site 67
- Installation Boundary
- Jurisdictional Wetlands

N

0 50 100 200 Feet

1 inch = 100 feet

Figure 3-1
Site 67 Sampling Locations
Site 67 Confirmatory Sampling Work Plan
MCB CamLej
North Carolina

CH2MHILL

SECTION 4

Quality Control Plan

All applicable work conducted by CH2M HILL and its subcontractors at the Site 67 will be performed in accordance with the QCP in **Section 8** of the MRP Master Project Plans. The QCP describes the QC approach and procedures to be employed during the investigation of Site 67. The QCP is divided into two parts: **Section 8.1** addresses field investigation activities and **Section 8.2** addresses MEC avoidance and surveying.

The specific QC audit procedures for the definable features of work (DFOW) to be employed at Site 67, 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
Site 67 Confirmatory Sampling Work Plan, Engineer's TNT Burn Pit
MCB Camp Lejeune
Jacksonville, North Carolina

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

TABLE 4-1
Definable Features of Work Auditing Procedures
Site 67 Confirmatory Sampling Work Plan, Engineer's TNT Burn Pit
MCB Camp Lejeune
Jacksonville, North Carolina

Definable Feature of Work with Auditable Function	Responsible Person(s)[1]	Audit Procedure[2]	QC Phase[3]	Freq. of Audit	Pass/Fail Criteria	Action if Failure Occurs
Demobilization	Project Manager, Site Manager	Verify facilities-support infrastructures are dismantled and shipped to appropriate location and area is returned to original condition.	FP	O	Facilities-support infrastructures are dismantled and shipped to appropriate location and site is returned to original condition.	Ensure that all support facilities are removed and that the site is returned to original condition
Final Project Reports and Closeout						
Site Specific Final Report preparation and approval	Project Manager	Verify that documentation of field actions and analytical results are accurate and complete.	IP	O	Documentation of field activities and analytical results are accurate and complete.	Ensure that documentation of field activities and analytical results are accurate and complete.
Archiving	GIS Manager	Verify data back-up systems are in place.	IP	O	Data back-up systems are in place	Ensure data back-up systems are in place
Project Closeout	Project Manager	Verify purchase orders have been closed out.	IP	O	Purchase orders have been closed out	Ensure purchase orders are closed out
Project Closeout	Project Manager	Verify invoices completed and approved.	IP	O	Invoices completed and approved	Ensure invoices are completed and approved

Notes:
IAW = in accordance with

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

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

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

SECTION 5

Environmental Protection Plan

5.1 Regional Ecological Summary

A summary of the regional ecological 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 observed in the vicinity of and aboard MCB Camp Lejeune such as the American alligator, the green sea turtle, the loggerhead sea turtle, the piping plover, the red-cockaded woodpecker, bald eagle, seabeach amaranth, and the rough-leaf loosestrife (USMC, 2006b). **Table 5-1** lists those species that could occur in Onslow County that are listed as threatened, endangered, or of special concern by the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act of 1973, as amended. MCB Camp Lejeune has active programs in place to protect the three federally protected avian species (American bald eagle, piping plover, and red cockaded woodpecker) that are known to occur on the base.

MCB Camp Lejeune worked with the USFWS to establish guidelines for military training in red-cockaded woodpecker cluster sites. Additionally, through Section 7 consultation, the Base implemented measures to properly manage the red-cockaded woodpecker habitats located on base (loblolly pine *[Pinus taeda]* and 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, 2006b). Site 67 is not within the vicinity of any of the current red-cockaded woodpecker management areas. The nearest cluster site is approximately 1.5 miles southeast of the site.

The bald eagle was removed from the USFWS endangered/threatened species list in August 2007 and is currently protected under the Federal Migratory Bird Treaty Act (MBTA) (16USC703712, as amended 1918), which protects all migratory birds, the Bald and Golden Eagle Protection Act (16USC668, amended 1962), and the National Bald Eagle Management Guidelines (USFWS, 2007). An active bald eagle's nest and an alternate nest are documented approximately 4,000 feet south of the site, across Traps Bay. Another nest is located at the junction of Sneads Creek and the New River, approximately 3.2 miles northwest of Site 67. Protective buffers that restrict ground and air-use activities have been established at approximately 330 ft; 660 ft; 1,000 ft; and 1,500 ft from the nest sites. The Site 67 is not within any of these buffer zones. However, non-nesting eagles may use Site 67 as transients or for foraging. The Site 67 is approximately 60 percent wetlands or waterways and may be used by eagles for foraging when humans are not present. The proposed work will be concentrated on the 1.5 acres of dry land on the western side of Site 67. Eagles would avoid the area during the work, but there are ample suitable foraging areas in the region so that no impacts would occur. No negative impacts to bald eagles are to be expected.

The Atlantic coast populations of piping plovers tend to prefer sandy beaches close to the primary dunes of barrier islands and coastlines. The species prefers sparsely vegetated open sand, gravel, or cobble for nesting sites and forage along the rack line where the tide washes onto the beach. Suitable habitat for the piping plover does not exist at Site 67.

Two species, the green sea turtle and the loggerhead sea turtle, are listed as threatened, are known to nest at Camp Lejeune on Onslow Beach, approximately 4.4 miles east of Site 67. Beaches and foraging habitat for the marine species, such as seagrass for manatees may be found in the bay downgradient of the site. Site activities in support of this work plan are limited to a shallow soil samples across the site and small number of groundwater samples. Work activities are not likely to impact these species. No impacts to these species are expected.

The American alligator is listed on the Federal Threatened and Endangered species list due to its similarity of appearance to the American crocodile. Potentially suitable foraging habitat for the American alligator exists at Site 67 and the species may occur in the project area as a transient. The American Alligator would not nest in Site 67, as the vegetation is unsuitable. The species would be expected to leave the area during the high level of human activity associated with the project. No impact to this species is expected.

The federally listed rough-leaved loosestrife does not occur in marshes or on islands. It would not occur in Site 67 because the habitat is unsuitable. No impacts to rough-leaved loosestrife would occur.

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. There are no primary dunes adjacent to Site 67. This plant is generally found along Onslow Beach and would not occur on or adjacent to Site 67.

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 at Site 67. Project design features have been developed to prevent impacts to listed species.

5.3 Wetlands Within the Project Site

Jurisdictional wetland areas are located at Site 67 (**Figure 1-1**). The investigative activities will be located on the western side of Site 67 outside of the wetland area. However, if work in areas determined to be jurisdictional wetlands is completed, the U.S. Army Corps of Engineers Wilmington District will be contacted to obtain the necessary authorization.

In order to install the DPT borings and to collect environmental samples, vegetation removal may be necessary. No significant soil disturbance is anticipated from planned site work as described in this Work Plan. No wetlands on or downstream of Site 67 are expected to be impacted indirectly by the project.

Because there will be no significant ground disturbance, a storm water pollution prevention plan will not be required. However if the potential for runoff to jurisdictional wetlands exists, appropriate protection measures will be put in place.

5.4 Cultural and Archaeological Resources within the Project Site

The environmental sampling activities proposed to support this WP 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 Base archaeologist confirmed that a cultural or archaeological resource is known to lie partially within the Site 67 boundary. The site was recommended as ineligible for the National Register of Historic Places by the Base archaeologist but confirmation from the State Historic Preservation Office (SHPO) is pending. The current WP investigation is within this area, but installation of the DPT borings is not expected to impact cultural resources. If any unmapped cultural or archaeological materials or resources are discovered within the project investigation area, the Base archaeologist will be notified to provide guidance on performing further work in the area. Should additional future work be planned and verified to be within the archaeological resource area (potentially National Register of Historic Places [NRHP] eligible site), the base project manager and archeologist will be contacted in order to assess whether a Request for Environmental Impact Review through the National Environmental Policy Act of 1969 (NEPA) process is required, prior to subsurface activity within the boundary.

5.5 Water Resources within the Project Site

As shown in **Figure 1-1**, Site 67 encompasses a small unnamed creek which enters Traps Bay. Based on the location of the investigation area, 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.

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, CAMA, the State's Dredge and Fill Law, Chapter 7 of Title 15A of the North Carolina Administrative Code (NCAC), and the land use plan of the County and/or local municipality in which the proposed project is located.

The Confirmatory Sampling investigations at Site 67 will include collection of surface and subsurface soil using hand augers and groundwater samples using DPT. There will be no potential to affect any coastal use or resources from the investigation. As outlined in Subpart "C" of 15 Code of Federal Regulations (CFR) 930, the U.S. 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 U.S. 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

The proposed work will be concentrated in designated investigation areas within the approximately 1.5 terrestrial acres of Site 67. Vegetation removal is anticipated in association with the field investigations described in this WP. Vegetation will primarily be removed for access to site sampling locations. Vegetation less than 6 inches in diameter will be removed to 6 inches above ground surface, in order to support environmental sampling activities. Consultation with the Base wildlife biologist confirms no threatened or endangered species have been located within the project 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 federally protected plant be identified within the project area, the specimens will be flagged for easy relocation and verification
- Should cultural or archaeological material or resource be discovered within the project area, a qualified archaeologist will be notified to provide guidance on performing further work in the area

- The PM will seek the guidance of the qualified ecologist to determine appropriate mitigation measures in the event that the performed work activities impact an environmental resource.

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
Site 67 Confirmatory Sampling Work Plan, Engineer's TNT Burn Pit
MCB Camp Lejeune
Jacksonville, North Carolina

Scientific Name	Common Name	Federal Status	Habitat
Anguilla rostrata	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.
Chelonia mydas	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.
Caretta caretta	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.
Dermochelys coriacea	Leatherback sea turtle	E	An open ocean species, it sometimes moves into shallow bays, estuaries and even river mouths.
Trichechus manatus	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.
Alligator mississippiensis	American alligator	T(S/A)	Rivers, swamps, estuaries, lakes, and marshes
Charadrius melodus	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.
Aimophila aestivalis	Bachman's sparrow	FSC	Occurs only in pine forests of the southeastern U.S.
Laterallus jamaicensis	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.
Acipenser brevirostrum	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.

Scientific Name	Common Name	Federal Status	Habitat
Rana capito capito	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.
Puma concolor couguar	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.
Passerina ciris ciris	Eastern painted bunting	FSC*	Found mainly in southern states and Mexico, where the brushy, weedy shrub-scrub habitat that this bird prefers abound
Ammodramus henslowii	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.
Ophisaurus mimicus	Mimic glass lizard	FSC	This species is found in the southeastern Coastal Plain. They are most common in pine flatwoods and open woodlands.
Picoides borealis	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 (Pinus palustris) 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.
Heterodon simus	Southern hognose snake	FSC	These snakes are found in sandy fields and woods of the Coastal Plain, particularly in the Sandhills region.
Agrotis buchholzi	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.

Scientific Name	Common Name	Federal Status	Habitat
Atrytonopsis sp.	a skipper	FSC	One species, the dusteds are fairly rare at the coast but found throughout North Carolina (*A. hianna*). An assumption is made that the genius is generally defined.
Isoetes microvela	A quillwort	FSC	Quillworts are usually restricted to areas of clean water where other plants are absent. Occasionally, quilwort may grow partly or entirely out of the water.
Rhexia aristosa	Awned meadowbeauty	FSC	Found in a variety of wet habitats in the Coastal Plain from New Jersey to Alabama
Lobelia boykinii	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.
Solidago pulchra	Coastal goldenrod	FSC	Bogs, freshwater habitats, grasslands
Parnassia caroliniana	Carolina grass-of-parnassus	FSC	Bogs, freshwater habitats, grasslands
Trillium pusillum var. pusillum	Carolina trillium	FSC	Grows in alluvial woods, pocosin borders and savannahs
Asplenium heteroresiliens	Carolina (wagner) spleenwort	FSC	Rock outcrops
Rhynchospora pleiantha	Coastal beaksedge	FSC	Extremely rare, found at fewer than 25 sites throughout its North Carolina-to-Alabama range
Solidago villosicarpa	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.
Thalictrum cooleyi	Cooley's meadowrue	E	Cooley's meadowrue occurs in moist to wet bogs and savannahs. It grows in wet areas along fireplow lines, roadside ditches, woodland clearings, and powerline rights-of-way, and needs some type of disturbance to maintain its open habitat.
Carex lutea	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.
Sagittaria weatherbiana	Grassleaf arrowhead	FSC	Found in shallow water of brackish swamps
Dichanthelium sp.	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 atone location in Delaware and two locations in North Carolina, both of which are on Camp Lejeune.
Myriophyllum laxum	Loose watermilfoil	FSC	Riparian habitats

Scientific Name	Common Name	Federal Status	Habitat
Calopogon multiflorus	Many-flower grass-pink	FSC	Grasslands, pinelands; typically in wet areas
Plantago sparsiflora	Pineland plantain	FSC	Savannahs, roadsides and ditches
Lindera melissifolia	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.
Litsea aestivalis	Pondspice	FSC	Freshwater habitats
Lysimachia asperulaefolia	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
Amaranthus pumilus	Seabeach amaranth	T	Occurs on barrier island beaches
Allium sp.	Savanna onion	FSC	Wet savannahs
Scleria sp.	Smooth-seeded hairy nutrush	FSC	Dry woods, pineland and savannahs (*S. triglomerata*)
Rhynchospora decurrens	Swamp forest beakrush	FSC	Swamp forests, very rare
Solidago verna	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
Rhynchospora thornei	Thorne's beaksedge	FSC	Bogs, freshwater habitats, pinelands
Dionea muscipula	Venus flytrap	FSC	Bogs, pinelands

E = Endangered—A taxon in danger of extinction throughout all or a significant portion of its range.
T = Threatened—A taxon likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
FSC = Federal species of special concern—species may or may not be listed in the future.
T(S/A)—Threatened due to similarity of appearance (e.g., American alligator)--a species that is threatened due to similarity of appearance with other rare species and is listed for its protection. These species are not biologically endangered or threatened and are not subject to Section 7 consultation.

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

SECTION 6

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Appendix A
Health and Safety Plan

Health and Safety Plan

Marine Corps Base Camp Lejeune North Carolina Site 67, Engineer's TNT Burn Site Confirmatory Sampling

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Atlantic Division

6506 Hampton Blvd.
Norfolk, VA 23508-1278

September 2009

CH2MHILL

Charlotte, North Carolina

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Prepared By:

Renee Clore/CH2M HILL	Date

Approved By:

Hope Oaks / Project Manager	Date

Client Acceptance:

Bryan Beck/NAVFAC Remedial Project Manager	Date

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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: Site 67 Engineer's TNT Burn Site

SITE ADDRESS: Site 67 is located in the Traps Bay Area of MCB Camp Lejeune, within an active demolitions area operated by the Engineer School

CH2M HILL PROJECT MANAGER: Hope Oaks/ATL

CH2M HILL OFFICE: CLT

DATE HEALTH AND SAFETY PLAN PREPARED: July 2009

DATE(S) OF SITE WORK: 2009 - 2010

SITE BACKGROUND AND SETTING: Site 67 was identified in a base wide Initial Assessment Study (IAS) as the Engineer's TNT Burn Site, used for TNT disposal in 1951. Reportedly, 2- to 3-foot pits were dug and filled with unwanted TNT which was then burned. Complete consumption of TNT was reported during burning.

In May 2009, CH2M HILL completed a detailed investigative review of information relating to Site 67 and conducted interviews with current and former Base personnel. The investigative review emphasized obtaining information identifying historical activities that may have resulted in environmental contamination of the project area. According to historical records, four ranges have overlapped the boundary of Site 67 (see the **Site Map** for Site 67 boundary). The ranges include three historic ranges (the Engineer Firing Range, Engineer Demolition Area "I-1," and the I-2 Demolition Area) and one active range (Engineer Training Area 1D).

The Engineer Firing Range and Engineer Demolition Area "I-1" were both in use during the late 1940's. The I-2 Demolition Area was in use from 1960 through 1993. The Engineer Training Area 1D appears on a 2005 Base Map and is currently in use. According to the Base Range Safety Officer, the Engineer Training Area 1D encompasses Site 67 and is currently in use as an active demolitions course.

According to the *Range Identification Preliminary Range Assessment* report (USACE, 2001) by the United States Army Corps of Engineers (USACE), the following munitions were reportedly used at this site between 1946 and the present:

- Demolitions
- 2.36-inch anti-tank rockets
- Rifle grenades
- Flamethrowers
- Antitank mines
- Claymore mines
- Mine clearing line charges
- Bangalore torpedoes.

Based on the historical review, munitions constituents (MC) and munitions and explosives of concern (MEC) represent the likely contaminants that are potentially present at Site 67.

TASKS CONDUCTED BY CH2M HILL: Confirmatory sampling site activities will include land surveying, utility locating, direct push technology (DPT) boring, surface and subsurface soil sampling, MEC avoidance, and groundwater monitoring activities.

Site Map

INDIA RANGE ROAD
SBB170
SBB343
SBB315
BB316
BB232
BB234
BB95
BB86
SBB87
BB88
BB87
BB233
SBB159
SBB317
SBB158
BB117
BB124
SBB157E
SBB157C
SBB157B
SBB157A
SBB157D
SBB155
SBB156
ACCESS RD TO TUZCANARY
Site 67
TRAPS BAY

Emergency Contacts

24-hour CH2M HILL Serious Incident Reporting Contact/Pager – 720-286-4911

If injured on the job, notify your supervisor and then call 1-866-893-2514 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

CH2M HILL- Medical Consultant
WorkCare
Dr. Peter Greaney M.D.
300 S. Harbor Blvd, Suite 600
Anaheim, CA 92805
800-455-6155
714-978-7488

LEPC (Poison Control)#: (800) 222-1222

CH2M HILL Director Security Operations
Thomas Horton/DEN
720/273-3100 (cell) or 720/286-0022 (office)

Fire/Spill Emergency – 911 or

Base Fire Response #: (910) 451-9111

Responsible Health and Safety Manager (RHSM)
Name: Mark Orman/MKE
Phone: (414) 847-0597

Security & Police – 911 or

Base Security #: (910) 451-2555

Regional Human Resources Department
Name: Carol Miscoe/SAN
Phone: 210/377-3085 x291

Utilities Emergency Phone Numbers
Water: Contact Base EMD
Gas: Contact Base EMD
Electric: Contact Base EMD

Worker's Compensation:
Contact Business Group HR dept. to have form completed or contact Jennifer Rindahl after hours: (720)891-5382

Safety Coordinator (SC)
Name: To be determined
Phone: To be determined

Media Inquiries Corporate Strategic Communications
Name: John Corsi
Phone: (720) 286-2087

Project Manager
Name: Hope Oaks/ATL
Phone: (678) 530-4226 (office)
(678) 656-5411 (cell)

Automobile Accidents
Rental: Linda Anderson/COR
(720) 286-2401
CH2M HILL Owned: Linda George
(720) 286-2057

Federal Express Dangerous Goods Shipping
Phone: 800/238-5355

CH2M HILL Dangerous Goods Shipping
Phone: 800/255-3924

Facility Alarms: To be determined

Evacuation Assembly Area(s): To be determined

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

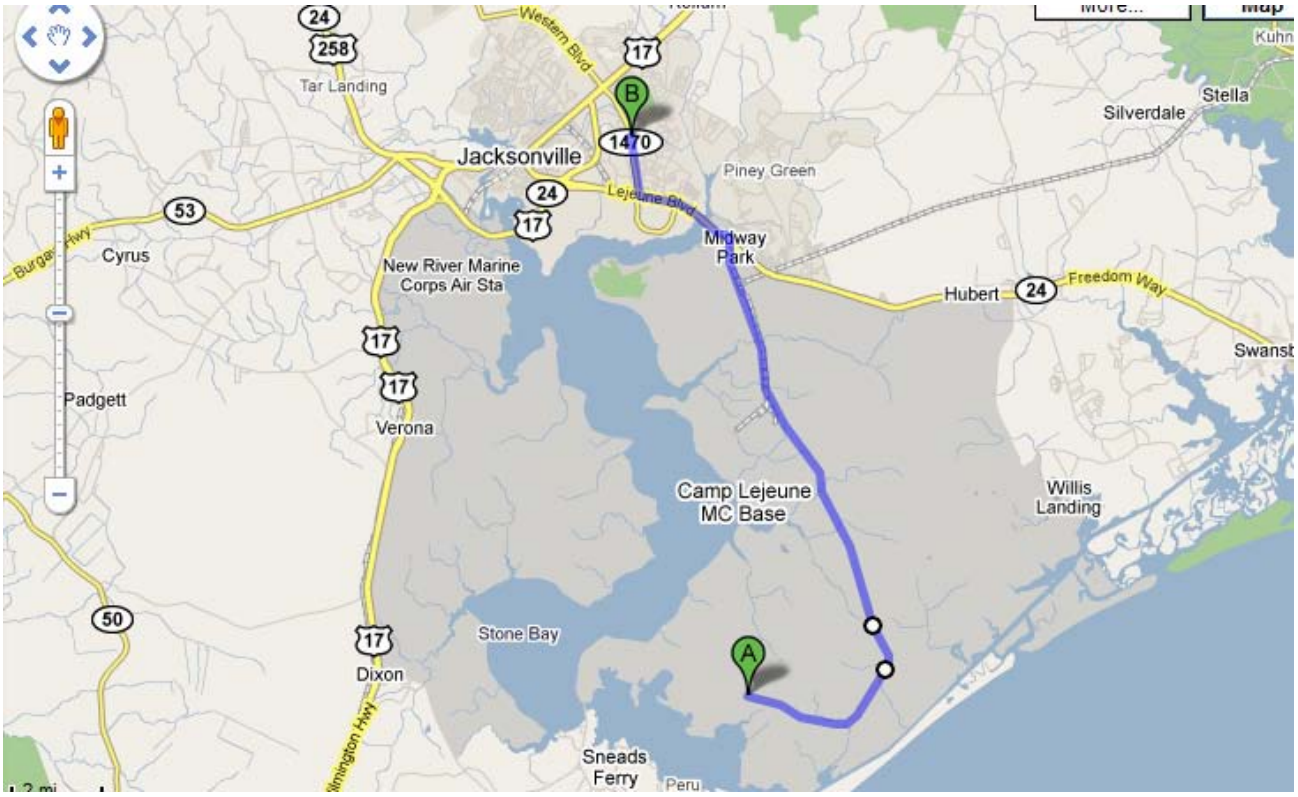
Directions to Local Hospital

Directions to Hospital From Traps Bay

Onslow County Memorial Hospital, 317 Western Blvd:
Phone: 910-557-2345

Summary: 17.8 miles (45 minutes)

Mile	Instruction	For
0.0	**Depart Traps Bay on Local road(s) (North)**	
0.1	Turn RIGHT (East) onto SR-172 [Sneads Ferry Rd]	10.7 mi
10.8	Turn RIGHT (North) onto Holcomb Blvd	3.4 mi
14.2	Bear LEFT (North-West) onto SR-24 [Freedom Way]	2.3 mi
16.5	Turn RIGHT (North) onto Western Blvd	1.3 mi
17.8	**Arrive Onslow Memorial Hospital [317 Western Blvd, Jacksonville, NC 28546]**	



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

- Groundwater monitoring
- DPT boring
- Soil sampling
- Investigative derived waste (IDW) management

1.1.2 Non-Hazwoper-Regulated Tasks

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

Utility locating
Land surveying
Clearing / grubbing

1.2 Change Management

PROJECT HS&E Change Management Form *This evaluation form should be reviewed on a **continuous** basis to determine if the current site health and safety plan adequately addresses ongoing project work, and should be completed whenever new tasks are contemplated or changed conditions are encountered.*			
Project Task:		Project/Task Manager:	
Project Number:		Project Name:	
	Evaluation Checklist	Yes	No
1.	Has the CH2M HILL staff listed in the original HASP changed?		
2.	Has a new subcontractor been added to the project?		
3.	Is any chemical or product to be used that is not listed in Attachment 2 of the plan?		
4.	Have additional tasks been added which were not originally addressed in Section 1.1 of the plan?		
5.	Have new contaminants or higher than anticipated levels of original contaminants been encountered?		
6.	Has other safety, equipment, activity or environmental hazards been encountered that are not addressed in Section 2.1 of the plan?		

If the answer is "YES" to Questions 1-3, an HSP revision is NOT needed. Please take the following actions:

- Confirm that staff's medical and training status is current – check training records at: http://www.int.ch2m.com/hands (or contact your regional SPA), and confirm subcontractor qualifications.
- Confirm with the project KA that subcontractor safety performance has been reviewed and is acceptable.
- Confirm with H&S that subcontractor safety procedures have been reviewed and are acceptable.

If the answer is "YES" to Questions 4-6, an HSP revision MAY BE NEEDED.

TABLE 1 HAZARD ANALYSIS
(Refer to Section 2.0 for Hazard Controls)

POTENTIALHAZARDS	PROJECT ACTIVITIES						
	Utility Locating	Land Surveying	Vegetation Clearing	DPT Well Installation	Soil Sampling	Groundwater Sampling	IDW Handling
Biological Hazards	X	X	X	X	X	X	X
Chemical Hazard-Dermal/Inhalation				X	X	X	X
Drilling				X			
Drum Handling				X	X	X	X
Electrical Safety				X			
Field Vehicles	X	X	X	X	X	X	X
Fire Prevention			X	X			
Groundwater Sampling						X	
Hand & Power Tools	X	X	X	X	X	X	X
Heavy Equipment				X			
IDW Drum Sampling							X
Knife Use				X	X	X	
Manual Lifting	X	X	X	X	X	X	X
MEC/UXO	X	X	X	X	X	X	X
Noise			X	X			
Pressure Washing/Equip Decon				X			
Pressurized Lines/Equipment				X			
Slips, trips, falls	X	X	X	X	X	X	X
Utilities (underground/overhead)			X	X			
Visible Lighting	X	X	X	X	X	X	X

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 Sections 2.1, 2.2, and 2.3.

In addition to the controls specified in this section, Project-Activity Self-Assessment Checklists are contained in Attachment 4. 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 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 4) 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 Chainsaws

Only chainsaws equipped with a park arrestor and fully functioning chain brake or "safety chain" shall be used. The following safety equipment shall be readily available while operating a chainsaw:

- Chainsaw operator's manual
- Fully stocked first aid kit.
- Multipurpose fire extinguisher.
- Foreign voltage detector (FVD) when topping utility poles.
- Grounded extension cord approved for outdoor use and ground fault circuit interrupter (GFCI) for electrical-powered chainsaws.
- Approved safety gasoline container and funnel or flexible nozzle for refueling gasoline-powered chainsaws
- Sledge hammer and non-metallic wedges when necessary to prevent pinching of the chain.

PPE Requirements

The following personal protective equipment shall be worn while operating chainsaws:

- Safety glasses with side shields or face shield to prevent injury from wood chips, sawdust, or other flying objects.
- Hard hat with properly fitted suspension to prevent head injury from falling debris.
- Steel-toed safety shoes or boots to prevent foot injury from falling objects and accidental contact with the moving chain.
- Hearing protection to prevent permanent damage to hearing. Ear muffs or plugs will have a decibel noise reduction rating (NRR) assigned to them. The higher the rating, the greater the protection offered.
- Non-leather, fabric work gloves to prevent hand injury from abrasions, splinters and cuts.
- Clothing that is well-fitted and free of loose edges that could become entangled in the saw.
- Protective chaps or leggings that cover the area from the groin to about 2 inches above the ankles should be considered. These chaps are made from synthetic fabrics that are designed to prevent the running saw chain from coming in contact with your legs.

Safe Operation

The following safe operation guidelines shall be followed regardless of the purpose for using a chainsaw:

- Inspect the chainsaw prior to use.
- Chainsaws shall be held firmly with both hands, with thumbs and fingers encircling both chain saw handles.
- Stand slightly to the left side of the saw, out of the plane of the cutting chain and guide bar to reduce the risk of injury in the event of a kickback.
- Position saw so that it is between the waist and mid-chest level. Overreaching or cutting above the mid-chest height shall be avoided.
- Maintain a full throttle setting while cutting. Chainsaws are designed to be run at full speed.
- Always be aware of what is in the saw's downward path after the cut.
- Do not attempt to cut material that is larger than the guide bar of the saw.
- Avoid cuts that will cause the chainsaw to jam. Always cut into the compression wood first until the cut starts to close; then cut from the other side toward the compression cut.
- Use a non-metallic wedge to prevent the compression cut jamming on the blade.
- Chainsaws are designed to feed themselves into the wood and require only light pressure to cut efficiently. If extra force is required to keep cutting, the chain requires sharpening. Additional signs of a dull chain include a saw that is cutting crooked, results in fine sawdust instead of chips, or the smell of burnt wood. Do not use a dull chain.
- Bystanders and helpers shall be kept at a safe distance from operation.

- Do not operate a chainsaw when fatigued; take frequent breaks.
- Work slowly; don't rush.
- A fire extinguisher shall be present at all times when operating the chainsaw in forest or brushy areas.

Refueling the Engine

The fuel for gasoline-powered chainsaws shall be mixed in accordance with the manufacturer's recommendations as outlined in the chainsaw operator's manual. Fuel shall be stored and transported in an approved safety container. The following precautions should also be followed:

- The engine shall be shut off and allowed to cool before refueling; never refuel a hot engine.
- A fire extinguisher shall be present during fueling and refueling.
- Smoking around fueling or refueling operations shall be prohibited.
- A funnel or a flexible nozzle shall be used to avoid spilling fuel on the engine.

2.1.2 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

2.1.3 Drum Handling

- Ensure that personnel are trained in proper lifting and moving techniques to prevent back injuries.
- Provide equipment to keep the operator removed from the drums to lessen the likelihood of injury. Such equipment might include: a drum grappler attached to a hydraulic excavator; a small front-end loader, which can be either loaded manually or equipped with a bucket sling; a rough terrain forklift; Roller conveyor equipped with solid rollers; drum carts designed specifically for drum handling.
- Make sure the vehicle selected has sufficient rated load capacity to handle the anticipated loads, and make sure the vehicle can operate smoothly on the available road surface.
- Ensure there are Plexiglas cab shields on loaders, backhoes, etc., when handling drums containing potentially explosive materials.
- Equipment cabs should be supplied with fire extinguishers, and should be air-conditioned to increase operator efficiency.
- Supply operators with appropriate respiratory protective equipment when needed.
- Ensure that drums are secure and are not in the operator's view of the roadway.
- Prior to handling, all personnel should be warned about hazards of handling.
- Throughout handling, personnel should be alert for information leading to the identity of new hazards. Exercise extreme caution in handling drums that are not intact and tightly sealed.
- Before moving anything, determine the most appropriate sequence in which the various drums and other containers should be moved (e.g. small containers may have to be removed first to permit heavy equipment to enter and move the drums.
- Overpack drums and an adequate volume of absorbent should be kept near areas where minor spills may occur.

2.1.4 Electrical

(Reference CH2M HILL SOP HSE-206, *Electrical Safety*)

General Electrical Safety

- Only qualified personnel are permitted to work on unprotected energized electrical systems.
- Only authorized personnel are permitted to enter high-voltage areas.
- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented.

- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment, remove from service.
- CH2M HILL has selected Ground Fault Circuit Interrupters (GFCIs) as the standard method for protecting employees from the hazards associated with electric shock.
  - GFCIs shall be used on all 120-volt, single phase 15 and 20-amphere receptacle outlets which are not part of the permanent wiring of the building or structure.
- An assured equipment grounding conductor program may be required under the following scenarios:
  - GFCIs cannot be utilized
  - Client requires such a program to be implemented
  - Business group decides to implement program in addition to GFCI protection
- Extension cords must be equipped with third-wire grounding. Cords passing through work areas must be covered, elevated or protected from damage. Cords should not be routed through doorways unless protected from pinching. Cords should not be fastened with staples, hung from nails, or suspended with wire.
- Electrical power tools and equipment must be effectively grounded or double-insulated UL approved.
- Operate and maintain electric power tools and equipment according to manufacturers' instructions.
- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and grounded, or where insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet from overhead power lines for voltages of 50 kV or less, and 10 feet plus ½ inch for every 1 kV over 50 kV.
- Temporary lights shall not be suspended by their electric cord unless designed for suspension. Lights shall be protected from accidental contact or breakage.
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

Portable Generator Hazards

- Portable generators are useful when temporary or remote electric power is needed, but they also can be hazardous. The primary hazards to avoid when using a generator are carbon monoxide (CO) poisoning from the toxic engine exhaust, electric shock or electrocution, and fire.
- NEVER use a generator indoors or in similar enclosed or partially-enclosed spaces. Generators can produce high levels of carbon monoxide (CO) very quickly. When you use a portable generator, remember that you cannot smell or see CO. Even if you can’t smell exhaust fumes, you may still be exposed to CO.
- If you start to feel sick, dizzy, or weak while using a generator, get to fresh air RIGHT AWAY. DO NOT DELAY. The CO from generators can rapidly lead to full incapacitation and death.

- If you experience serious symptoms, get medical attention immediately. Inform project staff that CO poisoning is suspected. If you experienced symptoms while indoors have someone call the fire department to determine when it is safe to re-enter the building.
- Follow the instructions that come with your generator. Locate the unit outdoors and away from doors, windows, and vents that could allow CO to come indoors.
- Keep the generator dry and do not use in rain or wet conditions. To protect from moisture, operate it on a dry surface under an open, canopy-like structure. Dry your hands if wet before touching the generator.
- Plug appliances directly into the generator. Or, use a heavy duty, outdoor-rated extension cord that is rated (in watts or amps) at least equal to the sum of the connected appliance loads. Check that the entire cord is free of cuts or tears and that the plug has all three prongs, especially a grounding pin.
- Most generators come with Ground Fault Circuit Interrupters (GFCI). Test the GFCIs daily to determine whether they are working
- If the generator is not equipped with GFCI protected circuits plug a portable GFCI into the generator and plug appliances, tools and lights into the portable GFCI.
- Never store fuel near the generator or near any sources of ignition.
- Before refueling the generator, turn it off and let it cool down. Gasoline spilled on hot engine parts could ignite.

2.1.5 Energized Electrical Work

(Reference CH2M HILL SOP HSE-221, *Energized Electrical*)

- Energized electrical work is defined as work performed on or near energized electrical systems or equipment with exposed components operating at 50 volts or greater. Working near energized live parts is any activity inside a Limited Approach Boundary.
- Only qualified personnel are permitted to work on unprotected energized electrical systems.
- Electrical wiring and equipment shall be de-energized prior to conducting work unless it can be demonstrated that de-energizing introduces additional or increased hazards or is unfeasible due to equipment design or operational limitations.
- All electrical systems shall be considered energized until lockout/tagout procedures are implemented.
- The Energized Electrical Work permit provided in the plan must be completed prior to working on unprotected energized electrical systems.
- Follow all control measures and procedures identified on the Energized Electrical Work Permit.

2.1.6 Fall Protection Activities

(Reference CH2M HILL, SOP HSE-308, *Fall Protection*)

The precautions listed below shall be followed when working from unprotected heights:

- Fall protection systems must be used to eliminate fall hazards when performing construction activities at a height of 6 feet or greater and when performing general industry activities at a height of 4 feet or greater.
- CH2M HILL staff exposed to fall hazards must complete initial fall protection training by completing either the CH2M HILL 10-Hour Construction Safety Awareness training course or the Fall Protection computer-based training module. Staff must also and receive project-specific fall protection training. Staff shall not use fall protection systems for which they have not been trained.
- The SC or designee must complete the Project Fall Protection Evaluation Form and provide project-specific fall protection training to all CH2M HILL staff exposed to fall hazards.
- The company responsible for the fall protection system shall provide a fall protection competent person to inspect and oversee the use of fall protection system. CH2M HILL staff shall be aware of and follow all requirements established by the fall protection competent person for the use and limitation of the fall protection system.
- When CH2M HILL designs or installs fall protection systems, staff shall be qualified as fall protection competent persons or work directly under the supervision of a CH2M HILL fall protection competent person.
- When horizontal lifelines are used, the company responsible for the lifeline system shall provide a fall protection qualified person to oversee the design, installation, and use of the horizontal lifeline.
- Inspect personal fall arrest system components prior to each use. Do not use damaged fall protection system components at any time, or for any reason. Fall protection equipment and components shall be used only to protect against falls, not to hoist materials. Personal fall arrest systems that have been subjected to impact loading shall not be used.
- Personal fall arrest systems shall be configured so that individuals can neither free-fall more than 6 feet or contact any lower level.
- Only attach personal fall arrest systems to anchorage points capable of supporting at least 5,000 pounds. Do not attach personal fall arrest systems to guardrail systems or hoists.
- Remain within the guardrail system when provided. Leaning over or stepping across a guardrail system is not permitted. Do not stand on objects (boxes, buckets, bricks, blocks, etc.) or ladders to increase working height on top of platforms protected by guardrails.
- Only one person shall be simultaneously attached to a vertical lifeline and shall also be attached to a separate independent lifeline.

2.1.7 Field Vehicles

- Field vehicles may be personal vehicles, rental vehicles, fleet vehicles or project vehicles.
- Emergency kits are available in all NWR offices for personal and rental vehicles. Fleet vehicles are equipped with emergency supplies. It is a project responsibility to equip all project vehicles with emergency equipment.
- Maintain both a First Aid kit and Fire Extinguisher in the field vehicle at all times.
- Utilize a rotary beacon on vehicle if working adjacent to active roadway.
- Car rental must meet the following requirements:
  - Dual air bags
  - Antilock brakes
  - Be midsize or larger
- Familiarize yourself with rental vehicle features:
  - Mirror adjustments
  - Seat adjustments
  - Cruise control features, if offered
  - Pre-program radio stations
- Always wear seatbelt while operating vehicle.
- Adjust headrest to proper position.
- Tie down loose items if utilizing a van.
- Pull off the road, put the car in park and turn on flashers before talking on a mobile phone.
- Close car doors slowly and carefully. Fingers can get pinched in doors.
- Park vehicle in a location where it can be accessed easily in the event of an emergency. If not possible, carry a phone.
- Have a designated place for storing the field vehicle keys when not in use.

2.1.8 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.

2.1.9 Groundwater Sampling/Water Level Measurements

- Wear the appropriate PPE when sampling, including safety glasses, nitrile gloves, and steel toe boots (refer to Section 4).
- Monitor headspace of wells prior to sampling to minimize any vapor inhalation (refer to Section 5 on air monitoring).
- Use caution when opening well lids. Wells may contain poisonous spiders and hornet or wasp nests.
- Use the appropriate lifting procedures (see CH2M HILL SOP HSE-112) when unloading equipment and sampling at each well.
- Avoid sharp edges on well casings.
- If dermal contact with the groundwater and acid used in sample preservation, wash exposed skin thoroughly with soap and water.
- Avoid eating and drinking on site and during sampling.
- Use ear plugs during sampling if sampling involves a generator.
- Containerize all purge water and transport to the appropriate storage area.

2.1.10 Hand and Power Tools

(Reference CH2M HILL, SOP HSE-210, *Hand and Power Tools*)

- Tools shall be inspected prior to use and damaged tools will be tagged and removed from service.
- Hand tools will be used for their intended use and operated in accordance with manufacturer's instructions and design limitations;
- Maintain all hand and power tools in a safe condition.
- Use PPE (such as gloves, safety glasses, earplugs, and face shields) when exposed to a hazard from a tool.
- Do not carry or lower a power tool by its cord or hose.
- Portable power tools will be plugged into GFCI protected outlets; and
- Portable power tools will be Underwriters Laboratories (UL) listed and have a three-wire grounded plug or be double insulated.
- Disconnect tools from energy sources when they are not in use, before servicing and cleaning them, and when changing accessories (such as blades, bits, and cutters).
- Safety guards on tools must remain installed while the tool is in use and must be promptly replaced after repair or maintenance has been performed.

- Store tools properly in a place where they will not be damaged or come in contact with hazardous materials.
- If a cordless tool is connected to its recharge unit, both pieces of equipment must conform strictly with electrical standards and manufacturer's specifications.
- Tools used in an explosive environment must be rated for work in that environment (that is, intrinsically safe, spark-proof, etc.).
- When using a knife or blade tool, stroke or cut away from the body with a smooth motion. Be careful not to use excessive force that could damage the tool, the material being cut or unprotected hands.
- Working with manual and pistol-grip hand tools may involve highly repetitive movement, extended elevation, constrained postures, and/or awkward positioning of body members (for example, hand, wrist, arm, shoulder, neck, etc.). Consider alternative tool designs, improved posture, the selection of appropriate materials, changing work organization, and sequencing to prevent muscular, skeletal, repetitive motion, and cumulative trauma stressors.

Machine Guarding

- Ensure that all machine guards are in place to prevent contact with drive lines, belts, chains, pinch points or any other sources of mechanical injury.
- Unplugging jammed equipment will only be performed when equipment has been shut down, all sources of energy have been isolated and equipment has been locked/tagged and tested.
- Maintenance and repair of equipment that results in the removal of guards or would otherwise put anyone at risk requires lockout of that equipment prior to work.

2.1.11 Haul Trucks

- Haul truck operators should be familiar with their equipment and inspect all equipment before use.
- Haul truck operators should ensure all persons are clear before operating truck or equipment. Before moving operators should sound horn or alarm, all equipment should be equipped with a working back up alarm.
- Haulage trucks or equipment with restricted visibility should be equipped with devices that eliminate blind spots.
- Employees should stay off haul roads. When approaching a haul area, employees should make eye contact and communicate their intentions directly with the equipment operator.
- If possible minimize steep grades on haul roads.
- Where grades are steep provide signage indicating the actual grade as well as measures for a runaway truck.
- Trucks are to be operated within the manufacturer's recommendations (for example- retarder charts indicate the combination of loads, grades and speeds that should not be

exceeded if the truck's retarder is to work properly – to ensure the truck does not descend grade at speeds greater than listed).

- Haul roads should be well lit, sufficiently wide (at least 50% of the width of the equipment on both sides of road) and equipped with reflectors to indicate access points.
- Haul roads should have adequate right-of-way signs indicating haul directions.

2.1.12 Investigation-Derived Waste (IDW) Drum Sampling

Personnel are permitted to handle and/or sample drums containing investigation-derived waste (IDW) only; handling or sampling other drums requires a plan revision or amendment approved by the CH2M HILL HSM. The following control measures will be taken when sampling drums containing IDW:

- Minimize transportation of drums.
- Sample only labeled drums or drums known to contain IDW.
- Use caution when sampling bulging or swollen drums. Relieve pressure slowly.
- If drums contain, or potentially contain, flammable materials, use non-sparking tools to open.
- Picks, chisels, and firearms may not be used to open drums.
- Reseal bung holes or plugs whenever possible.
- Avoid mixing incompatible drum contents.
- Sample drums without leaning over the drum opening.
- Transfer the content of drums using a method that minimizes contact with material.
- PPE and air monitoring requirements specified in Sections 4 and 5 must address IDW drum sampling.
- Spill-containment procedures specified in Section 7 must be appropriate for the material to be handled.
- All drums and liquid transfer equipment should be grounded to reduce the potential of a static discharge.

2.1.13 Knife Use

Knives (fixed/utility) shall not be used. If it is demonstrated that a knife is the right tool for the job, this plan will be amended and the activity that knife use will be used for shall be reviewed. An AHA shall also be developed to address hazards and subsequent controls, PPE, and training.

Responsibilities	• Supervisors with assistance from the FTL/SC are responsible for funding and ensuring the correct tool is being used, employees wear the proper PPE when using knives, and they have reviewed this policy. • Employees are responsible for having and utilizing the proper PPE while performing an activity requiring the use of a knife. Employees are also responsible for understanding the proper use of a knife.
Glove Requirements	• In general, Kevlar cut resistant gloves are to be worn when using a knife in an occupational setting. • Other types of gloves may be required and will be identified within the AHA / written procedure. Example - Leather gloves may be worn when using the acetate sleeve cutter.
Training (Ref. VO for additional hand safety topics)	All employees that will use a knife must be trained in the proper use. • When using a knife always cut away from yourself. • Many tasks using a utility knife require a knife edge but not a sharp point. For these tasks you can add protection against puncture wounds by using a rounded-tip blade. • If you use a folding knife, it must be a locking blade type. • Never use a knife that will fold under pressure. • If you use a fixed blade knife, make sure there is a handle guard to keep your hand from slipping forward. Also, make sure the handle is dry and non- greasy/slippery to assure a better grip. • When cutting, make the force of the cut carry the blade away from any part of your body. If you have a peculiar situation where this is not possible, protect yourself with a leather apron, or other material placed between you and the blade. Consider putting the material to be cut in a vise, or other holding device. • If you carry a fixed blade knife, use a sheath or holder. • Store utility knives safely, retract the blade or sheath an open blade before storing. Never, leave a knife with the blade exposed on the floor, on a pallet, on a work surface, or in a drawer or cabinet. • Keep your knife sharp. A dull blade requires you to use more force to cut, and consequently increases the risk of slip or mistake. • Knives used on the job, but not carried with you, must be properly stored when not in use • Never use a defective knife. • Utility knife blades are brittle and can snap easily. Don't bend them or apply side loads to them by using them to open cans or pry loose objects. Use the knife only to cut. It was not designed to work as a prybar, screw driver, hole punch, and other assorted things that make it seem so easy. • If you do get cut, seek medical attention to treat the injury by notifying your supervisor and contacting Health Resources at 1-866-893-2514.

Examples of preferred tools and Kevlar cut resistant gloves:

A safety spring provides for automatic blade "shoot-back" into the handle when contact w/cutting surface is lost

Stay focused on the cutting job. It only takes a second of inattention with a sharp blade to produce a serious cut. Letting the mind wander or talking with others while using a knife greatly increases the risk of an accident and injury. If you are interrupted while working with a knife, stop cutting, retract the blade, and place the knife down on a secure surface before dealing with the interruption. You should never continue cutting while distracted!

As always, utilize the hierarchy of controls and first attempt to engineer out the hazard and frequently ask ourselves do we have the right tool for the job.

2.1.14 Lockout/Tagout Activities

(Reference CH2M HILL SOP HSE-310, *Lockout and Tagout*)

- Only qualified personnel may work on energized equipment that has not been deenergized by lockout/tagout procedures.
- When CH2M HILL controls the work, CH2M HILL must verify that subcontractors affected by the unexpected operation of equipment develop a written lockout/tagout program, provide training on lockout/tagout procedures and coordinate its program with other affected subcontractors. This may include compliance with the owner or facility lockout/tagout program.

- When CH2M HILL personnel are affected by the unexpected operation of equipment they must complete the lockout/tagout training course in the Basic Program. Project training may also be required on site specific lockout procedures.
- Standard lockout/tagout procedures include the following six steps: 1) notify all personnel in the affected area of the lockout/tagout, 2) shut down the equipment using normal operating controls, 3) isolate all energy sources, 4) apply individual lock and tag to each energy isolating device, 5) relieve or restrain all potentially hazardous stored or residual energy, and 6) verify that isolation and deenergization of the equipment has been accomplished. Once verified that the equipment is at the zero energy state, work may begin.
- All safe guards must be put back in place, all affected personnel notified that lockout has been removed and controls positioned in the safe mode prior to lockout removal. Only the individual who applied the lock and tag may remove them.

2.1.15 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.
- 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.
- 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.

2.1.16 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.

2.1.17 Pressure Washing Operations

- Only trained, authorized personnel may operate the high-pressure washer.
- Follow manufacturer's safety and operating instructions.
- Inspect pressure washer before use and confirm deadman switch fully operational
- The wand must always be pointed at the work area.
- The trigger should never be tied down
- Never point the wand at yourself or another worker.
- The wand must be at least 42 inches from the trigger to the tip.
- The operator must maintain good footing.
- Non-operators must remain a safe distance from the operator.
- No unauthorized attachment may be made to the unit.
- Do not modify the wand.
- All leaks or malfunctioning equipment must be repaired immediately or the unit taken out-of-service.
- Polycoated Tyvek or equivalent, 16-inch-high steel-toed rubber boots, safety glasses, hard hat with face shield, and inner and outer nitrile gloves will be worn, at a minimum.

2.1.18 Stairways and Ladders

(Reference CH2M HILL SOP HSE-214*, Stairways and Ladders*)

- Stairway or ladder is generally required when a break in elevation of 19 inches or greater exists.
- Personnel should avoid using both hands to carry objects while on stairways; if unavoidable, use extra precautions.
- Personnel must not use pan and skeleton metal stairs until permanent or temporary treads and landings are provided the full width and depth of each step and landing.
- Ladders must be inspected by a competent person for visible defects prior to each day's use. Defective ladders must be tagged and removed from service.
- Ladders must be used only for the purpose for which they were designed and shall not be loaded beyond their rated capacity.
- Only one person at a time shall climb on or work from an individual ladder.
- User must face the ladder when climbing; keep belt buckle between side rails.
- Ladders shall not be moved, shifted, or extended while in use.
- User must use both hands to climb; use rope to raise and lower equipment and materials.
- Straight and extension ladders must be tied off to prevent displacement.
- Ladders that may be displaced by work activities or traffic must be secured or barricaded.
- Portable ladders must extend at least 3 feet above landing surface.
- Straight and extension ladders must be positioned at such an angle that the ladder base to the wall is one-fourth of the working length of the ladder.
- Stepladders are to be used in the fully opened and locked position.
- Users are not to stand on the top two steps of a stepladder; nor are users to sit on top or straddle a stepladder.
- Fixed ladders $\geq$ 24 feet in height must be provided with fall protection devices.
- Fall protection should be considered when working from extension, straight, or fixed ladders greater than 6 feet from lower levels and both hands are needed to perform the work, or when reaching or working outside of the plane of ladder side rails.

2.1.19 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 (e.g., 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.

2.1.20 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, and 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.

2.1.21 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.

2.1.22 Visible Lighting

- While work is in progress outside construction areas shall have at least 33 lux (lx).
- Construction work conducted inside buildings should be provided with at least 55 lux light.
- The means of egress shall be illuminated with emergency and non-emergency lighting to provide a minimum 11 lx measured at the floor. Egress illumination shall be arranged so that the failure of any single lighting unit, including the burning out of an electric bulb will not leave any area in total darkness.

2.1.23 Working Around Material Handling Equipment

- Never approach operating equipment from the rear. Always make positive contact with the operator, and confirm that the operator has stopped the motion of the equipment.
- Never approach the side of operating equipment; remain outside of the swing and turning radius.
- Maintain distance from pinch points of operating equipment.
- Never turn your back on any operating equipment.
- Never climb onto operating equipment or operate contractor/subcontractor equipment.
- Never ride contractor/subcontractor equipment unless it is designed to accommodate passengers and equipped with firmly attached passenger seat.
- Never work or walk under a suspended load.
- Never use equipment as a personnel lift; do not ride excavator buckets or crane hooks.
- Always stay alert and maintain a safe distance from operating equipment, especially equipment on cross slopes and unstable terrain.

2.2 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 down 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 the work area to determine what problems or hazards may exist.

2.2.2 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.

2.2.3 Substance Abuse

(Reference CH2M HILL SOP HSE-105, *Drug-Free Workplace*)

Employees who work under the influence of controlled substances, drugs, or alcohol may prove to be dangerous or otherwise harmful to themselves, other employees, clients, the company, the company's assets and interests, or the public. CH2M HILL does not tolerate illegal drug use, or any use of drugs, controlled substances, or alcohol that impairs an employee's work performance or behavior. Drug and/or alcohol testing is applicable under CCI and munitions response projects performed in the United States. In addition, employees may be required to submit to drug and/or alcohol testing as required by clients. When required, this testing is performed in accordance with SOP HSE-105, Drug-Free Workplace. Employees who are enrolled in drug or alcohol testing are required to complete annual training located on the VO.

Prohibitions onsite include:

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

2.2.4 Driving

- Always be aware of surroundings while operating a vehicle. Avoid intellectual stress & worries, talking on a cellular phone, eating, drinking, smoking, reading a map, adjusting controls or looking at a passenger while driving.
- Use prudent speed limits, assure that backup warning devices are working, be aware of blind spots or other hazards associated with low visibility, etc. Use a spotter if necessary.
- Do no drive while drowsy. Drowsiness can occur at any time, but is most likely after 18 hours or more without sleep.

2.2.5 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.

2.2.6 Inclement Weather

Sudden inclement weather can rapidly encroach upon field personnel. Preparedness and caution are the best defenses. Field crew members performing work outdoors should carry clothing appropriate for inclement weather. Personnel are to take heed of the weather forecast for the day and pay attention for signs of changing weather that indicate an impending storm. Signs include towering thunderheads, darkening skies, or a sudden increase in wind. If stormy weather ensues, field personnel should discontinue work and seek shelter until the storm has passed.

Protective measures during a lightning storm include seeking shelter; avoiding projecting above the surrounding landscape (don't stand on a hilltop--seek low areas); staying away from open water, metal equipment, railroad tracks, wire fences, and metal pipes; and positioning people several yards apart. Some other general precautions include:

- Know where to go and how long it will take to get there. If possible, take refuge in a large building or vehicle. Do not go into a shed in an open area.
- The inclination to see trees as enormous umbrellas is the most frequent and most deadly mistake. Do not go under a large tree that is standing alone. Likewise, avoid poles, antennae and towers.
- If the area is wide open, go to a valley or ravine, but be aware of flash flooding.
- If you are caught in a level open area during an electrical storm and you feel your hair stand on end, drop to your knees, bend forward and put your hands on your knees or crouch. The idea is to make yourself less vulnerable by being as low to the ground as possible and taking up as little ground space as possible. Lying down is dangerous, since the wet earth can conduct electricity. Do not touch the ground with your hands.
- Do not use telephones during electrical storms, except in the case of emergency

Remember that lightning may strike several miles from the parent cloud, so work should be stopped/restarted accordingly. The lightning safety recommendation is 30-30: Seek refuge when thunder sounds within 30 seconds after a lightning flash; and do not resume activity until 30 minutes after the last thunder clap.

High winds can cause unsafe conditions, and activities should be halted until wind dies down. High winds can also knock over trees, so walking through forested areas during high-wind situations should be avoided. If winds increase, seek shelter or evacuate the area. Proper body protection should be worn in case the winds hit suddenly, because body temperature can decrease rapidly.

2.2.7 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.

2.2.8 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.

2.2.9 Temperature Extremes

Each employee is responsible for the following:

- Recognizing the symptoms of heat or cold stress
- Taking appropriate precautionary measures to minimize their risk of exposure to temperature extremes
- Communicating any concerns regarding heat and cold stress to their supervisor or SC

2.2.9.1 Heat Stress

General

Physical fitness influences a person's ability to perform work under heat loads. At a given level of work, the more fit a person is, the less the physiological strain, the lower the heart rate, the lower the body temperature (indicates less retrained body heat—a rise in internal temperature precipitates heat injury), and the more efficient the sweating mechanism.

Acclimatization is the degree to which a worker's body has physiologically adjusted or acclimatized to working under hot conditions. Acclimatization affects their ability to do work. Acclimatized individuals sweat sooner and more profusely than unacclimatized individuals. Acclimatization occurs gradually over 1 to 2 weeks of continuous exposure, but it can be lost in as little as 3 days in a cooler environment.

Dehydration reduces body water volume. This reduces the body’s sweating capacity and directly affects its ability to dissipate excess heat.

The ability of a body to dissipate heat depends on the ratio of its surface area to its mass (surface area/weight). **Heat dissipation** is a function of surface area, while heat production depends on body mass. Therefore, overweight individuals (those with a low ratio) are more susceptible to heat-related illnesses because they produce more heat per unit of surface area than if they were thinner. Monitor these persons carefully if heat stress is likely.

When wearing **impermeable clothing**, the weight of an individual is not as important in determining the ability to dissipate excess heat because the primary heat dissipation mechanism, evaporation of sweat, is ineffective.

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

Precautions

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

- Observe one another for signs of heat stress. Persons who experience signs of heat syncope, heat rash, or heat cramps should consult the SC to avoid progression of heat-related illness.

Thermal Stress Monitoring

The following procedures should be implemented when the ambient air temperature exceeds 70° F, the relative humidity is high (greater than 50 percent), or when the workers exhibit symptoms of heat stress.

- The heart rate should be measured by the radial pulse for 30 seconds, as early as possible in the resting period.
- The heart rate at the beginning of the rest period should not exceed 110 beats per minute, or 20 beats per minute above resting pulse.
- If the heart rate 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 110 beats per minute at the beginning of the next rest period, the following work cycle should be further shortened by 33 percent.
- Continue this procedure until the rate is maintained below 110 beats per minute, or 20 beats per minute above resting pulse.
- Alternately, the oral temperature can be measured before the workers have something to drink.
- If the oral temperature exceeds 99.6 degrees F at the beginning of the rest period, the following work cycle should be shortened by 33 percent.
- Continue this procedure until the oral temperature is maintained below 99.6 degrees F. While an accurate indication of heat stress, oral temperature is difficult to measure in the field.

2.2.9.2 Cold

General

Low ambient temperatures increase the heat lost from the body to the environment by radiation and convection. In cases where the worker is standing on frozen ground, the heat loss is also due to conduction.

Wet skin and clothing, whether because of water or perspiration, may conduct heat away from the body through evaporative heat loss and conduction. Thus, the body cools suddenly when chemical protective clothing is removed if the clothing underneath is perspiration soaked.

Movement of air across the skin reduces the insulating layer of still air just at the skin's surface. Reducing this insulating layer of air increases heat loss by convection.

Non-insulating materials in contact or near-contact with the skin, such as boots constructed with a metal toe or shank, conduct heat rapidly away from the body.

Certain common drugs, such as alcohol, caffeine, or nicotine, may exacerbate the effects of cold, especially on the extremities. These chemicals reduce the blood flow to peripheral parts of the

body, which are already high-risk areas because of their large surface area to volume ratios. These substances may also aggravate an already hypothermic condition.

Precautions

- 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 wet 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 (below) 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, and/or 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 **not** hot–water. Have victim drink warm fluids, but **not** coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but **not** coffee or alcohol. Get medical attention.

Wind Chill Chart

Wind (mph) \ Temperature (°F)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

2.3 Biological Hazards and Controls

2.3.1 Black Bears

Bears may inhabit wooded areas where there is scarce continuous human presence. Make your presence known-especially when vegetation and terrain make it hard to see. Make noise, sing, or talk loudly. Avoid thick brush. Try to walk with the wind at your back so your scent will warn bears of your presence.

Give bears plenty of room. Every bear has a "personal space" - the distance within which a bear feels threatened – that can be from a few feet to a few hundred feet. If you stray within that zone, a bear may act aggressively. Never approach bears, even if only out of curiosity, and never attempt to feed bears.

If a bear cannot recognize you, he may come closer or stand on his hind legs for a better view. You may try to back away slowly diagonally, but if the bear follows, stop and stand your ground. If the bear moves closer or acts aggressively, stay close together and wave your arms and shout.

Do not climb a tree – black bears are good climbers.

Do not run. Bears have been clocked at speeds of up to 35 mph, and like dogs, will chase fleeing animals. Bears often make bluff charges, sometimes up to 10 feet away without making contact. Continue waving your arms and shouting. Never imitate bears sounds or use high-pitched squeals.

If attacked, do not run. Clasp your hands tightly over the back of your neck or if you are carrying a backpack use it to protect your head and neck and remain still.

For Black bears, if the attack lasts for more than a few seconds, respond aggressively - use sticks, rocks, your fists or noise. Black bears will sometimes back off if they are challenged.

2.3.2 Bees and Other Stinging Insects

Bees 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; contact the occupational nurse at 1-866-893-2514 immediately if a reaction develops or 911 if the reaction is severe.

2.3.3 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.

Work Controls

- Observe universal precautions to prevent contact with blood or other PIMs. Where differentiation between body fluid types is difficult or impossible, consider all body fluids to be potentially infectious materials.
- Consider all sharps encountered at industrial, medical, dental, or biological waste facilities or sampling locations to be contaminated and PIMs.
- Always wash your hands and face with soap and running water after contacting PIMs. If washing facilities are unavailable, use an antiseptic cleanser with clean paper towels or moist towelettes. These must be provided for employees who have been exposed to PIMs. When antiseptic cleansers or towelettes are used, always rewash your hands and face with soap and running water as soon as available. Do not consume food or beverages until after thoroughly washing your hands and face.

- Decontaminate all potentially contaminated equipment and environmental surfaces with chlorine bleach as soon as possible. Clean and decontaminate on a regular basis (and immediately upon visible contamination) all bins, pails, cans, and other receptacles intended for reuse that have the potential for becoming contaminated.
- Use one part chlorine bleach (5.25 percent sodium hypochlorite solution) diluted with 10 parts water for decontaminating equipment or surfaces after initially removing blood or other PIMs. Remove contaminated PPE as soon as possible before leaving a work area.
- Place regulated waste in containers that are closable; are constructed to contain all contents and prevent leakage of fluids during handling, storage, transport or shipping; are labeled with a Biological warning label or color-coded; and are tightly closed prior to removal to prevent spillage or protrusion of contents during handling, storage, transport, or shipping.

Employees who participate in waste characterization studies, sort or sample refuse, or contact medical, dental, or biological waste streams should follow these procedures:

- If exposure is anticipated, this group of employees should wear safety goggles or glasses, puncture-resistant utility gloves with inner latex glove liners, Tyvek coveralls or cotton coveralls with a rubber apron, and puncture-resistant shoes or boots.
- If splash potential is present, employees should wear a full-face shield.
- If a respiratory hazard is present, a full-face respirator with HEPA filters should be worn.

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

2.3.4 Coyotes

Coyotes are found in some areas of the base. While far from domesticated, coyotes show little fear of humans and have become comfortable living in close proximity to our communities. Although they tend to do most of their hunting after dusk, coyotes can be active at any time. Under normal circumstances, a coyote is not a danger to humans. They are, however, territorial and will respond aggressively if they or their family are threatened.

If you encounter a coyote that behaves aggressively, you have probably gotten too close to its prey or its family. Try to scare the coyote by yelling and waving your arms. Throw rocks, sticks or other objects. Do not turn away and run.

2.3.5 Feral Dogs

Avoid all dogs – both leashed and stray. Do not disturb a dog while it is sleeping, eating, or caring for puppies. If a dog approaches to sniff you, stay still. An aggressive dog has a tight mouth, flattened ears and a direct stare. If you are threatened by a dog, remain calm, do not scream and avoid eye contact. If you say anything, speak calmly and firmly. Do not turn and run, try to stay still until the dog leaves, or back away slowly until the dog is out of sight or you

have reached safety (e.g. vehicle). If attacked, retreat to vehicle or attempt to place something between you and the dog. If you fall or are knocked to the ground, curl into a ball with your hands over your head and neck and protect your face. If bitten, immediately scrub the bite site vigorously with soap and water. Report the incident to the local authorities. Seek medical attention as soon as possible.

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. Mosquitoes are believed to be the primary source for exposure to the West Nile Virus as well as several other types of encephalitis. The following guidelines should be followed to reduce the risk of these concerns for working in areas where mosquitoes are prevalent.

- Stay indoors at dawn, dusk, and in the early evening.
- Wear long-sleeved shirts and long pants whenever you are outdoors.
- Spray clothing with repellents containing permethrin or DEET since mosquitoes may bite through thin clothing.
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35% DEET (N,N-diethyl-meta-toluamide). 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 and contact the occupational nurse at 1-866-893-2514.

2.3.7 Poison Ivy, Poison Oak, 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. Shrubs are usually 12 to 30 inches high, or can also be a tree-climbing vine, with triple leaflets and short, smooth hair underneath. Plants are red and dark green in Spring and Summer, with yellowing leaves anytime especially in dry areas. Leaves may achieve bright reds in Fall, but plants lose its (yellowed, then brown) leaves in Winter, leaving toxic stems. All parts of the plant remain toxic throughout the seasons. These plants contain urushiol (you-ROO-shee-ol), a colorless or pale

yellow oil that oozes from any cut or crushed part of the plant, including the roots, stems and leaves and causes allergic skin reactions when contacted. The oil is active year round.

Become familiar with the identity of these plants (see below). 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.

Poison Ivy

Poison Sumac

Poison Oak

Contamination with poison ivy, sumac or oak can happen through several pathways, including:

- Direct skin contact with any part of the plant (even roots once above ground foliage has been removed).
- Contact with clothing that has been contaminated with the oil.
- Contact from removing shoes that have been contaminated (shoes are coated with urishol oil).
- Sitting in a vehicle that has become contaminated.
- Contact with any objects or tools that have become contaminated.
- Inhalation of particles generated by weed whacking, chipping, vegetation clearing.

If you must work on a site with poison ivy, sumac or oak the following precautions are necessary:

- Do not drive vehicles onto the site where it will come into contact with poison ivy, sumac or oak. Vehicles which need to work in the area, such as drill rigs or heavy equipment must be washed as soon as possible after leaving the site.
- All tools used in the poison ivy, sumac or oak area, including those used to cut back poison oak, surveying instruments used in the area, air monitoring equipment or other test apparatus must be decontaminated before they are placed back into the site vehicle. If on-site decontamination is not possible, use plastic to wrap any tools or equipment until they can be decontaminated.

- Personal protective equipment, including Tyvek coveralls, gloves, and boot covers must be worn. PPE must be placed into plastic bags and sealed if they are not disposed immediately into a trash receptacle.
- As soon as possible following the work, shower to remove any potential contamination. Any body part with suspected or actual exposure should be washed with "Tecnu" or other product designed for removing urushiol. If you do not have Tecnu wash with cold water. Do not take a bath, as the oils can form and invisible film on top of the water and contaminate your entire body upon exiting the bath.
- Tecnu may also be used to decontaminate equipment.
- Use IvyBlock or similar products to prevent poison oak, ivy and sumac contamination. Check with the closest CH2M HILL warehouse to see if these products are available. Follow all directions for application.

If you do come into contact with one of these poisonous plants and a reaction develops, contact your supervisor and the occupational nurse 1-866-893-2514.

2.3.8 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. Call the occupational nurse at 1-866-893-2514 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.

2.3.9 Spiders - Brown Recluse

It is regarded by many as the most dangerous spider in the United States. Because of interstate shipping/transportation, the Brown Recluse spider can be found most anywhere in the United States. Brown Recluse Spiders are usually 1 inch or larger in size, including the legs and can grow as large as 3 inches. Young Brown Recluse spiders are smaller. Brown recluse spider bites don't always hurt right away. away. In fact, you may not know that you have been bitten until other symptoms appear. Symptoms of a brown recluse spider bite may include the following:

- Reddened skin followed by a blister that forms at the bite site.
- Mild to intense pain and itching for 2 to 8 hours following the bite.
- An open sore with a breakdown of tissue (necrosis) that develops within a few hours to 3 to 4 days following the bite and the area may become painful, itchy, hot, swollen, red and tender. An irregular ulcerous sore, caused by necrosis, will often appear that is from ¼ inch to 10 inches in diameter. Prompt attention is the best defense against preventing the necrosis. The wound is often described as being reddish and surrounded by a bluish area with a narrow whitish separation in between the red and the blue. This gives it the famous

"bull's eye" pattern. In just hours, a bite from the highly venomous Brown Recluse spider can create blisters and cause tissue damage.

Some people have a severe, systemic (whole-body) reaction to brown recluse spider bites, including the rapid destruction of red blood cells and anemia. Signs and symptoms include:

- Fever and chills
- Skin rash all over the body with many tiny, flat purple and red spots
- Nausea or vomiting
- Joint pain

If you think you have been bitten by a brown recluse spider:

- Remain calm. Too much excitement or movement will increase the flow of venom into the blood.
- Try to collect the spider, without being bitten, (even a mangled specimen has diagnostic value), if possible, for positive identification by a spider expert. A plastic bag, small jar, or pill vial is useful and no preservative is necessary, but rubbing alcohol helps to preserve the spider.
- Apply a cool, wet cloth to the bite or cover the bite with a cloth and apply an ice bag to the bite.
- Do not apply a tourniquet. It may cause more harm than benefit.
- Try to positively identify the spider to confirm its type.
- Seek prompt medical attention.

A brown recluse bite can be serious and will likely require immediate medical care. Seek medical attention if you believe you have been bitten by a recluse spider, especially if severe symptoms develop throughout your body or an open sore and necrosis develop. A brown recluse spider bite is diagnosed through a physical examination and questions about the bite. You should be prepared to describe the spider, where and when the bite took place, and what you were doing at the time. Your health professional will ask what your main symptoms are, when they began, and how they have developed, progressed, or changed since the bite.

2.3.10 Widow Spiders

The Northern Black Widow spider may be encountered in Northern Regions of the United States. Other similar widow spiders are the Red Widow and the Brown Widow. Female widow spiders range from 8-15 mm in body length; males are smaller, sometimes very small (2 mm). Most have globose, shiny abdomens that are predominantly black with red markings (although some may be pale and/or have lateral stripes), with moderately long, slender legs. These spiders are nocturnal and build a three-dimensional tangled web, often with a conical tent of dense silk in a corner where the spider hides during the day. In nature, most species are found under rocks and logs, but they readily adapt to human-altered environments, where they are most commonly found in outbuildings (sheds, barns, privies), water meter holes, nursery cans, and under any item or structure (*e.g.*, barbeque grill, slide, sand box) that has been undisturbed for a lengthy period. Formerly, most bites by black widows (almost all by female spiders) occurred in outhouses, but presently, widow bites occur most frequently when the spider is trapped against human skin, either by reaching under objects where the spider is hiding or

when putting on clothing, gloves or shoes containing the spider. Widow spiders are generally very timid and only bite in self-defense when they accidentally contact humans.

Black Widow

Red Widow

Brown Widow

Bite symptoms are systemic, spreading through the lymphatic system, and usually start about 1-3 hours after the bite. The most common symptoms are intense pain, rigid abdominal muscles, muscle cramping, malaise, local sweating, nausea, vomiting, and hypertension. Other symptoms may includetremors, labored breathing, restlessness, increased blood pressure, and fever. If left untreated, widow bite symptoms usually last 3-5 days.

If bitten, remain calm, and immediately seek medical attention (contact your physician, hospital and/or poison control center). Apply an ice pack directly to the bite area to relieve swelling and pain. Try to collect the spider, without being bitten, (even a mangled specimen has diagnostic value), if possible, for positive identification by a spider expert. A plastic bag, small jar, or pill vial is useful and no preservative is necessary, but rubbing alcohol helps to preserve the spider. A hospital stay may be recommended, particularly for those with a heart condition or with health problems. A physician may administer a specific antivenin to counteract the venom or calcium gluconate to relieve pain. Calcium gluconate and/or antivenin may be administered to relieve or counteract symptoms.

2.3.11 Ticks

Every year employees are exposed to tick bites at work and at home putting them at risk of illness. 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.

In some geographic areas exposure is not easily avoided. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray **only outside** of clothing with permethrin or permanone and spray skin with only DEET; and check yourself frequently for ticks.

Where site conditions warrant (vegetation above knee height, tick endemic area) or when tasks warrant (e.g., having to sit/kneel in vegetation) that diminish the effectiveness of the other controls mentioned above, bug-out suits (obtained from MKE warehouse)/Tyvek shall be used. Bug-out suits are more breathable than Tyvek.

Take precautions to avoid exposure by including pre-planning measures for biological hazards prior to starting field work. Contact the MKE Warehouse for preventative equipment such as repellants, protective clothing and tick removal kits. Use the buddy system and perform tick inspections prior to entering the field vehicle. If ticks were not planned to be encountered and are observed, do not continue field work until these controls can be implemented.

See Tick Fact Sheet attached to this HSP for further precautions and controls to implement when ticks are present. Information includes the procedure for submitting a removed tick for testing. If bitten by a tick, follow the removal procedures found in the tick fact sheet, call the occupational nurse at 1-866-893-2514 and submit the tick to Clongen laboratory using the form in the fact sheet attachment.

Be aware of the 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 RMSF and Lyme disease, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, again contact the occupational nurse at 1-866-893-2514.

Be sure to complete an Incident Report (either use the HITS system on the VO) or see Attachment 8 if you do come in contact with a tick. For more detailed information go to HSSE website or contact the RHSM.

2.4 Radiological Hazards and Controls

Refer to CH2M HILL's Core Standard, Radiological Control and Radiological Controls Manual for additional requirements.

Hazards	Controls
None Known	None Required

2.5 MEC Avoidance Procedures

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

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

Soil Sampling and Temporary Monitoring Well Locations. The UXO Technicians will clear the surface area of the work site for soil sampling and temporary monitoring well installation. The area will be clearly marked, and large enough to accommodate the direct push equipment and provide a work area for the crews. As a minimum, the cleared area will be a square, with a side dimension equal to twice the length of the largest vehicle or piece of equipment for use on

site. If a pre-selected area indicates magnetic anomalies, a new sampling / drill site will be chosen.

Borehole Sampling. If surface samples are required they will be obtained prior to the start of boring. The borehole procedures will be completed using DPT equipment. Prior to DPT sampling, an UXO Technician will advance a borehole using a hand auger, and check the borehole with a down hole magnetometer a minimum of every 1 foot, to the deepest sampling depth or a maximum of 5 feet to ensure that smaller items of MEC, undetectable from the surface will be detected. The anticipated depth of potential MEC items is anywhere from near-surface to < 1 ft, based on penetration calculations of the types of ammunition previously used on the site. Should any MEC item be identified during DPT sampling, work will stop and the depth of down hole sampling will be re-evaluated.

2.6 Contaminants of Concern

Potential contaminants of concern include:

Contaminants of Concern					
Contaminant	Location and Maximum[a] Concentration (ppm)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
2,4,6-trinitrotoluene	GW: Unknown SB: Unknown SS: Unknown	1.5 mg/m^3	500 mg/m^3	Irritation skin, mucous membrane; liver damage, jaundice; cyanosis; sneezing; cough	10.59

Footnotes:

[a] Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), S (Surface Soil), SL (Sludge), SW (Surface Water).
[b] Appropriate value of PEL, REL, or TLV listed.
[c] IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.
[d] PIP = photoionization potential; NA = Not applicable; UK = Unknown.

Potential Routes of Exposure		
Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 4.	**Inhalation:** Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 4 and 5, respectively.	**Other:** 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).

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*)

3.1.1 Hazardous Waste Operations Training

All employees engaging in hazardous waste operations or emergency response shall receive appropriate training as required by 29 CFR 1910.120 and 29 CFR 1926.65. At a minimum, the training shall have consisted of instruction in the topics outlined in the 29 CFR 1910.120 and 29 CFR 1926.65. Personnel who have not met these training requirements shall not be allowed to engage in hazardous waste operations or emergency response activities.

3.1.1.1 Initial Training

General site workers engaged in hazardous waste operations shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations, unless otherwise noted in the above-referenced standards.

Employees who may be exposed to health hazards or hazardous substances at treatment, storage, and disposal (TSD) operations shall receive a minimum of 24 hours of initial training to enable the employee to perform their assigned duties and functions in a safe and healthful manner.

Employees engaged in emergency response operations shall be trained to the level of required competence in accordance with 29 CFR 1910.120.

3.1.1.2 Three-Day Actual Field Experience

General site workers for hazardous waste operations shall have received three days of actual experience (on-the-job training) under the direct supervision of a trained, qualified supervisor and shall be documented. If the field experience has not already been received and documented at a similar site, this supervised experience shall be accomplished and documented at the beginning of the assignment of the project.

3.1.1.3 Refresher Training

General site workers and TSD workers shall receive 8-hours of refresher training annually (within the previous 12-month period) to maintain qualifications for fieldwork. Employees engaged in emergency response operations shall receive annual refresher training of sufficient content and duration to maintain their competencies or shall demonstrate competency in those areas at least annually.

3.1.1.4 Eight-Hour Supervisory Training

On site management or supervisors who will be directly responsible for, or supervise employees engaged in hazardous waste site operations, will have received at least 8 hours of additional specialized training on managing such operations. Employees designated as SC-HW employees are considered 8-hour HAZWOPER Site Safety Supervisor trained.

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	SC/FA-CPR
Hope Oaks	ATL	Project Manager	SSC-HW/FA-CPR
Renee Clore	CHC	Task Manager	SSC-HW/FA-CPR
To be determined			

3.2 Field Team Chain of Command and Communication Procedures

3.2.1 Client: NAVFAC

Contact Name: Bryan Beck
Phone: (757) 322-4734
Facility Contact Name: Robert Lowder, Base Environmental Management Division
Phone: (910) 451-9607

3.2.2 CH2M HILL

Program Manager: Ray Tyler
Project Manager (PM): Hope Oaks
Responsible Health and Safety Manager (RHSM): Mark Orman
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, contractor's 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 3rd 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 3rd 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 4 and 5, 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 4, 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 3rd 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 3rd 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-Hazardous Waste
- 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: Utility Locating
Subcontractor Contact Name: TBD
Telephone:

Subcontractor: Surveying
Subcontractor Contact Name: TBD
Telephone:

Subcontractor: Vegetation Clearing
Subcontractor Contact Name: TBD
Telephone:

Subcontractor: DPT Drilling
Subcontractor Contact Name: TBD
Telephone:

The subcontractors listed above are required to submit their own Site-Specific HSP. 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 5 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 4 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.

4.0 Personal Protective Equipment (PPE)

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

4.1 Required PPE

- 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.

The table below outlines PPE to be used according to task based on project-specific hazard assessment. If a task other than the tasks described in this table needs to be performed, contact the RHSM so this table can be updated.

Project-Specific PPE Requirements[a]

Task	Level	Body	Head	Respirator [b]
General site entry Surveying Utility clearance Observation of material loading for offsite disposal Oversight of remediation and construction	D	Work clothes; safety toed leather work boots and gloves	Hardhat [c] Safety glasses with side shields Ear protection [d]	None required
GW / soil sampling Geoprobe boring Well Install	Modified D	Work clothes or cotton coveralls **Boots:** Safety-toe, chemical-resistant boots OR Safety -toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Safety glasses with side shields Ear protection [d]	None required
Investigation-derived waste (drum) sampling and disposal	Modified D	**Coveralls:** Uncoated Tyvek® **Boots:** Safety -toe, chemical-resistant boots OR Safety -toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Splash shield [c] Safety glasses with side shields Ear protection [d]	None required.

Reasons for Upgrading or Downgrading Level of Protection with approval of HSM

Upgrade[f]	Downgrade
• Request from individual performing tasks. • Change in work tasks that will increase contact or potential contact with hazardous materials. • Occurrence or likely occurrence of gas or vapor emission. • Known or suspected presence of dermal hazards. • Instrument action levels (Section 5) exceeded.	• New information indicating that situation is less hazardous than originally thought. • Change in site conditions that decrease the hazard. • Change in work task that will reduce contact with hazardous materials.

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.
[b] No facial hair that would interfere with respirator fit is permitted.
[c] Hardhat and splash-shield areas are to be determined by the SC.
[d] Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.
[e] See cartridge change-out schedule in Section 4.2.
[f] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the RHSM, and an SC qualified at that level is present.

PPE Certification

I certify that the PPE requirements listed in the table above for the associated tasks are based upon the project-specific hazard assessment I performed.

Mark Orman	29 July 2009	29 July 2009
Name	Date of Certification	Date(s) of Project Hazard Assessment

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[a]	Action to be Taken when Action Level reached	Frequency [b]	Calibration
Toxic Gas Monitor: MultiRAE Plus with 10.6 eV lamp (VOCs, O_2, LEL, CO, H_2S)	Sampling and intrusive activities	0-1 ppm 1-5 ppm >5 ppm	Level D Level C – not permitted Level B – not permitted	Initially and periodically during task	Daily
LEL	Sampling and intrusive activities	0-10% : >10% LEL:	No explosion hazard Explosion hazard; evacuate or vent	Continuous during advancement of boring or trench	Daily
O_2Meter:	Sampling and intrusive activities	>25%[c] O_2: 20.9%[c] O_2: <19.5%[c] O_2:	Explosion hazard; evacuate or vent Normal O_2 O_2 deficient; vent or use SCBA	Continuous during advancement of boring or trench	Daily
Nose-Level Monitor [d]	DPT	<85 dB(A) 85-120 dB(A) 120 dB(A)	No action required Hearing protection required Stop; re-evaluate	Initially and periodically during task	Daily

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

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

[c] If the measured percent of O_2 is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O_2 action levels apply only to ambient working atmospheres, and not to confined-space entry. More-stringent percent LEL and O_2 action levels are required for confined-space entry (refer to Section 2).

[d] 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
5 Gas Meter (MultiRAE) **PID:** OVM, 10.6 eV lamp	100 ppm isobutylene	RF = 1.0	100 ppm	1.5 lpm reg T-tubing/ tedlar bag
LEL/O_2/H_2S/CO Sensors				
	Methane	NA	2.5% (50% LEL)	1.5 lpm reg T-tubing/ tedlar bag
	Oxygen	NA	20.9%	1.5 lpm reg T-tubing/ tedlar bag
	Hydrogen Sulfide	NA	25	1.5 lpm reg T-tubing/ tedlar bag
	Carbon Monoxide	NA	50	1.5 lpm reg T-tubing/ tedlar bag

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.

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

Personnel	Sample Equipment	Heavy Equipment
– Boot wash/rinse – Glove wash/rinse – Outer-glove removal – Body-suit removal – Inner-glove removal – Respirator removal – Hand wash/rinse – Face wash/rinse – Shower ASAP – Dispose of PPE in municipal trash, or contain for disposal – Dispose of personnel rinse water to facility or sanitary sewer, or contain for offsite disposal	– Wash/rinse equipment – Solvent-rinse equipment – Contain solvent waste for offsite disposal	– Power wash – Steam clean – Dispose of equipment rinse water to facility or sanitary sewer, or contain for offsite disposal

6.2 Diagram of Personnel-Decontamination Line

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SC 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.

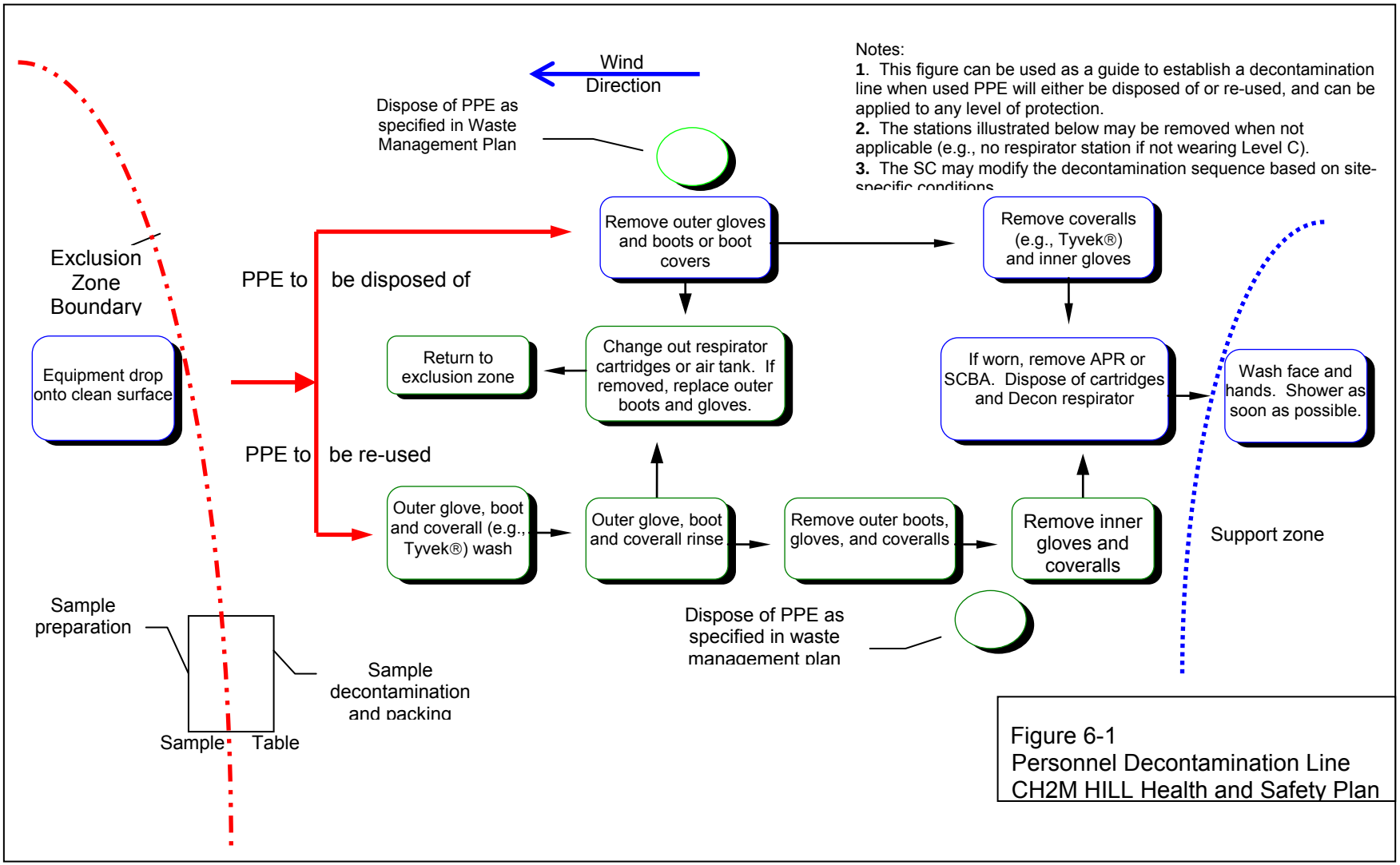


Figure 6-1
Personnel Decontamination Line
CH2M HILL Health and Safety Plan

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.

8.0 Site-Control Plan

8.1 Site-Control Procedures

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

- The SC will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.
- Topics for briefing on site safety: general discussion of Health and Safety Plan, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, emergencies.
- The SC 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- Core Standard, *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.

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.

Emergency Equipment and Supplies	Location
20 (or two 10) class A,B,C fire extinguisher	In field vehicle and field trailer
First aid kit	In field vehicle and field trailer
Eye Wash	In field vehicle and field trailer
Potable water	In field trailer
Bloodborne-pathogen kit	In field vehicle and field trailer
Additional equipment (specify): Cell Phone	FTL / SSC

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 9.7.

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 Emergency Contacts at the front of this HSP.
- 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 1-866-893-2514 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 5.

- 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 9.7.

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.

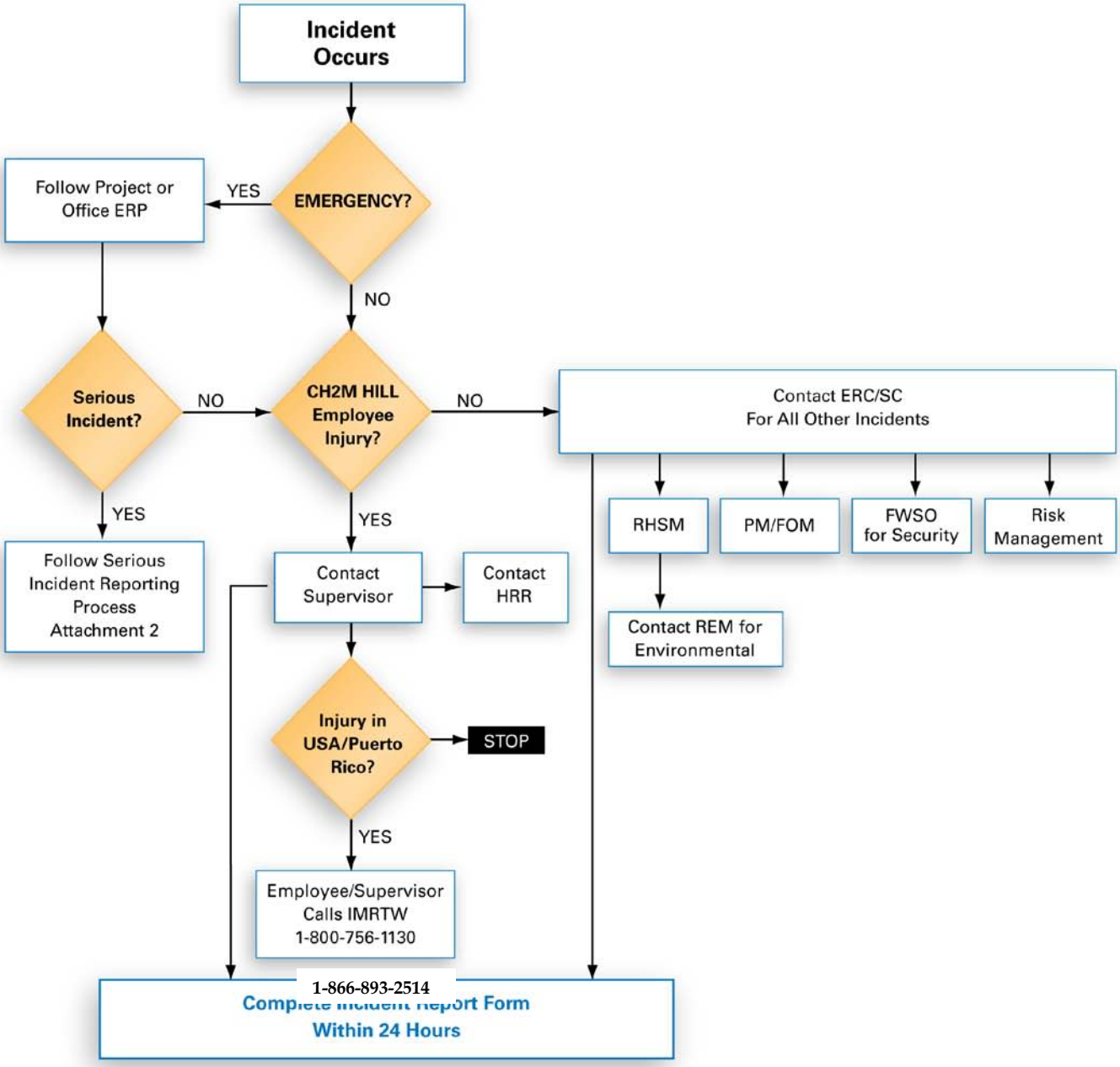
9.7 Incident Notification and Reporting

(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) 1-866-893-2514. 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

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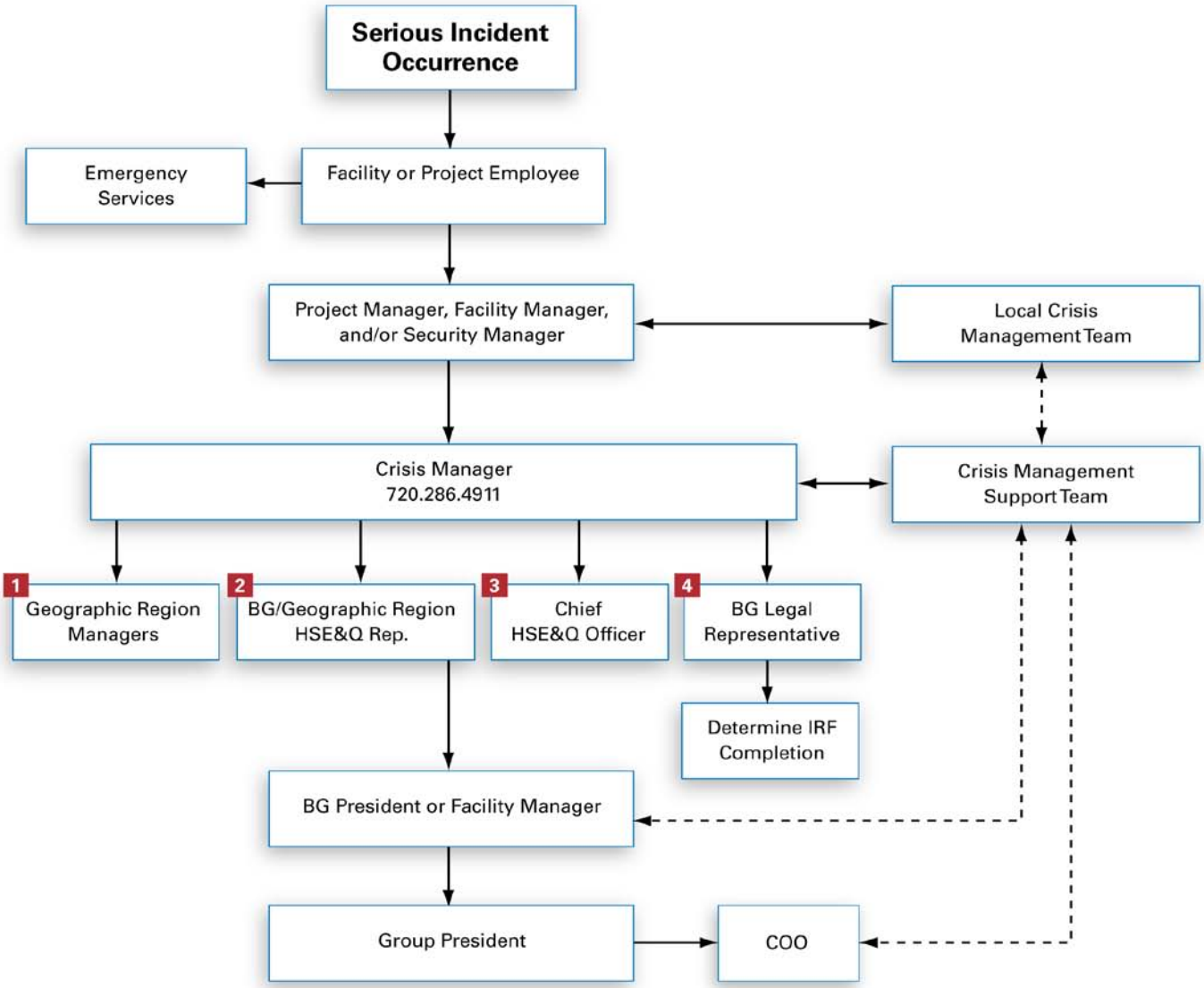
Attachment 2
CH2M HILL Serious Incident Notification



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

(Reference CH2M HILL SOP HSE-103, *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 by CH2M HILL projects to implement the BBLPS include:

- Activity Hazard Analysis (AHA)
- Pre-Task Safety Plans (PTSP)
- Safe Behavior Observations (SBO)
- 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 5. 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, which 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 5, 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 Safe Behavior Observations

Safe Behavior Observations (SBOs) 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. SBOs 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 SBO each week for tasks/operations addressed in the project-specific HSP or AHA. The SC or designee shall complete the SBO form in **Attachment 5** for the task/operation being observed and submit the SBO form weekly to the "SER SBO Mailbox" email address.

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 5.**

- 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.

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: Renee Clore/CHC **Date:** July 28, 2009

Approved By: Mark Orman/MKE **Date:** 29 July 2009

Revisions

Revisions Made By: **Date:**

Revisions to Plan:

Revisions Approved By: **Date:**

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: Project Activity Self-Assessment Checklists/Permits

Attachment 5: Behavior Based Loss Prevention Forms

Attachment 6: Material Safety Data Sheets

Attachment 7: Working Alone Standard

Attachment 8: Tick Fact Sheet

Attachment 9: Notice of Safety Violation Form

Attachment 10: Stop Work Order Form

Health and Safety Plan Employee Sign-off Form

EMPLOYEE SIGNOFF FORM

Health and Safety Plan

The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this HSP, have read and understood it, and agree to abide by its provisions.

Project Name: Confirmatory Sampling Site 67 **Project Number:** 380666

EMPLOYEE NAME (Please print)	**EMPLOYEE SIGNATURE**	**COMPANY**	**DATE**

Chemical Inventory/Register Form

CH2MHILL

CHEMICAL INVENTORY/REGISTER FORM

Refer to SOP HSE-107, Attachment 1, for instructions on completing this form.

Location: _____

HCC: _____

☐ Office ☐ Warehouse ☐ Laboratory ☐ Project: _____
Project No.: _____

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

MSDS for the listed products will be maintained at: _____

Chemical-Specific Training Form

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

Refer to SOP 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.

CH2M HILL Health and Safety Plan

Attachment 4

Project Activity Self-Assessment Checklists/Permits/Forms

- **Drilling**
- **Fall Protection**
- **Hand and Power Tools**
- **Hazardous Materials Handling**
- **Lockout/Tagout**
- **Manual Lifting**
- **Personal Protective Equipment**
- **Stairways & Ladders**
- **Traffic Control**

CH2M HILL Health and Safety Plan

Attachment 5

Behavior Based Loss Prevention System Forms

Activity Hazard Analysis Template

Pre-Task Safety Plans

Safe Behavior Observation

Incident Report and Investigation

(use electronic form when possible)

HITS

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

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

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

	PRINT NAME	SIGNATURE	
Supervisor Name:	_____	_____	**Date/Time:**_____
Safety Officer Name:	_____	_____	**Date/Time:**_____
Employee Name(s):	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____

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):

__ Chemical burns/contact	__ Trench, excavations, cave-ins	__ Ergonomics
__ Pressurized lines/equipment	__ Overexertion	__ Chemical splash
__ Thermal burns	__ Pinch points	__ Poisonous plants/insects
__ Electrical	__ Cuts/abrasions	__ Eye hazards/flying projectile
__ Weather conditions	__ Spills	__ Inhalation hazard
__ Heights/fall > 6 feet	__ Overhead Electrical hazards	__ Heat/cold stress
__ Noise	__ Elevated loads	__ Water/drowning hazard
__ Explosion/fire	__ Slips, trip and falls	__ Heavy equipment
__ Radiation	__ Manual lifting	__ Aerial lifts/platforms
__ Confined space entry	__ Welding/cutting	__ Demolition

Other Potential Hazards (Describe):

_____

_____

_____

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

Name (Print): _____

Signature:_____ Date:_____

Safe Behavior Observation Form		
Project Name:	Observer:	Date:
Program / Client:	Project Mgr. & No.:	
Position/Title of worker observed:	Background Information/ comments:	
Task/Observation Observed:		

- Identify and reinforce safe work practices/behaviors
- Identify and improve on at-risk practices/acts
- Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards
- Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)
- Positive, corrective, cooperative, collaborative feedback/recommendations

Actions & Behaviors	Safe	At-Risk	Observations/Comments
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			**Positive Observations/Safe Work Practices:**
Properly trained/ qualified/ experienced			
Tools/equipment available and adequate			
Proper use of tools			**Questionable Activity/Unsafe Condition Observed:**
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			**Observer's Corrective Actions/Comments:**
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			**Observed Worker's Corrective Actions/Comments:**
Other…			

CH2M HILL Health and Safety Plan

Attachment 6

Material Safety Data Sheets

CH2M HILL Health and Safety Plan

Attachment 7

Working Alone Standard

CALL – IN CONTACT FORM

Date of site work:_____ Expected start time:_____

Name of CH2M HILL employee in the field:_____

Name of CH2M HILL employee responsible to receive contact:

Client Emergency Contact (if any):

CH2M HILL employee's contact numbers:

Radio #_____

Cell Phone #_____

Address and Location of work:_____

Directions/Map:

Planned Activity:_____

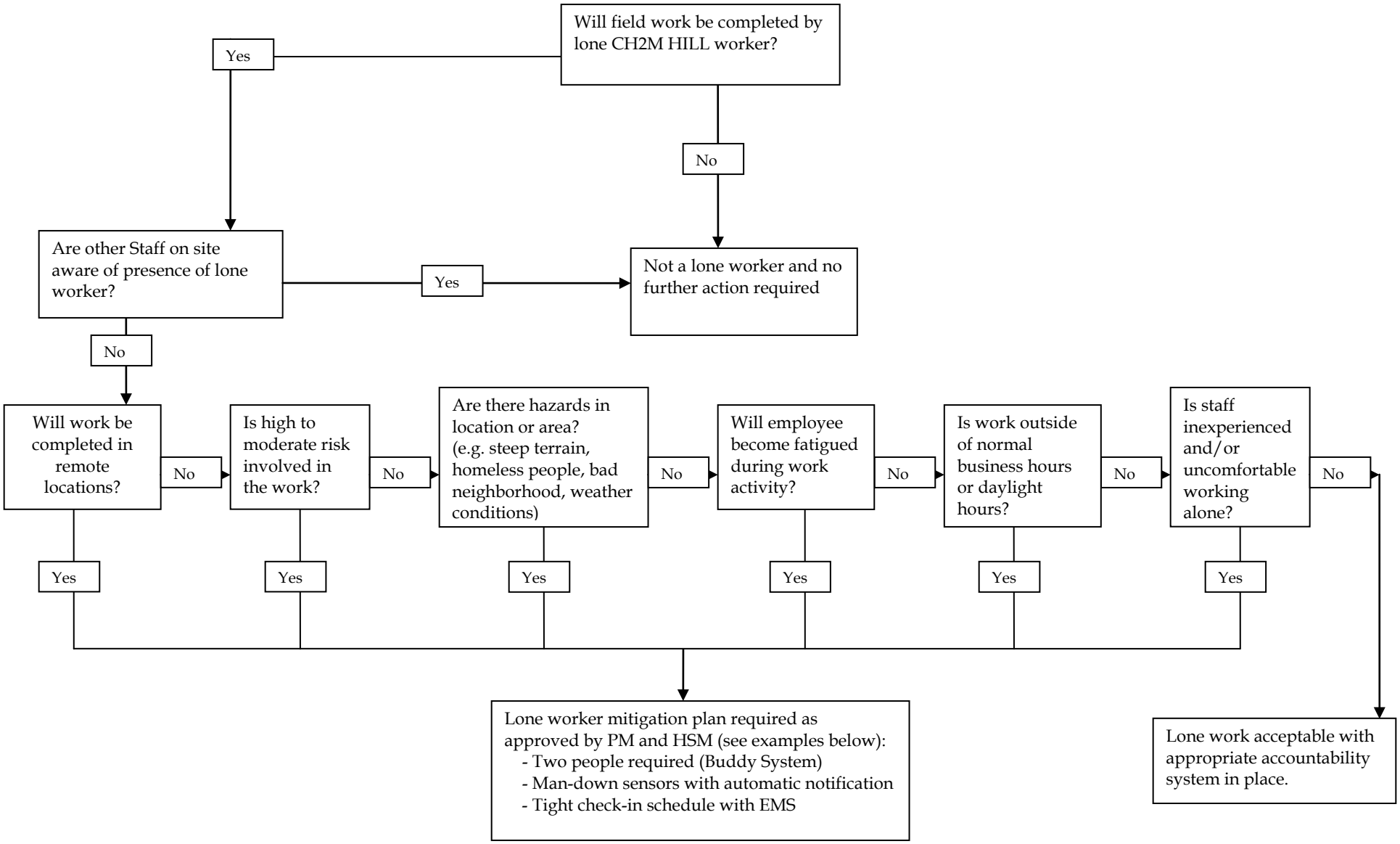
Specified Frequency and time for call in:_____

Time	Verified	Location

If lone worker fails to call in at specified frequency/time:

1) Call worker's radio and cell to determine if an emergency exists.
2) If no reply, immediately call Client security/emergency service if there is one at the site.
3) If there is no client security call Emergency Services (911). Inform the dispatcher there is a lone worker that cannot be contacted and there may be an emergency on site. Provide the lone worker's name, their last known location, and your contact information.
4) After Emergency Services have been contacted, call the other emergency contacts, Project Manager, and Health and Safety Manager.

Lone Worker Protocol



CH2M HILL HEALTH AND SAFETY PLAN

Attachment 8

Tick Fact Sheet

Tick-Borne Pathogens — A Fact Sheet

Most of us have heard of Lyme disease or Rocky Mountain Spotted Fever (RMSF), but there are actually six notifiable tick-borne pathogens that present a significant field hazard. In some areas, these account for more than half of our serious field incidents. The following procedures should be applied during any field activity—even in places that are predominantly paved with bordering vegetation.

Hazard Recognition

An important step in controlling tick related hazards is understanding how to identify ticks, their habitats, their geographical locations, and signs and symptoms of tick-borne illnesses.

Tick Identification

There are five varieties of hard-bodied ticks that have been associated with tick-borne pathogens. These include:

- Deer (Black Legged) Tick (eastern and pacific varieties)
- Lone Star Tick
- Dog Tick
- Rocky Mountain Wood Tick

These varieties and their geographical locations are illustrated on the following page.

Tick Habitat

In eastern states, ticks are associated with deciduous forest and habitat containing leaf litter. Leaf litter provides a moist cover from wind, snow, and other elements. In the north-central states, is generally found in heavily wooded areas often surrounded by broad tracts of land cleared for agriculture.

On the Pacific Coast, the bacteria are transmitted to humans by the western black-legged (deer) tick and habitats are more diverse. For this region, ticks have been found in habitats with forest, north coastal scrub, high brush, and open grasslands. Coastal tick populations thrive in areas of high rainfall, but ticks are also found at inland locations.

Illnesses and Signs & Symptoms

There are six notifiable tick-borne pathogens that cause human illness in the United States. These pathogens may be transmitted during a tick bite—normally hours after attachment. The illnesses, presented in approximate order of most common to least, include:

- Lyme (bacteria)
- RMSF (bacteria)
- Ehrlichiosis (bacteria)
- STARI (Southern Tick-Associated Rash Illness) (bacteria)
- Tularemia (Rabbit Fever) (bacteria)
- Babesia (protozoan parasite)

Symptoms will vary based on the illness, and may develop in infected individuals typically between 3 and 30 days after transmission. Some infected individuals will not become ill or may develop only mild symptoms. These illnesses present with some or all of the following signs & symptoms: fever, headache, muscle aches, stiff neck, joint aches, nausea, vomiting, abdominal pain, diarrhea, malaise, weakness, small solid, ring-like, or spotted rashes. The bite site may be red, swollen, or develop ulceration or lesions. For Lyme disease, the bite area will sometimes

resemble a target pattern. A variety of long-term symptoms may result if the illness is left untreated, including debilitating effects and death.

Deer Tick

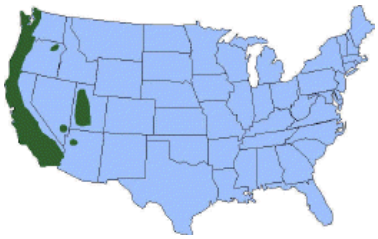
From Left: adult female, adult male, nymph, and larvae Deer Tick (cm

Lone Star Tick

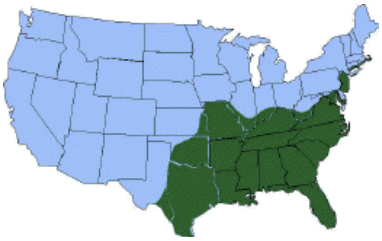
Dog Tick

Rocky Mountain Wood Tick

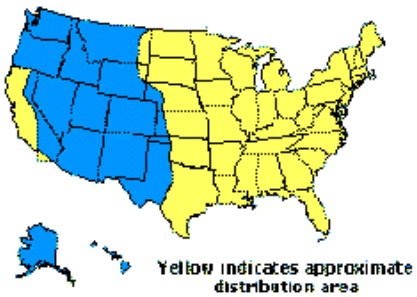
Distribution of Deer Tick (dark green)

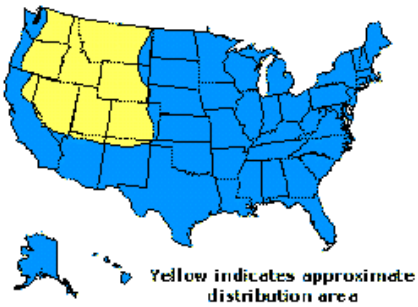


Distribution of Pacific Deer Tick (dark green)



Distribution of Lone Star Tick (Green)





Hazard Control

The methods for controlling exposure to ticks include, in order of most- to least-preferred:

- Avoiding tick habitats and ceasing operations in heavily infested areas
- Reducing tick abundance through habitat disruption or application of acracide
- Personal protection through use of repellants and protective clothing
- Frequent tick inspections and proper hygiene

Vaccinations are not available and preventative antibiotic treatment after a bite is generally not recommended.

Avoidance and Reduction of Ticks

To the extent practical, tick habitats should be avoided. In areas with significant tick infestation, consider stopping work and withdrawing from area until adequate tick population control can be achieved. Stopping and withdrawing should be considered as seriously as entering an area without proper energy control or with elevated airborne contaminants—tick-borne pathogens present risk of serious illness!

In areas where significant population density or infestation exists, tick reduction should be considered. Tick reduction can be achieved by disrupting tick habitats and/or direct population reduction through the use of tick-toxic pesticides (Damminix, Dursban, Sevin, etc.).

Habitat disruption may include only simple vegetative maintenance such as removing leaf litter and trimming grass and brush. Tick populations can be reduced by between 72 and 100 percent when leaf litter alone is removed. In more heavily infested areas, habitat disruption may include grubbing, tree trimming or removal, and pesticide application (Damminix, Dursban, Sevin, etc.). This approach is practical in smaller, localized areas or perimeter areas that require occasional access. Habitat controls are to be implemented with appropriate health and safety controls, in compliance with applicable environmental requirements, and may be best left to the property owner or tenant or to a licensed pesticide vendor. Caution should be exercised when using chemical repellents or pesticides in or around areas where environmental or industrial media samples will be collected for analysis.

Personal Protection

After other prevention and controls are implemented, personal protection is still necessary to control exposure to ticks. Personal protection must include all of the following steps:

- Where site conditions warrant (vegetation above knee height, tick endemic area) or when tasks warrant (e.g., having to sit/kneel in vegetation) that diminish the effectiveness of the other controls mentioned above, bug-out suits (obtained from MKE warehouse)/Tyvek shall be used. Bug-out suits are more breathable than Tyvek.
- So that ticks may be easily seen, wear light-colored clothing. Full-body New Tyvek (paper-like disposable coveralls) may also be used
- To prevent ticks from getting underneath clothing tuck pant legs into socks or tape to boots
- Wear long-sleeved shirts, a hat, and high boots
- Apply DEET repellent to exposed skin or clothing per product label
- Apply permethrin repellent to the outside of boots and clothing before wearing, per product label
- Frequently check for ticks and remove from clothing
- At the end of the day, search your entire body for ticks (particularly groin, armpits, neck, and head) and shower

- To prevent pathogen transmission through mucous membranes or broken/cut skin, wash or disinfect hands and/or wear surgical-style nitrile gloves any time ticks are handled

Pregnant individuals and individuals using prescription medications should consult with their physician and/or pharmacists before using chemical repellents. Because human health effects may not be fully known, use of chemical repellents should be kept to a minimum frequency and quantity. Always follow manufacturers' use instructions and precautions. Wash hands after handling, applying, or removing protective gear and clothing. Avoid situations such as hand-to-face contact, eating, drinking, and smoking when applying or using repellents.

Remove and wash clothes per repellent product label. Chemical repellents should not be used on infants and children.

Vaccinations are generally not available for tick-borne pathogens. Although production of the LYMErix™ Lyme disease vaccination has been ceased, vaccination may still be considered under specific circumstances and with concurrence from the consulting physician.

Tick Check

A tick check should be performed after field survey before entering the field vehicle (you do not want to infest your field vehicle with ticks). Have your field partner check your back; the backs of your legs, arms, and neck; and your hairline. Shake off clothing as thorough as possible before entering the vehicle. Once the field day is complete, repeat this procedure and perform a thorough self check.

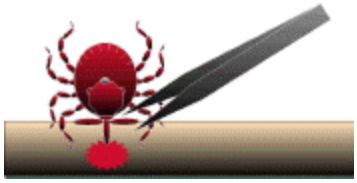
If a tick has embedded itself into the skin, remove the tick as described below.

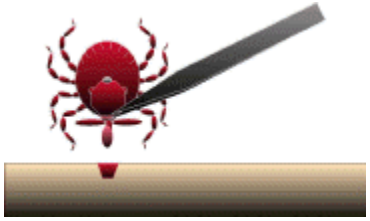
Tick Removal

1. Use the tick removal kit obtained through the CH2M HILL Milwaukee warehouse, or a fine-tipped tweezers or shield your fingers with a tissue, paper towel, or nitrile gloves.

Tick Bites\Tick Remover.pdf

2. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. If this happens, remove mouthparts with tweezers. Consult your healthcare provider if





infection occurs.

3. Avoid squeezing, crushing or puncturing the body of the tick because its fluids (saliva, hemolymph, gut contents) may contain infectious organisms. Releasing these organisms to the outside of the tick's body or into the bite area may increase the chance of infectious organism transmission.

4. Do not handle the tick with bare hands because infectious agents may enter through mucous membranes or breaks in the skin. This precaution is particularly directed to individuals who

remove ticks from domestic animals with unprotected fingers. Children, elderly persons, and immunocompromised persons may be at greater risk of infection and should avoid this procedure.

5. After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.

6. You may wish to save the tick for identification in case you become ill. Your doctor can use the information to assist in making an accurate diagnosis. Place the tick in a plastic bag and put it in your freezer. Write the date of the bite on a piece of paper with a pencil and place it in the bag.

Note: Folklore remedies such as petroleum jelly or hot matches do little to encourage a tick to detach from skin. In fact, they may make matters worse by irritating the tick and stimulating it to release additional saliva, increasing the chances of transmitting the pathogen. These methods of tick removal should be avoided. In addition, a number of tick removal devices have been marketed, but none are better than a plain set of fine tipped tweezers.

First-Aid and Medical Treatment

Tick bites should always be treated with first-aid. Clean and wash hands and disinfect the bite site after removing embedded tick. Individuals previously infected with Lyme disease does not confer immunity—re-infection from future tick bites can occur even after a person has contracted a tick-borne disease.

CH2M Hill has a protocol in place for employees who have experienced a tick bite due to work-related activities, to test all ticks that have been removed from them for the presence of Borrelia burgdorferi.

The employee should contact the Injury Management/Return To Work provider (IMRTW), WorkCare using the toll-free number 866-893-2514 to report the tick bite. WorkCare will follow-up with each CH2M Hill employee who reports a tick bite and is at risk of developing Lyme disease by monitoring for symptoms up to 45 days, and will refer the employee to a medical provider for evaluation and treatment as necessary

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 9

Notice of Safety Violation Form

Notice of Safety Violation

REPORT PREPARED BY:

Name:	**Title:**	**Signature:**	**Date:**

VIOLATION:

Description:	Date:
	_____

SUBCONTRACTOR SIGNATURE OF NOTIFICATION:

Name:	**Title:**	**Signature:**	**Date:**

**** Corrective action is to be taken immediately. Note below the action taken, sign and return to CCI.****

SUBCONTRACTOR'S CORRECTIVE ACTION

Description:	Date of Nonperformance:
	_____

SUBCONTRACTOR SIGNATURE OF CORRECTION

Name:	**Title:**	**Signature:**	**Date:**

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 10

Stop Work Order Form

Stop Work Order

REPORT PREPARED BY:

Name:	**Title:**	**Signature:**	**Date:**

ISSUE OF NONPERFORMANCE:

Description:	Date of Nonperformance:
	_____

SUBCONTRACTOR SIGNATURE OF NOTIFICATION:

Name:	**Title:**	**Signature:**	**Date:**

**** Corrective action is to be taken immediately. Note below the action taken, sign and return to CCI.* Work may not resume until authorization is granted by CH2M HILL Constructors, Inc. Representative,***

SUBCONTRACTOR'S CORRECTIVE ACTION

Description:	Date of Nonperformance:
	_____

SUBCONTRACTOR SIGNATURE OF CORRECTION

Name:	**Title:**	**Signature:**	**Date:**

Appendix B
Archival Records Search Report

Draft

Archival Records Search Report for Confirmatory Sampling at Site 67 Engineer's TNT Burn Site

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Contract Task Order 040

October 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

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2-11 Historical Aerial – 1962
2-12 Existing Conditions Map – 1963
2-13 Historical Aerial – 1989

Attachments

A Resource Review Summary
B Historical Maps and Photos

Acronyms and Abbreviations

ARSR	Archival Records Search Report
ASCS	Agricultural Stabilization and Conservation Service
ASR	Archive Search Report
ETA	Engineer Training Area
GIS	Geographic Information System
IAS	Initial Assessment Study
MC	Munitions constituents
MCB	Marine Corps Base
MEC	munitions and explosives of concern
TNT	2,4,6-trinitrotoluene
USACE	United States Army Corps of Engineers
USMC	United States Marine Corps
WWII	World War II

SECTION 1

Introduction

This archive records review was completed in support of confirmatory sampling at Site 67, the Engineer's 2,4,6-trinitrotoluene (TNT) Burn Site, first identified in the 1983 base wide Initial Assessment Study (IAS) and hereafter referred to as Site 67. Site 67 is comprised of approximately 4 acres of land located immediately north of Traps Bay near the southern boundary of Marine Corps Base (MCB) Camp Lejeune (**Figure 1-1**). The purpose of confirmatory sampling at Site 67 is to verify the presence of hazardous wastes, munitions constituents (MC), and munitions and explosives of concern (MEC) and assess the potential for impacts to human health and the environment.

1.1 Objective

This Archival Records Search Report (ARSR) 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 the potential presence of hazards to human health or the environment.

1.2 Scope

This ARSR includes a review of existing information relating to the site and the surrounding areas. The scope of the report includes a review of existing historical information (including MCB Camp Lejeune maps, drawings, and reports, and interviews with Base personnel).

A summary of the resources identified and reviewed during the preparation of this ARSR is provided in **Attachment A,** and includes a detailed list of aerial and Base photographs, historical maps and records, and current Base records reviewed at Gray Research Center on MCB Quantico, Virginia, the National Archives at College Park, Maryland, and at MCB Camp Lejeune.

Primary cartographic references used in ARSRs include:

- Existing Conditions Maps, provided by the MCB Camp Lejeune Public Works Office, showing buildings, roads, and some utilities at MCB Camp Lejeune
- Range Overlay Maps, found in the *Range Identification Preliminary Range Assessment* (USACE, 2001), which show historical ranges at MCB Camp Lejeune
- Aerial imagery, provided by the MCB Camp Lejeune Geographic Information System (GIS), showing an aerial view of MCB Camp Lejeune for the years 1938, 1956, 1962, 1989 and 2004.

SECTION 2

Site Information

2.1 Facility Information

MCB Camp Lejeune is located on the Atlantic coast in Onslow County, North Carolina. The city of Jacksonville, North Carolina, 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. 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 Marine Expeditionary Force units and includes six major Marine Corps commands, two Navy commands, one Coast Guard command, and is home to 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 Website, 2008).

2.2 Ownership History

The history of the land now occupied by MCB Camp Lejeune is documented primarily through land records and maps. Following the start of World War II (WWII), the War Department began purchasing tracts of land in 1941 from local residents to meet the need for an East Coast amphibious training facility. Prior to 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 Website, 2008).

The initial land transferred to the government was acquired in 14 separate transactions between April and October 1941 and totaled 173.8 square miles or 111,155 acres (85,155 acres of land and 26,000 acres under water) (Loftfield, 1981; Louis Berger Group, 2002). The individual tracts of land were grouped into various "areas" for consolidation. The facility was initially referred to as the Marine Barracks New River, which was changed to MCB Camp Lejeune in 1942 (Global Security Website, 2008).

Site 67 is located within land acquisition Area I, the Traps Bay area, which is bounded to the southeast by the New River, to the southwest by the Atlantic Ocean, to the northeast by Gillette Creek and to the northwest by arbitrary property boundaries. Area I consists of 93 tracts of land acquired by the government in 1941 from area landowners (**Figure 2-1**)

2.3 Operational History

The estimated area of Site 67 is 4 acres located just north of Traps Bay on an unnamed creek to the east of India Range Road as shown on **Figure 2-2**. The site boundary is based on a description provided in the Initial Assessment Study (IAS) of the location of the TNT Burn

Site as being "200 meters southeast of Building SBB-159 and about 50 feet away from the water" (Water and Air Research, 1983). Based on the current aerial imagery, the area is heavily vegetated and a large portion is classified as jurisdictional wetland.

The earliest available historical record of the Traps Bay area is an aerial image from 1938 (**Figure 2-3**), before the land was purchased for MCB Camp Lejeune. The cleared area currently in use by the Engineer School, encroaching on the western portion of Site 67, appears to have been cultivated land prior to Base use (ASCS, 1938).

Based on available information, the Traps Bay area of MCB Camp Lejeune has been in use since the late 1940's by the Engineer School for various training operations including firing ranges and demolitions. Site 67 was identified in a base wide IAS as the Engineer's TNT Burn Site, used for TNT disposal in 1951. The study states that within a one acre area "2- to 3-foot pits were dug and unwanted TNT was opened and burned. Complete consumption of all TNT was reported during these procedures" (Water and Air Research, 1983). During the course of this archival records review, a number of resources were identified discussing range and demolition use in the immediate area of Site 67; however the only direct reference to Site 67 or the Engineer's TNT burn site was found in the IAS. According to a former Range Safety Officer, it is likely that any such TNT burn site would have been located near a road (Redmond, 2009) for easy access.

The primary source of range information for the Site 67 area is the *Range Identification Preliminary Range Assessment* (USACE, 2001). Based on cartographic references, four historic ranges (the Engineer Firing Range (Engineer School Range 1), Engineer Demolition Area I-1, I-2 Demolition Area, and Firing Position 24, **Figure 2-4**) and one active range (Engineer Training Area 1D [ETA-1D]) appear to overlap Site 67 (**Figure 2-5**).

Several sources refer to the Engineer School demolition course area, located in the vicinity of Site 67, being used from approximately 1946 to the present. Although specific locations are not always provided in documents such as training directives and letters to the Commandant, several cartographic references indicate that the Traps Bay area was used primarily for demolitions training during this time. Additional munitions use was also reported in the area which included the following items:

- 2.36-inch anti-tank rockets
- Rifle grenades
- Flamethrowers
- Antitank mines
- Claymore mines
- Mine clearing line charges
- Bangalore torpedoes.

2.3.1 Engineer Firing Range (Engineer School Range 1)

The first known use of the Traps Bay area, which includes Site 67, by MCB Camp Lejeune was the Engineer Firing Range as known as Engineer School Range 1 (Archives Search Report Number 2.39 [ASR 2.39]) identified in the *Range Identification Preliminary Range Assessment*. The range appears on the 1946 range overlay map identified as the Engineer Firing Range (**Figure 2-6**). According to the *Range Identification Preliminary Range Assessment*, the range was used in 1947. Camp General Order Number 5-1946 authorized the use of anti-

tank and rocket grenades, demolitions, and flame throwers. The *Range Identification Preliminary Range Assessment* report states that as of February 2000, specific munitions safety issues associated with Engineer Firing Range (Engineer School Range 1) are "anti-tank munitions containing sensitive fuzing and present a significantly increased hazard area forward of the munition" (USACE, 2001). It is assumed that the entire range area shown on **Figure 2-6** is potentially impacted by this former range. The range boundary completely encompasses Site 67.

The *Range Identification Preliminary Range Assessment* identified the following types of munitions and fuzing used on Engineer Firing Range (Engineer School Range 1):

- Rifle grenade (Fuzing: base detonating)
- Rocket, 2.36", anti-tank (Fuzing: base detonating)
- Demolition materials (Fuzing: electric and non-electric firing systems)
- Flame throwers (no fuzing).

2.3.2 Engineer Demolition Area I-1

In a 1947 historical range map, the Engineer Demolition Area I-1 (**Figure 2-7**) appears to correspond with the 1946 Engineer Firing Range (Engineer School Range 1) from **Figure 2-4**. There is no cartographic record indicating the Engineer Demolition Area I-1 was in use after 1947; however several references indicate that a demolitions course was being taught by the Engineer School (which includes the entire area from Courthouse Bay to Traps Bay). Due to the documented continued use of the surrounding areas for demolition (see I-2 Demolition Area discussion below), it is assumed that demolitions activities for the Engineer School occurred in the Engineer Demolition Area I-1 after 1947.

A 1949 aerial photograph (**Figure 2-8**) shows a cleared area west of the Site 67 boundary in the same location as the cultivated areas shown in the 1938 aerial (ASCS, 1949). The total cleared area appears smaller, indicating that vegetation encroachment had occurred. There is a small cleared area in the western portion of Site 67. No buildings are visible on this photo.

A letter to Headquarters Marine Corps, dated December 1, 1949 (MCB Camp Lejeune, 1949a), lists the following proposed explosive allowance for calendar year 1950 for the Engineer School at MCB Camp Lejeune:

- Cap, blasting, special, electric (type 11) – 1,350
- Cap, blasting, special, non-electric (type 1) – 1,350
- Charge, shaped, M-3 – 36
- Cord, detonating, 500′ spools – 72
- Dynamite, Nitroglycerine, gelatine dynamite 40% – 270 lb
- Explosive, Composition C-3 – 3,000 lb
- Explosive, TNT, Rectangular, 1-lb block – 3,000 lb
- Fire crackers, Mark 2 Model Q (ordnance item) – 800
- Fuse, blasting, time – 13,500 ft
- Lighter, fuse, friction type M-1 – 500
- Lighter, fuse, weatherproof, M-2 – 2,000
- Torpedo, Bangalore – 36

- Firing device, pull friction type M-2 – 200
- Firing device, pressure type, M1A1 w/extension – 200.

According to a 1949 letter to the Commandant regarding the training syllabi for the Engineer School at MCB Camp Lejeune, the demolitions course was part of the Basic Construction Course. The course description includes "characteristics of explosives; safety precautions; handling and storage; demolition equipment; placement of charges; preparation and firing" (MCB Camp Lejeune, 1949b).

Later, in 1956, a Training Directive from Headquarters Marine Corps indicated that the demolitions course was part of the Construction Foreman Course at the Engineer School at MCB Camp Lejeune (USMC, 1956). In a 1956 aerial photograph the site appears to be wooded (**Figure 2-9**). See Section 2.3.4 for continued use of the area known as Engineer Demolition Area I-1 past 1956.

2.3.3 Firing Position 24

According to the *Range Identification Preliminary Range Assessment* report, Firing Position 24 was an artillery firing position (several firing positions are referenced in the report under ASR #2.212). The report references a September 25, 1976 map (**Figure 2-10**) for the location of Firing Position 24, the type of weapon used and direction of fire was unspecified. The report indicated that "at a firing point, only items like unused propellant charges and supplemental charges will be found" (USACE, 2001).

2.3.4 I-2 Demolition Area

The I-2 Demolition Area (ASR 2.125) is shown on the 1987 Range Overlay Map (**Figure 2-6**). According to the *Range Identification Preliminary Range Assessment*, the range was used from 1960 to approximately 1988. Base Order Number 11102.1B, dated May 5, 1960, identified the I-2 Demolitions Area as being located in the Traps Bay area (USACE, 2001). The I-2 Demolition Area was used to train engineers on assembly and initiating of charges and may also have contained TNT burn sites (Redmond, 2009). Prior to 1960, this area was known as the Engineer Demolition Area I-1, Section 2.3.2.

The 1962 aerial imagery (**Figure 2-11**) shows a road and clearing along the western boundary of Site 67. The cleared area indicates that Site 67 was likely in use during this time period. Several of the cleared areas northeast of the Site 67 correspond with buildings on current aerial imagery (**Figure 2-1**).

Existing conditions maps as early as 1963 (**Figure 2-12**) to the latest available existing conditions map in 2005 (**Figure 2-5**) show a road leading to several buildings within the I-2 Demolitions Area. Most of the buildings are labeled as applied teaching facilities or magazines in the 1963 map. These buildings also appear on aerial imagery for 1989 and 2004. The closest buildings to Site 67 currently, are approximately 750 feet to the west and are associated with the I-2 Demolition Area to the west. The two closest buildings (SBB158 and SBB159) are both used for explosive storage and several other buildings in the area are used as armories and explosive/flammable storage (CH2M HILL, 2009).

In February 1970, Base Order Number P11102.1G authorized the use of demolitions and land mines on the range, not to exceed 50 pounds net TNT equivalent per shot (USACE,

2001). Base Order Number P11102.1K in December 1986 authorized the use of M68A1 (inert) tank cannons (USACE, 2001).

By 1989, the area inside Site 67 appears overgrown and no longer in use (**Figure 2-13**). The cleared area (labeled as ETA-1 in **Figure 2-4)** is in roughly the same location as it appears today.

According to the *Range Identification Preliminary Range Assessment* types of munitions and fuzing used in the I-2 Demolition Area were:

- Demolitions (Fuzing: electric and non-electric firing systems)
- Land Mines (Fuzing: Integral)
- M68A1 (no fuzing).

The I-2 Demolitions Area encompasses the entirety of Site 67.

2.3.5 ETA-1, Engineering Training Area (MCES)

ETA-1, Engineering Training Area (ASR 2.185), hereafter referred to as ETA-1, appears on the 1993 Range Overlay Map (**Figure 2-6**). The training area does not appear to overlap Site 67, however on a later Existing Conditions Map from 2005 (**Figure 2-5**), it appears that ETA-1 was split into ETA-1A, ETA-1B, ETA-1C, and ETA-1D, all of which are classified as military live firing ranges (MCB Camp Lejeune, 2005). ETA-1D is the only range that encompasses a portion of Site 67; it is an active demolitions range (Richardson, 2009c). ETA-1, depicted in the cleared area on **Figure 2-4**, is currently used as a demolitions area by the Engineer School which may restrict access to Site 67 during training exercises (Richardson, 2009a). The Engineer School uses the full range of explosives and demolitions in the ETA-1 area, including ETA-1D, with a limited net explosive weight (Richardson, 2009b). According to Base Order P3570.1B, dated October 17, 2006, the primary function of ETA-1 is demolitions training for the Marine Corps Engineering School (MCES) (MCB Camp Lejeune, 2006).

There are reports that, starting around 1973, the cleared land near Site 67 was used for line charge training using a live rocket motor and an inert line charge (Redmond, 2009). This system consisted of an M353 three and half ton or M200A1 two and half ton trailer (or M200 tracked trailer) chassis, a launcher assembly, M147 firing kit M58A3 line charge and a 5-inch MK22 Mod 4 rocket. The line charge was 350 feet long and contains 5 pounds per linear foot of composition C-4 explosive. Engineer units employ the mine clearing line charge (MICLIC) in response to minefield breaching requirements identified by the maneuver forces. The MICLIC's trailers are then towed to the selected area where an engineer prepares the line for firing. Once it is detonated, it clears a lane measuring 8 meters by 100 meters (Redmond, 2009).

According to the *Range Identification Preliminary Range Assessment*, ETA-1 has been in use from 1994 to present. Base Order P3570.1 in June 1994 authorized the following: "Charges are not to exceed 50 lbs net TNT equivalency per shot. Live land mines authorized for demonstration purposes. Must be controlled fired. Bangalore Torpedoes require 500M safety for personnel in the open."

Base Order P3570-1B authorizes the following ammunitions for use at ETA-1 (MCB Camp Lejeune, 2006):

- Dynamite
- C-4 Demolition Charges
- TNT Demolition Charges
- Shaped Charges
- Detonation Cord
- Claymore Mine
- Bangalore Torpedo
- Antitank Mines
- Cratering Charge
- Flex Linear
- Deta sheets
- RDX Boosters
- Blasting Caps
- Pyrotechnics
- 12 Gauge Lock Buster Round

Field Expedient Charges: not to exceed 50lbs TNT equivalency, special range request required for use.

- Claymore
- Bangalore Torpedo
- Shaped Charge
- Cratering Charge
- Urban Charge
- Soap Dish/Omni Charge
- Water Charge
- Breaching Charges (as required)

2.4 Previous Site Investigations

The only known environmental study at Site 67 was the 1983 IAS completed by Water and Air Research, Inc. for the Naval Energy and Environmental Support Activity. The purpose of the IAS was to identify and assess sites at MCB Camp Lejeune posing a potential threat to human health and the environment due to contamination from past hazardous materials operations. The study involved historical records and aerial photograph review, field inspections, and personnel interviews. Based on these reviews, Site 67 was not considered an environmental threat and was not recommended for further investigations. No environmental sampling was conducted during this study (Water and Air Research, 1983).

SECTION 3

Findings

No historic information was found during this archival records review that specifically references the Site 67 Engineer's TNT Burn Site. However, site documentation indicates that four historic ranges (the Engineer Firing Range, Engineer Demolition Area I-1, I-2 Demolition Area, and Firing Position 24) and one operational range (Engineer Training Area 1D [ETA-1D]) overlap Site 67. The Site 67 area appears to have been in use from 1946 to the present as part of the Engineer training school. Munitions reportedly used at this site between 1946 and the present include:

- Demolitions
- 2.36-inch anti-tank rockets
- Rifle grenades
- Flamethrowers
- Antitank mines
- Claymore mines
- Mine clearing line charges
- Bangalore torpedoes
- Charges (soap dish/omni, flex, shaped, cratering, and urban)
- Deta sheets
- RDX boosters
- Pyrotechnics

Historical maps and aerial photographs dating from 1938 to 2005 were reviewed during the archive search activities. Aerial photographs indicate that Site 67 appears to be heavily wooded with an unnamed creek and wetland areas present in the center of the site. Historical aerials show that the western portion of Site 67 was cleared of vegetation in the late 1940s and early 1960s.

Based on historic site uses, it is assumed that Site 67 may be impacted with MC and MEC. According to the Base Range Control Officer, evidence of demolition activities that may be encountered during site investigation activities include the presence of: Hawks (old steel vehicles), trees with explosive damage, craters, evidence of destroyed bridges over the creek, and small pieces of metal which are electric blasting caps (Richardson, 2009a).

SECTION 4

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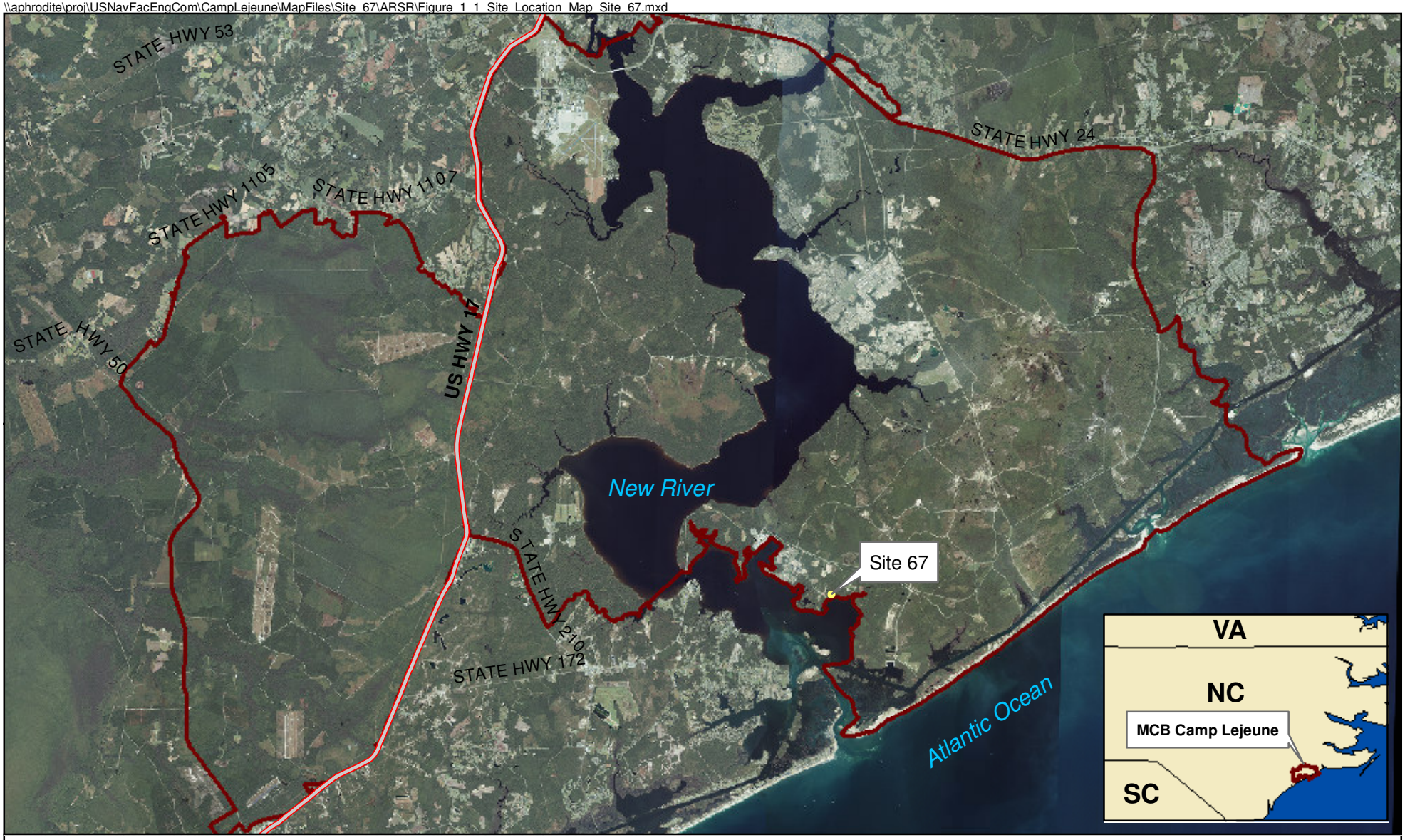
Figures

\\aphrodite\proj\USNavFacEngCom\CampLejeune\MapFiles\Site_67\ARSR\Figure_1_1_Site_Location_Map_Site_67.mxd



Legend

- Highways
- Site 67 Boundary
- Installation Boundary

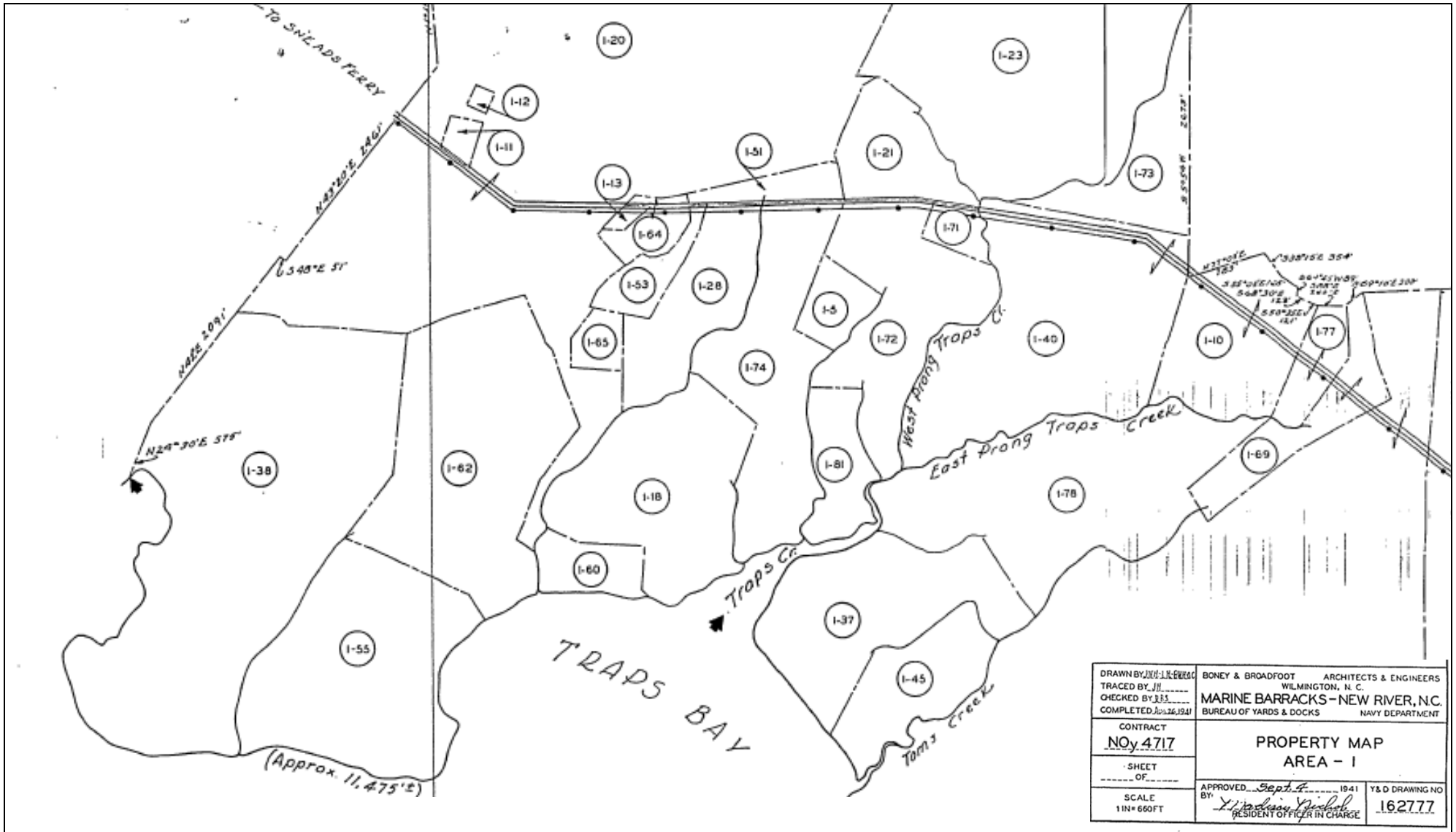
N

0 7,500 15,000 30,000 Feet

1 inch = 15,000 feet

Figure 1-1
Site Location Map
Site 67 Archival Records Search Report
MCB Camp Lejeune
North Carolina

CH2MHILL



LEGEND

- PROPERTY LINES
- TRACT NUMBERS (I-0)
- ROADS
- POWER LINES
- STREAMS
- TERMINAL POINTS
- BOUNDARY DISTANCES
- TRIANGULATION STATIONS

0 1250 2500

Approximate Scale in Feet

N

Figure 2-1
Property Map –Area I (Portion)
Site 67 Archival Records Search Report
MCB Camp Lejeune
North Carolina

Source: Bureau of Yards and Docks, 1941

CH2MHILL

\\aphrodite\proj\USNavFacEngCom\CampLejeune\MapFiles\Site_67\ARSR\Figure 2-2 - Site Map.mxd

Legend

- Creek
- Site 67
- Buildings
- Installation Boundary
- Jurisdictional Wetlands

N

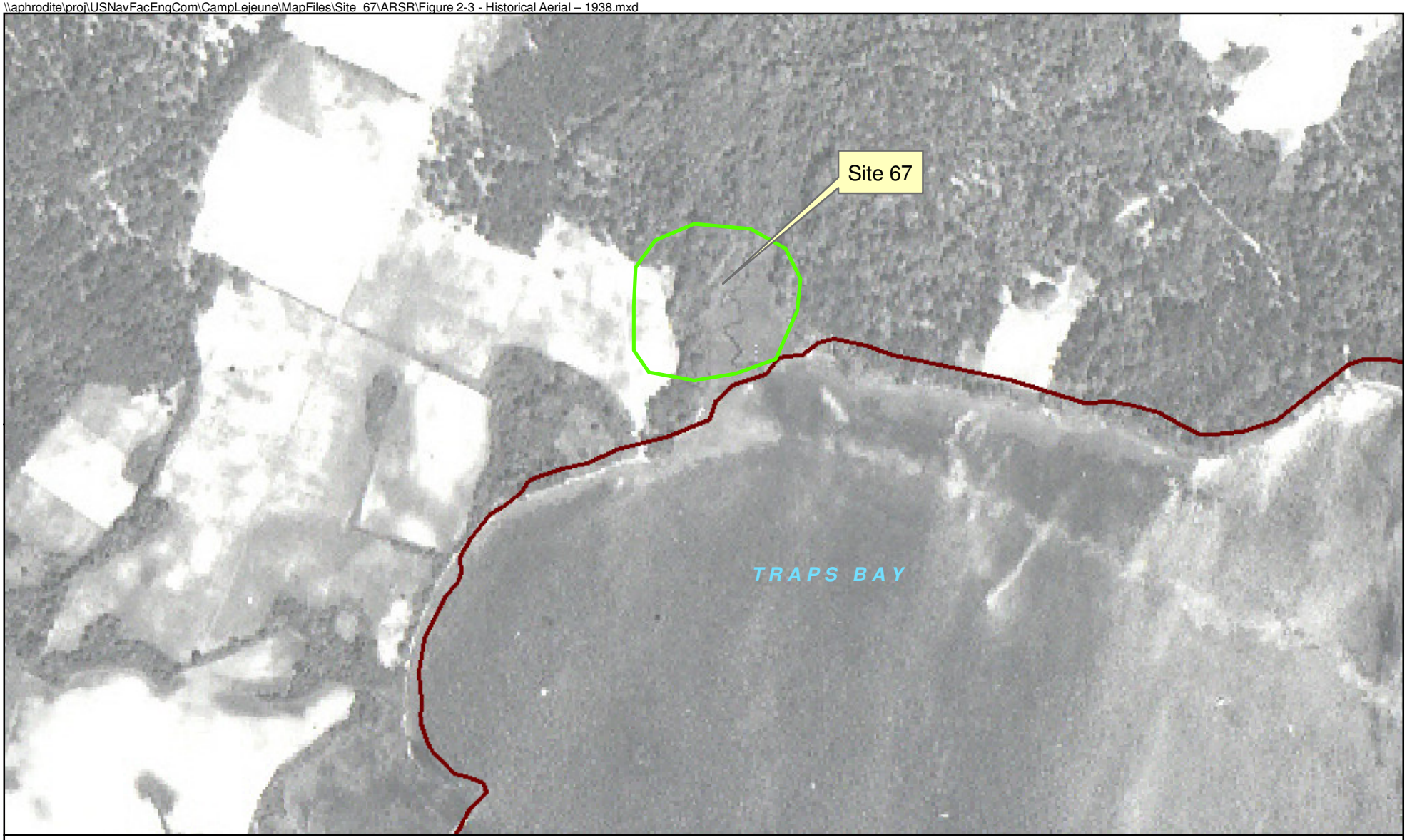
0 200 400 800 Feet

1 inch = 400 feet

Figure 2-2
Site Map
Site 67 Archival Records Search Report
MCB Camp Lejeune
North Carolina

CH2MHILL

\\aphrodite\proj\USNavFacEngCom\CampLejeune\MapFiles\Site_67\ARSR\Figure 2-3 - Historical Aerial – 1938.mxd



Legend
Site 67
Installation Boundary

N

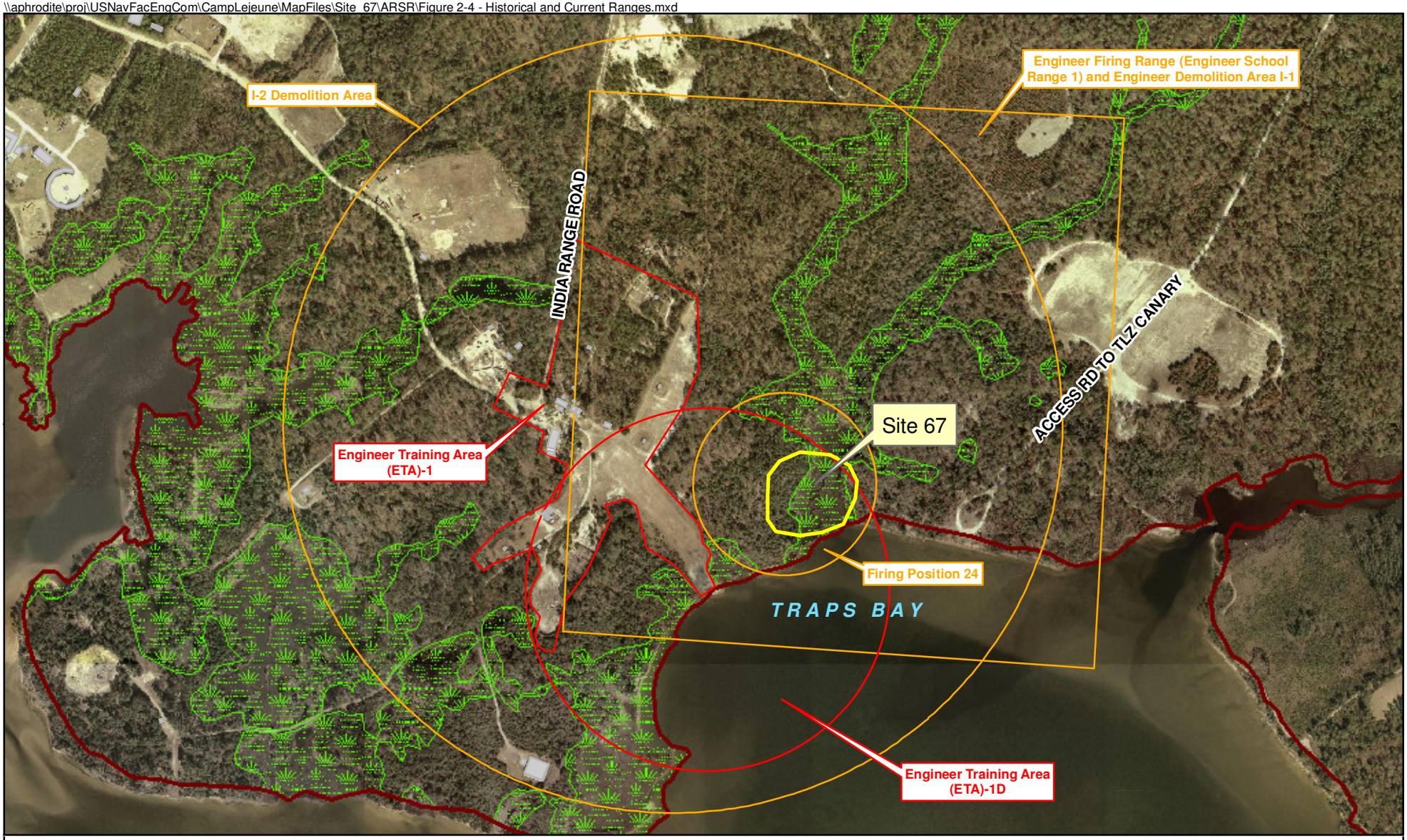
0 200 400 800 Feet

1 inch = 400 feet

Figure 2-3
Historical Aerial – 1938
Site 67 Archival Records Search Report
MCB Camp Lejeune
North Carolina

CH2MHILL

\\aphrodite\proj\USNavFacEngCom\CampLejeune\MapFiles\Site_67\ARSR\Figure 2-4 - Historical and Current Ranges.mxd



Legend

- Site 67
- Buildings
- Operational Ranges
- Historical Ranges
- Installation Boundary
- Jurisdictional Wetlands

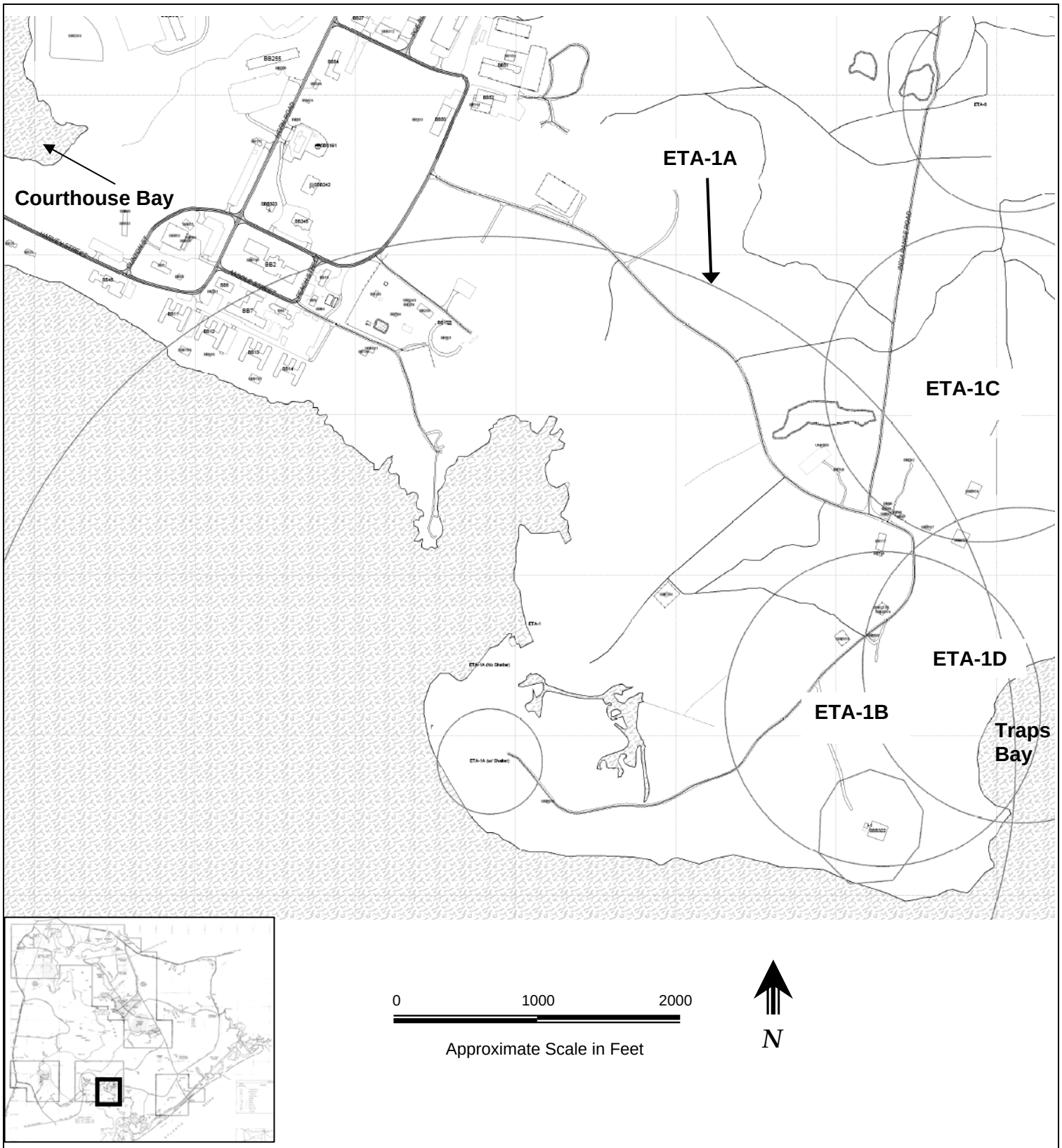
N

0 375 750 1,500 Feet

1 inch = 750 feet

Figure 2-4
Historical and Current Ranges
Site 67 Archival Records Search Report
MCB Camp Lejeune
North Carolina

CH2MHILL



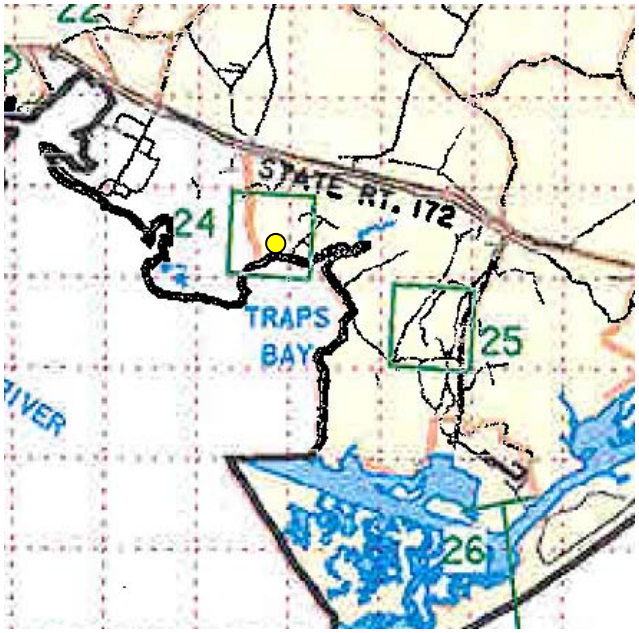
Notes:
Site 67 is not shown because Existing Conditions Maps for the Engineers Area and Courthouse Bay do not extend to Traps Bay

ETA-1A, -1B, -1C, -1D are Military Live Fire Ranges

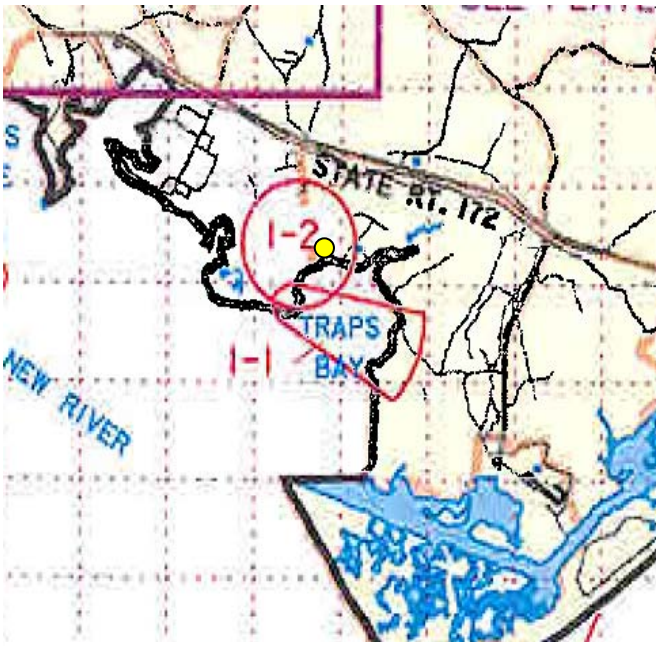
Source: MCB Camp Lejeune, 2005

Figure 2-5
Existing Conditions Map – 2005
Site 67 Archival Records Search Report
MCB Camp Lejeune
North Carolina

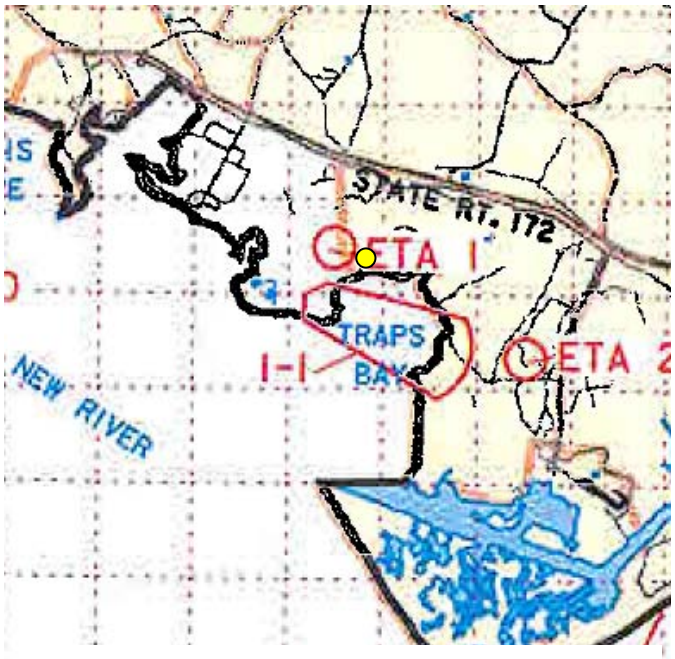
CH2MHILL



Range Overlay Map – 1946
24 Engineer Firing Area



Range Overlay Map – 1987
I-2 Demolition Area



Range Overlay Map – 1993
ETA 1 Engineer Training Area

0 2000 4000
Approximate Scale in Meters

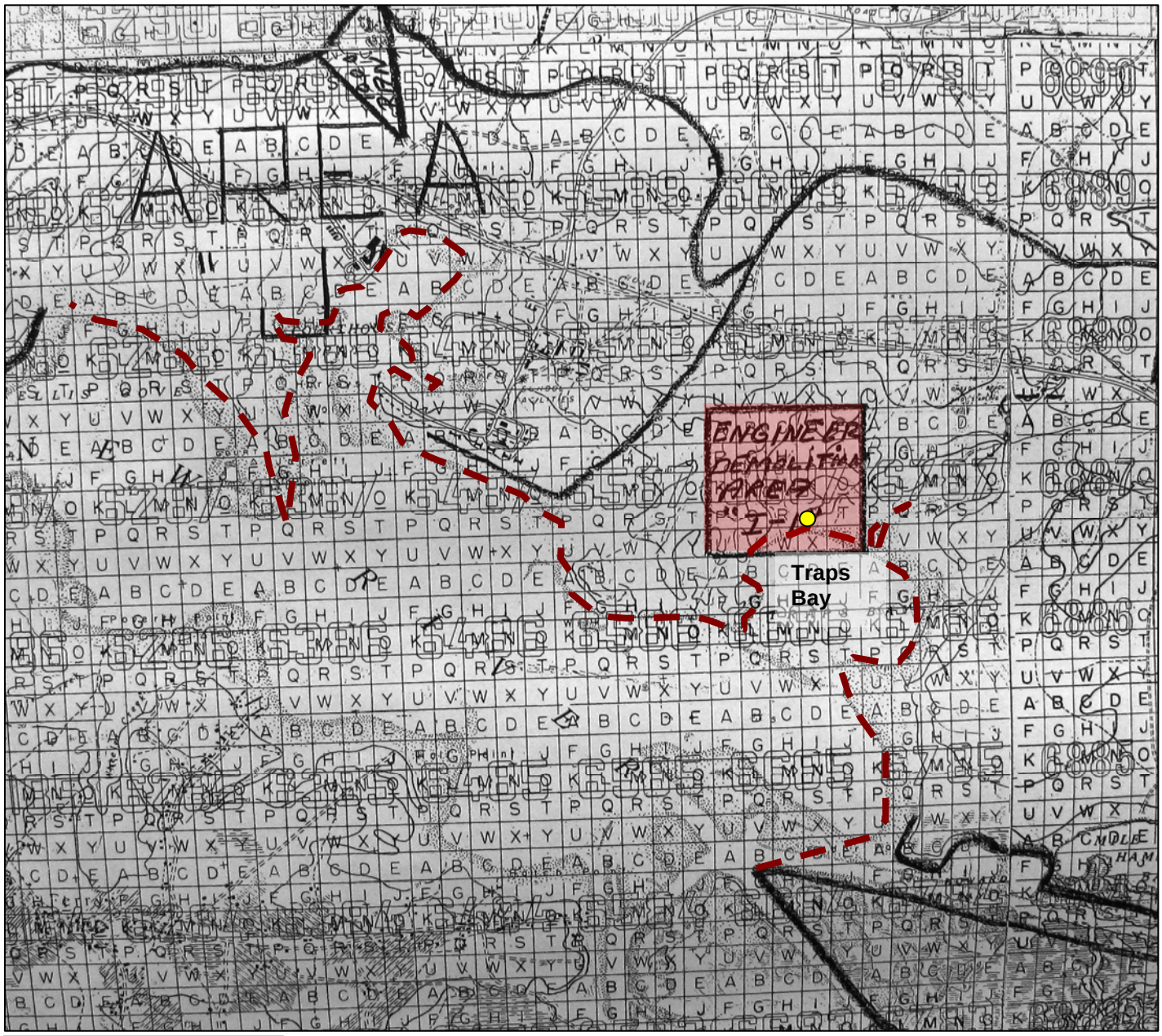
N

Approximate Location of Site 67

Figure 2-6
Range Overlay Maps
Site 67 Archival Records Search Report
MCB Camp Lejeune
North Carolina

CH2MHILL

Source: USACE, 2001



0 1000 2000

Approximate Scale in Feet

N

Legend

Engineer Demolition Area I-1

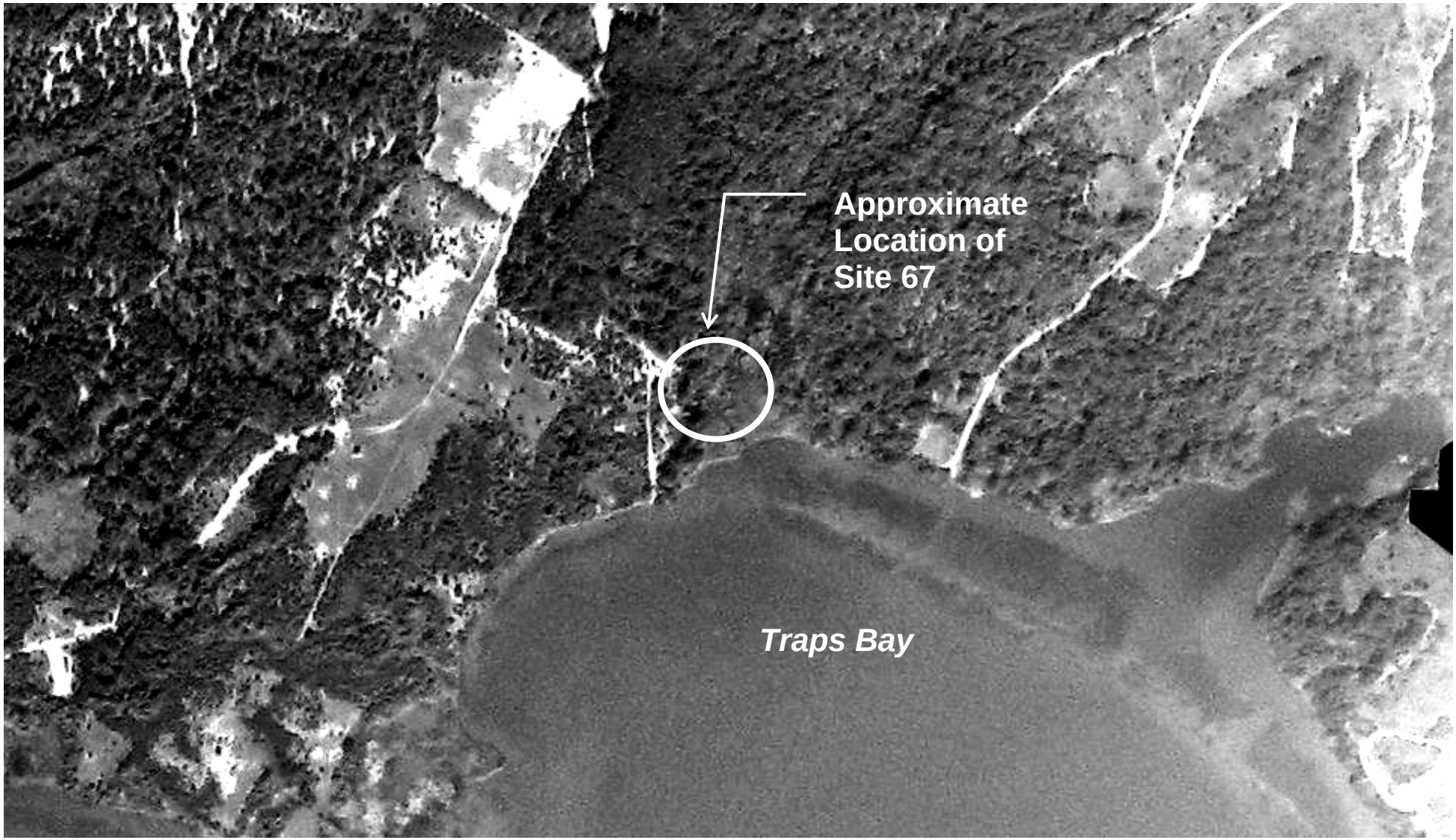
Approximate Base Boundary

Approximate Location of Site 67

Figure 2-7
Historical Map - 1947
Site 67 Archival Records Search Report
MCB Camp Lejeune
North Carolina

Source: USMC, 1947

CH2MHILL



0 600 1200

Approximate Scale in Feet

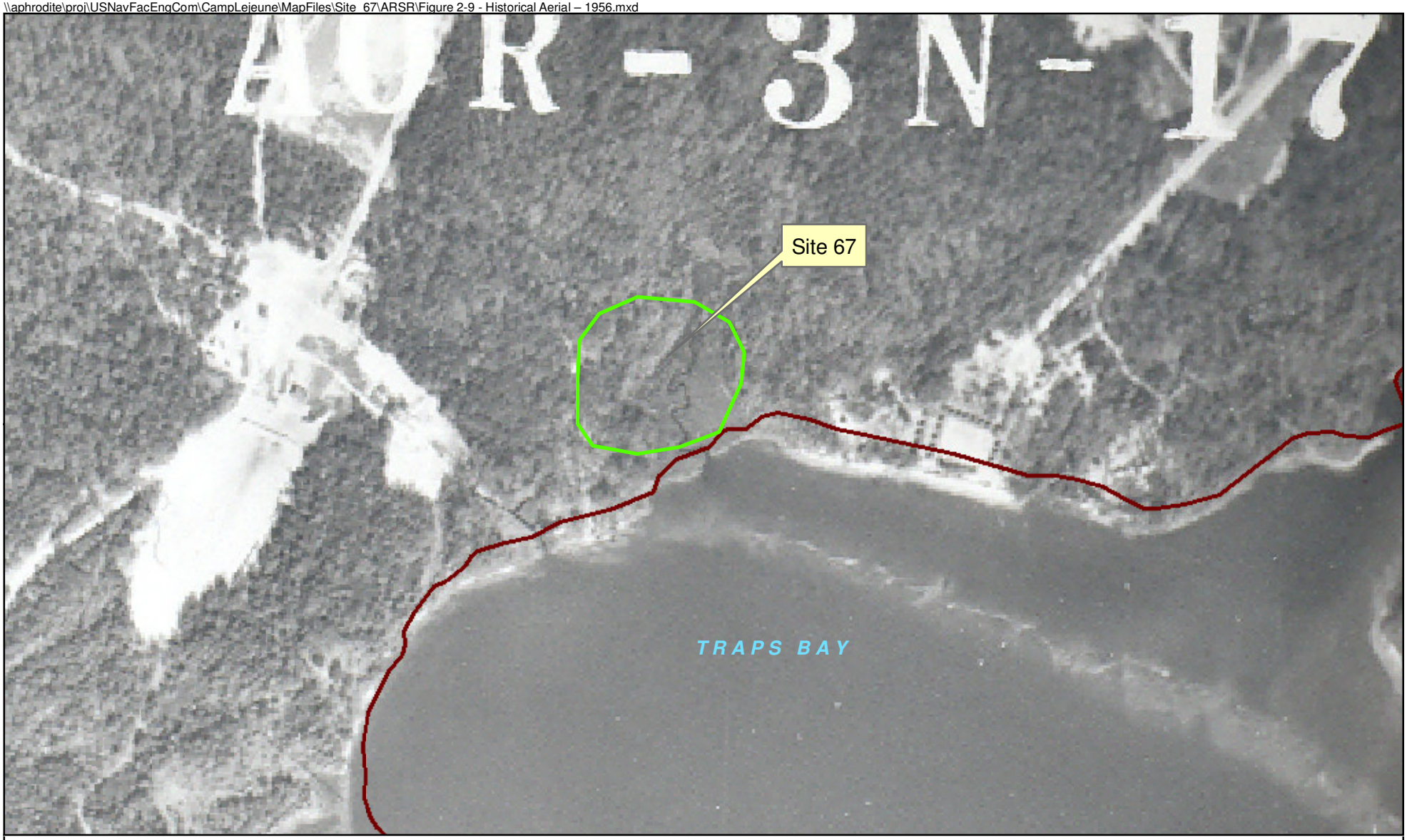
N

Figure 2-8
Historical Aerial - 1949
Site 67 Archival Records Search Report
MCB Camp Lejeune
North Carolina

Source: ASCS, 1949

CH2MHILL

\\aphrodite\proj\USNavFacEngCom\CampLejeune\MapFiles\Site_67\ARSR\Figure 2-9 - Historical Aerial – 1956.mxd



Legend

Site 67

Installation Boundary

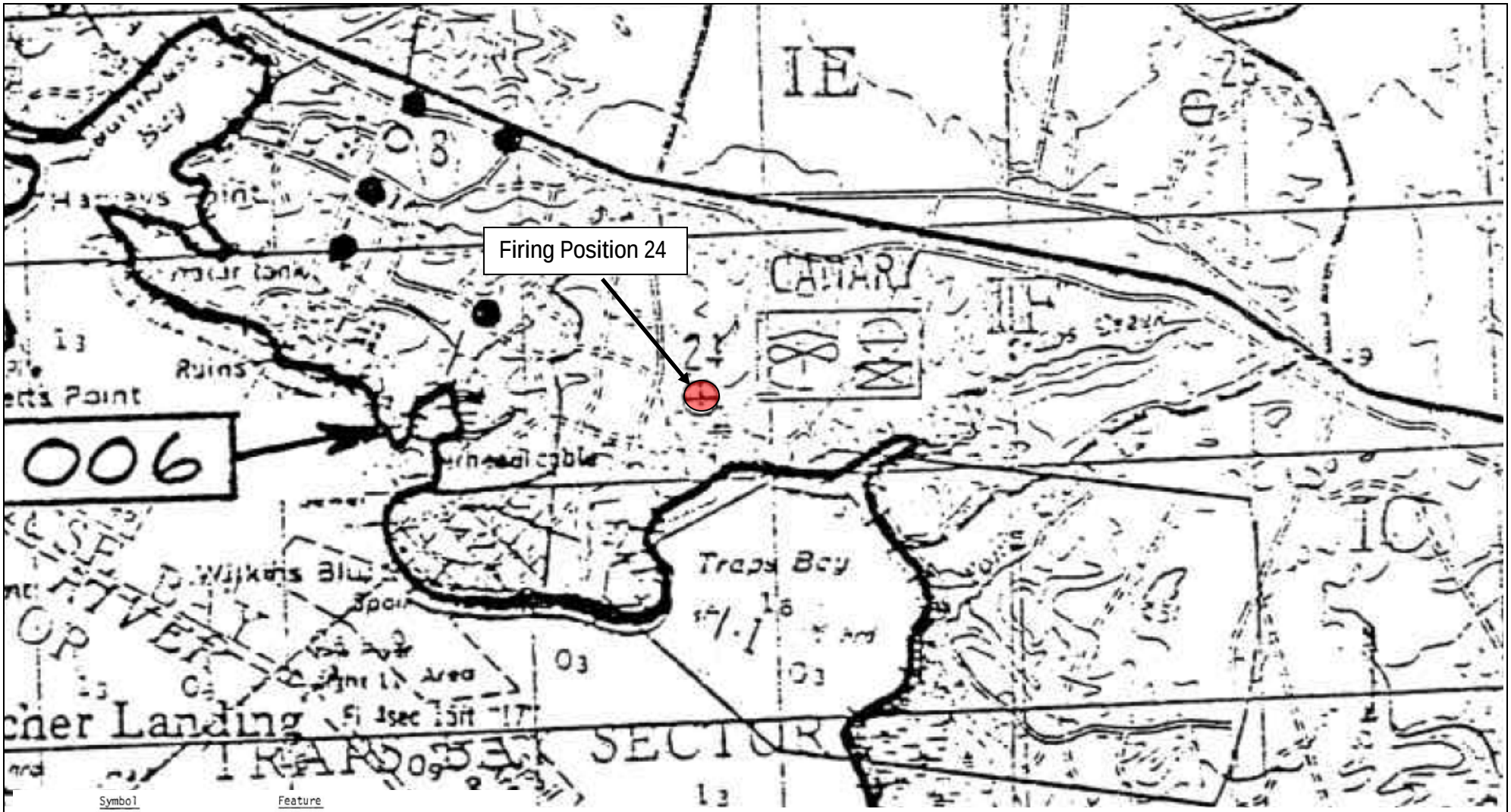
N

0 200 400 800 Feet

1 inch = 400 feet

Figure 2-9
Historical Aerial – 1956
Site 67 Archival Records Search Report
MCB Camp Lejeune
North Carolina

CH2MHILL



Symbol	Feature
———	Facility Boundary
●	Public Drinking Water Well
STP-001 →	Sewage Treatment Plant Location and NPDES ID Number
← HWS →	Facility Used to Store Hazardous Waste Awaiting Transfer to Approved Off Base Disposal Facilities

0 2500 5000

Approximate Scale in Feet

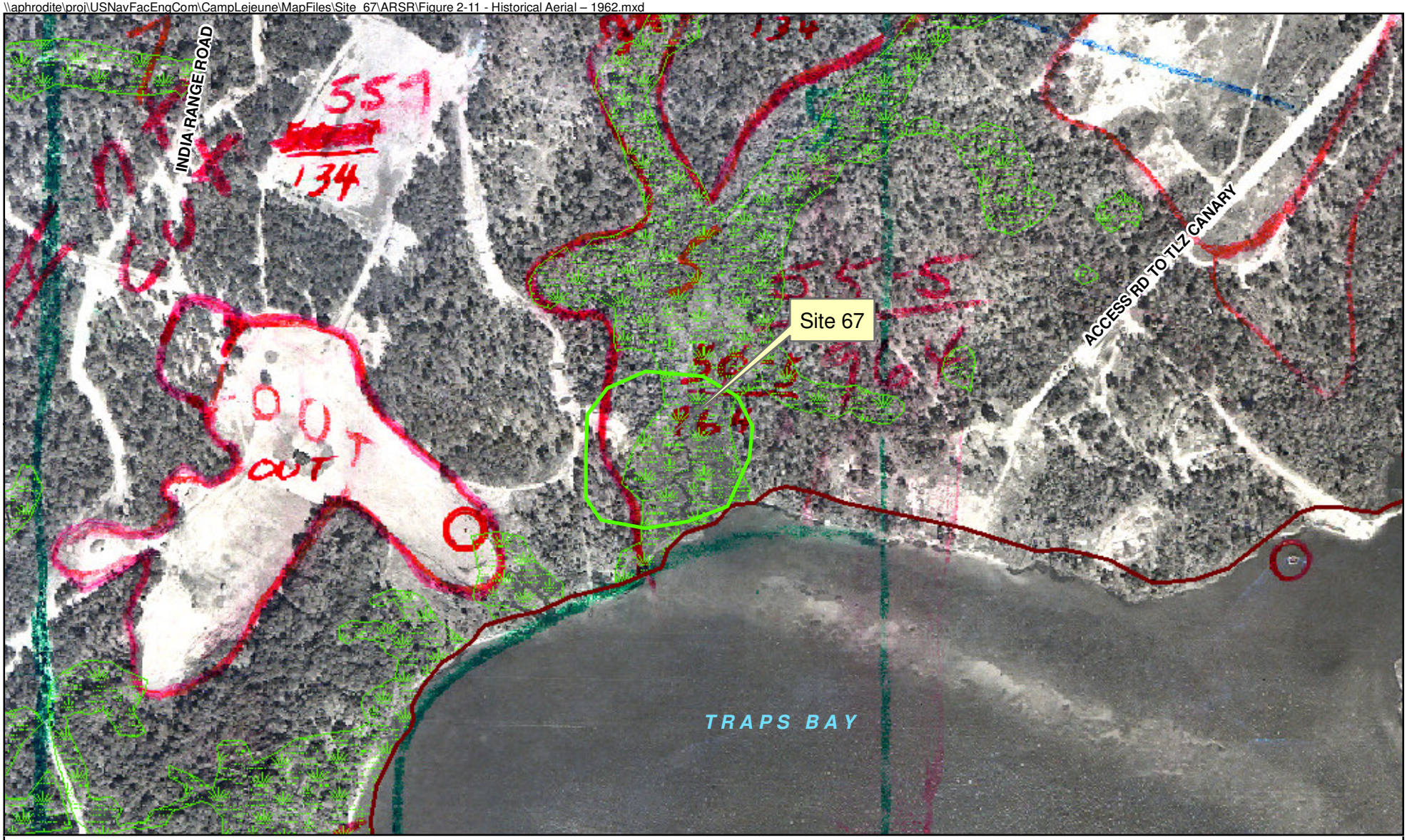
N

Figure 2-10
Historical Map - 1976
Site 67 Archival Records Search Report
MCB Camp Lejeune
North Carolina

Source: Baker, 1992

CH2MHILL

\\aphrodite\proj\USNavFacEngCom\CampLejeune\MapFiles\Site_67\ARSR\Figure 2-11 - Historical Aerial – 1962.mxd



Legend

- Site 67
- Installation Boundary
- Jurisdictional Wetlands

N

0 200 400 800 Feet

1 inch = 400 feet

Figure 2-11
Historical Aerial – 1962
Site 67 Archival Records Search Report
MCB Camp Lejeune
North Carolina

CH2MHILL

Note:
Site 67 is not shown because Existing Conditions Maps for the Engineers Area and Courthouse Bay do not extend to Traps Bay

0 1000 2000

Approximate Scale in Feet

N

Figure 2-12
Existing Conditions Map - 1963
Site 67 Archival Records Search Report
MCB Camp Lejeune
North Carolina

Source: MCB Camp Lejeune, 1963

CH2MHILL

\\aphrodite\proj\USNavFacEngCom\CampLejeune\MapFiles\Site_67\ARSR\Figure 2-13 - Historical Aerial – 1989.mxd

Legend
- Site 67
- Installation Boundary
- Jurisdictional Wetlands

N

0 200 400 800 Feet

1 inch = 400 feet

Figure 2-13
Historical Aerial – 1989
Site 67 Archival Records Search Report
MCB Camp Lejeune
North Carolina

CH2MHILL

Attachment A
Resource Review Summary

Resource Review Summary

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

Resource	Actions Completed
Quantico, Virginia, Marine Corps Library, Gray Research Center – Archives and Special Collections	Reviewed files related to Camp Lejeune. Made copies of relevant historic maps and text. April 27, 2009.
Quantico, Virginia, Marine Corps Library, Gray Research Center - Histories department	Reviewed text and photographs related to Camp Lejeune. Made copies of relevant text and photos. April 28, 2009.
United States National Archives (NARA II) Historical Files	Reviewed text and aerial photographs from Text and Cartographic Divisions. Made copies of relevant files, maps and photos. April 28 – May 1, 2009.
Onslow County Public Library	Reviewed documents and spoke with personnel in relation to historical land use for site. April 21, 2009.
Swansboro Branch Public Library	Reviewed documents and spoke with personnel in relation to historical land use for site. April 21, 2009.
Camp Lejeune Personnel	
Andrew Smith/Environmental Management Division	Contacted via e-mail and phone. Provided historical aerials from Base GIS. May 6, 2009.
Dennis Dunham/ Public Works Technical Records	Contacted via e-mail and received land acquisition property maps. December 23, 2008.
Julie Rowe/MCB Camp Lejeune Archivist	Phone interview and e-mail conversation. April 27, 2009.
Duane Richardson/ Base Range Safety Officer	Contacted via e-mail and conducted personal interviewed. April 21, 2009.
MCB Camp Lejeune Base Library	Reviewed documents and spoke with personnel in relation to historical land use for site. April 21, 2009.

Marine Corp Library Review

Archives and Special Collections: Text Division

United State Marine Corps Archives & Special Collections
2040 Broadway Street
Quantico, Virginia 22134

Site Visit: April 27, 2009
File review at Marine Corps Base, Quantico, Virginia, Gray Research Center, Marine Corps Archives and Special Collections.

Reviewed command chronologies from 1976-1986.

Box 420: Command Chronologies, MCB Camp Lejeune, 1976-1979

Box 421: Command Chronologies, MCB Camp Lejeune, July – December 1979 to January – June 1982

Box 422: Command Chronologies, MCB Camp Lejeune, July – December 1982 to January – June 1984

Box 423: Command Chronologies, MCB Camp Lejeune, July – December 1984 to July – December 1985

Box 424: Command Chronologies, MCB Camp Lejeune, January – June 1986

Boxes contained general chronological information for various branches at Camp Lejeune. Most relevant sections were in Base Training Facilities Branch.

List of Documents Obtained from Archives and Special Collections

- Excerpt from Command Chronology, MCB Camp Lejeune, Training Facilities Division, July – December 1978
- Excerpt from Command Chronology, MCB Camp Lejeune, Training Facilities Division, July – December 1979
- Excerpt from Command Chronology, MCB Camp Lejeune, Training Facilities Division, January – June 1980
- Excerpt from Command Chronology, MCB Camp Lejeune, Training Facilities Division, July – December 1980
- Excerpt from Command Chronology, MCB Camp Lejeune, Training and Operations, January – June 1983
- Excerpt from Command Chronology, MCB Camp Lejeune, Training and Operations, July – December 1983
- Excerpt from Command Chronology, MCB Camp Lejeune, Training and Operations (Section IV: Annex B) , July – December 1984
- Excerpt from Command Chronology, MCB Camp Lejeune, Training and Operations, January – June 1986

Historical Reference Branch

Photograph Historian: Lena Kaljot
Text Historian: Robert V. Aquiilina
3079 Moreell Avenue
Quantico, Virginia 22134
www.history.usmc.mil

Site Visit: April 27, 2009
Reviewed documents, photographs and maps related to Camp Lejeune.

List of Maps Obtained from Historical Reference Branch

- "Artillery Firing Problems Occurring Frequently, Camp G-3 Section", Camp Lejeune, N.C. undated
- "Camp Lejeune General Area Map" Marine Barracks, New River. Feb 19, 1942
- "Long Range Firing, 155 and 90mm Gun BN's, Camp G-3 Section" Camp Lejeune, N.C. undated
- "Camp Lejeune Ranges and Maneuvering Areas" Reference Map, North Carolina Approaches to New River. August 2, 1952
- "Training Areas and Facilities" February 16, 1953

List of Documents Obtained from Historical Reference Branch

- "Semper Fidelis: A history of Onslow County and Camp Lejeune, N.C." Louis J. Berger Group, 2006
- "Syllabus for Combat Engineer Course, Fiscal Year 1958" Engineer School Battalion, MCB Camp Lejeune. Dated December 10, 1956 – Specific page refers to Demolitions Course
- "Packard X: Informational Handbook" May 24-29, 1959

List of Aerial Photographs Obtained from Historical Reference Branch

- "Camp Lejeune, NC – Looking East" May 6, 1948
- "Camp Lejeune, NC – Looking South" May 6, 1948
- "Engineer Area, Camp Lejeune, NC – Looking East" September 21, 1948
- "Engineer Area, Camp Lejeune, NC – Looking South" September 21, 1948
- "Engineer Area, Camp Lejeune, NC – Looking West" September 21, 1948

National Archives and Records Administration Review

National Archives at College Park
8601 Adelphi Road
College Park, MD 20740-6001
http://www.archives.gov/dc-metro/college-park/

Site visit: April 27 – May 1, 2009

Textual Records

Reviewed records of the Bureau of Yards and Docks relating to Naval property case files and records of the Marine Corps from 1939-1958; details are provided below.

- Record Group 41: Records of the Bureau of Yards and Docks
- Reviewed 8 boxes of files from Entry 1001 – Naval Property Case Files 1941-1958:

- Record Group 41 (Bureau of Yards and Docks), Entry 1001, Naval Property Case Files, North Carolina: New River, 1941 - 1958, Box 933
- Record Group 41 (Bureau of Yards and Docks), Entry 1001, Naval Property Case Files, North Carolina: New River, 1941 - 1958, Box 934
- Record Group 41 (Bureau of Yards and Docks), Entry 1001, Naval Property Case Files, North Carolina: New River, 1941 - 1958, Box 935
- Record Group 41 (Bureau of Yards and Docks), Entry 1001, Naval Property Case Files, North Carolina: New River, 1941 - 1958, Box 936
- Record Group 41 (Bureau of Yards and Docks), Entry 1001, Naval Property Case Files, North Carolina: New River, 1941 - 1958, Box 937
- Record Group 41 (Bureau of Yards and Docks), Entry 1001, Naval Property Case Files, North Carolina: New River, 1941 - 1958, Box 938
- Record Group 41 (Bureau of Yards and Docks), Entry 1001, Naval Property Case Files, North Carolina: New River, 1941 - 1958, Box 940
- Record Group 41 (Bureau of Yards and Docks), Entry 1001, Naval Property Case Files, North Carolina: New River, 1941 - 1958, Box 941
- **General Description**: Documents related to original land acquisition for Camp Lejeune, expansion, easements, railroad, schools, and housing developments on Base etc.

Documents Obtained from Record Group 41:

- Letter to Judge Advocate General of the Navy from Newman A. Townsend Jr., dated February 27, 1942. "Acquisition of land for Marine Corps Training Area, Onslow County, North Carolina: Area N, Tracts #1 and #2", also includes property map of N-2A
- Case Report "Tract G-56" Offer to Settle recommendation, dated 1/21/43, includes enclosed property map
- Case Report "Tract G-63" Offer to Settle recommendation, dated 1/21/43, includes enclosed property map

Record Group 127: Records of the United States Marine Corps (USMC)
Reviewed 7 boxes from Entry 18A: General Correspondence, Office of the Commandant, January 1939-June 1950.

- Record Group 127 (USMC), Entry 18A, Office of the Commandant, General Correspondence, January 1939-June 1950, 1275/70-80: Camp Lejeune, Box 218.
- Record Group 127 (USMC), Entry 18A, Office of the Commandant, General Correspondence, January 1939-June 1950, 1275/70-80: Camp Lejeune, Box 219.
- Record Group 127 (USMC), Entry 18A, Office of the Commandant, General Correspondence, January 1939-June 1950, 1275/70-80: Camp Lejeune, Box 220.

- **General Description**: Correspondence related to Camp Lejeune. Copied correspondence files on Cherry Point bombing targets at Camp Lejeune.
- Record Group 127 (USMC), Entry 18A, Office of the Commandant, General Correspondence, January 1939-June 1950, 1520-30-7: Education- Marine Corps Schools-Engineers School (Quantico), Box 507.
- Record Group 127 (USMC), Entry 18A, Office of the Commandant, General Correspondence, January 1939-June 1950, 1520-30-7: Education- Marine Corps Schools-Engineers School (Quantico), Box 508.
- **General Description:** Correspondence related to Engineers school, primarily at Camp Lejeune. Several references to demolitions courses include: lists of enlisted men who completed courses, course syllabi. By 1949, demolitions course was incorporated in the Basic Construction Course. Copied recommended syllabus for Basic Construction Course.
- Record Group 127 (USMC), Entry 18A, Office of the Commandant, General Correspondence, January 1939-June 1950, Education- Naval Engineers School, Box 545.
- Record Group 127 (USMC), Entry 18A, Office of the Commandant, General Correspondence, January 1939-June 1950, 2000-20-2: Ordnance – explosives, dynamite, TNT, Box 1205.
- **General Description:** Correspondence related to supply of ordnance for various bases. Copied ordnance disposal and handling document.

Reviewed 2 boxes from Entry 24: Correspondence Files of the Office of the Commandant and Headquarters Support Division

- Record Group 127 (USMC), Entry 24, Correspondence Files of the Office of the Commandant and Headquarters Support Division, Box 9.
- Record Group 127 (USMC), Entry 24, Correspondence Files of the Office of the Commandant and Headquarters Support Division, Box 10.
- **General Description:** Education files – primarily related to curriculum for several bases. No copies made from this entry.

Reviewed 2 boxes from Entry 50: Real Estate

- Record Group 127 (USMC), Entry 50: Real Estate, Box 2.
- Record Group 127 (USMC), Entry 50: Real Estate, Box 3.
- **General Description:** Real estate files associated with Camp Lejeune, similar to Bureau of Yards and Docks, no copies made from this entry.

Reviewed 10 boxes from Entry 59: Correspondence files of the Office of the Commandant and Headquarters Support Division, January 1939 – June 1950

- Record Group 127 (USMC), Entry 59, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1939-June 1950, Box 1.

- Record Group 127 (USMC), Entry 59, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1939-June 1950, Box 2.
- Record Group 127 (USMC), Entry 59, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1939-June 1950, Box 3.
- Record Group 127 (USMC), Entry 59, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1939-June 1950, Box 4.
- Record Group 127 (USMC), Entry 59, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1939-June 1950, Box 5.
- Record Group 127 (USMC), Entry 59, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1939-June 1950, Box 6.
- Record Group 127 (USMC), Entry 59, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1939-June 1950, Box 7.
- Record Group 127 (USMC), Entry 59, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1939-June 1950, Box 8.
- Record Group 127 (USMC), Entry 59, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1939-June 1950, Box 9.
- Record Group 127 (USMC), Entry 59, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1939-June 1950, Box 10.
- **General Description:** "Unclassified" correspondence from 1939-1950, incorporates information for several bases, research reports on flame throwers. Primarily regarding administrative issues (i.e. personnel, course quotas, supplies for bases/schools etc.) No copies made from this entry.

Reviewed 17 boxes from Entry 102: Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950 – June 1958

- Record Group 127 (USMC), Entry 102, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950-June 1958, Box 20.
- Record Group 127 (USMC), Entry 102, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950-June 1958, Box 21.
- Record Group 127 (USMC), Entry 102, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950-June 1958, Box 71.
- Record Group 127 (USMC), Entry 102, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950-June 1958, Box 72.
- Record Group 127 (USMC), Entry 102, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950-June 1958, Box 73.
- Record Group 127 (USMC), Entry 102, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950-June 1958, Box 320.

- Record Group 127 (USMC), Entry 102, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950-June 1958, Box 321.
- Record Group 127 (USMC), Entry 102, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950-June 1958, Box 328.
- Record Group 127 (USMC), Entry 102, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950-June 1958, Box 329.
- Record Group 127 (USMC), Entry 102, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950-June 1958, Box 330.
- Record Group 127 (USMC), Entry 102, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950-June 1958, Box 331.
- Record Group 127 (USMC), Entry 102, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950-June 1958, Box 332.
- Record Group 127 (USMC), Entry 102, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950-June 1958, Box 333.
- Record Group 127 (USMC), Entry 102, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950-June 1958, Box 334.
- Record Group 127 (USMC), Entry 102, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950-June 1958, Box 400.
- Record Group 127 (USMC), Entry 102, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950-June 1958, Box 401.
- Record Group 127 (USMC), Entry 102, Correspondence Files of the Office of the Commandant and Headquarters Support Division, January 1950-June 1958, Box 402.
- **General Description: A**dministrative correspondence for several Marine Corps bases: rifle/pistol competition awards/results, personnel transfers, establishing/disestablishing various operations, class quotas, curriculum, Advanced Research Group frequently discussed in education files. Boxes 400-402 were related to Camp Lejeune, primarily about personnel transfers and tables of organization.

Documents Obtained from Record Group 127:

- Letter from Commandant of the Marine Corps to Commanding General, Marine Barracks, Camp Lejeune. January 4, 1951. Letter MC-1277568. Regarding Engineer School Batallion quotas and control dates for courses.
- Letter from Commandant of the Marine Corps to Commanding General, Marine Corps Base, Camp Lejeune. May 3, 1956. Subject: Training Directive, Engineer School Battalion, Fiscal Year 1957.
- Letter from Commandant of the Marine Corps to Commanding General, Marine Corps Air Station, Cherry Point, North Carolina. October 28, 1947. Subject: Assignment of Space in Camp Lejeune Area to be Utilized for the Construction of Bombing and Strafing

Targets for use of Air, Fleet Marine Force, Atlantic Units attached to Marine Corps Air Station, Cherry Point, N.C.

- Conference Report. May 24, 1946. Subject: Inter Air Traffic Control Board Cast 593 (review) (Camp Davis) Camp Lejeune, N.C. and Marine Corps Air Base, Cherry Point, N.C. Air Space Danger Area.
- Letter from the Chief of the Bureau of Ordnance to the Commandant of the Marine Corps. March 6, 1948. Subject: Proposed Letter of Instruction on Handling, Storage and Destruction of Ammunition and Explosives, Comments Concerning.
- Letter from Headquarters U.S. Marine Corps. Letter of Instruction Number 1567. April 19, 1948. Subject: Handling, Storage, and Destruction of Ammunition and Explosives.
- Letter from the Commanding General, Marine Barracks, Camp Lejeune To Commandant of the Marine Corps. October 14, 1949. Subject: Training syllabi, recommendation for revision of.
- Letter from Colonel Randall M. Victory (via Commanding Officer Marine Barracks Camp Lejeune) to Commandant of the Marine Corps. November 22, 1949. Subject: Authority for the expenditure of ammunition, request for.
- Headquarters U.S. Marine Corps. Memorandum for Director, Division of Plans and Policies (G-4). August 24, 1949. Subject: Authority to expend certain demolition items in training Organized Marine Corps Reserve units at Camp Lejeune, North Carolina.
- Letter from the Commanding Officer MCB Camp Lejeune to Commandant of the Marine Corps. December 1, 1949. Subject: Proposed explosive allowance for calendar year 1950.
- Letter from the Commanding General to the Chief of Naval Operations (via: Commandant of the Marine Corps). June 3, 1947. Subject: Danger Zones in Navigable Waters

Cartographic and Architectural Records

Site Visit: May 1, 2009

Copied aerial photographs of Onslow County, North Carolina for the years 1938 and 1949. Record Group 145: ASCS – Agricultural Stabilization and Conservation Service

Focus area: Traps Bay area, MCB Camp Lejeune

Onslow County Public Library

Onslow County Public Library
58 Doris Avenue East
Jacksonville, NC 28540
910.455.7350
http://www.co.onslow.nc.us/library/

Site visit: April 21, 2009

Documents reviewed:

1. Loftfield, Thomas, C. Principal Investigator. (1981). Archeological and Historical Survey of USMC Base, Camp Lejeune; Naval Facilities Engineering Command Norfolk, Coastal Zone Resources Corp., Volumes I and II, Contract No. N62470-79-C-4273. August.

   Discussed one archeological dig in Traps Bay area, appeared to be very close to Site 67 based on map (see photographs). Only cultural artifacts discovered were discussed in report, no evidence of TNT or other explosives.

2. Watson, Alan. (1995). Onslow Country: A Brief History. Division of Archives and History. North Carolina Department of Cultural Resources. Raleigh.

   No pertinent information found.

Swansboro Branch Public Library

Swansboro Branch Library
1460 West Corbett Avenue
Swansboro, NC 28584
Phone: 910-326-4888

Site visit: April 21, 2009
Documents Reviewed at Swansboro Public Library:
No pertinent documents found.

MCB Camp Lejeune Base Records Review

Contact: Duane Richardson
Base Range Safety Officer
Marine Corps Base, Camp Lejeune
(910)451-1240
Duane.richardson@usmc.mil

Per personal interview on April 21, 2009, Duane discussed Site 67 as follows:

"Oh yes, the Engineers Training Area. During Phase I of the investigation, look for the following evidence that TNT was blown here:

Hawks (old steel vehicle)
Trees with explosive damage
Craters
Evidence of destroyed bridges over the creek
Small pieces of metal which are electric blasting caps

There is a pistol training range just south of this site and an urban breacher training area to the north, probably of little significance. Be very careful as this site is adjacent to an active demolition range. Personnel will have to communicate with Bob Lowder and Range Control about access to the site, which may often be restricted. Access road to the east of the site may be better to minimize interference."

Contact: Dennis Dunham
Technical Records, Public Works Office
Marine Corps Base, Camp Lejeune
(910) 451-2818 ext 273
Dennis.dunham@usmc.mil

Per e-mail conversations existing conditions maps and land acquisition property maps. All maps have been converted to electronic files and Dennis is happy to look up any information needed on builds and any civil work, sewage, electrical, etc.

Contact: Julie Rowe
Archivist, Combat Camera
Marine Corps Base, Camp Lejeune
Julie.rowe.ctr@usmc.mil
(910) 451-1238

The archivist position at MCB Camp Lejeune was created fairly recently and is still in development. Currently the office holds photos and oral histories of the main area of MCB Camp Lejeune and the collection is growing. Specifically to Site 67, no documents were found.

MCB Camp Lejeune Base Library

1401 West Road
Camp Lejeune, NC 28547-2539
http://library.usmc-mccs.org/Lejeune/index.htm

Site visit: April 21, 2009

Documents Reviewed at MCB Camp Lejeune Base Library:

1. Marine Corps Gazette. (1946). Volume 30. United State Marine Corps. Quantico, VA.

   No pertinent information found.

2. Marine Corps Gazette. (1947). Volume 31. United State Marine Corps. Quantico, VA.

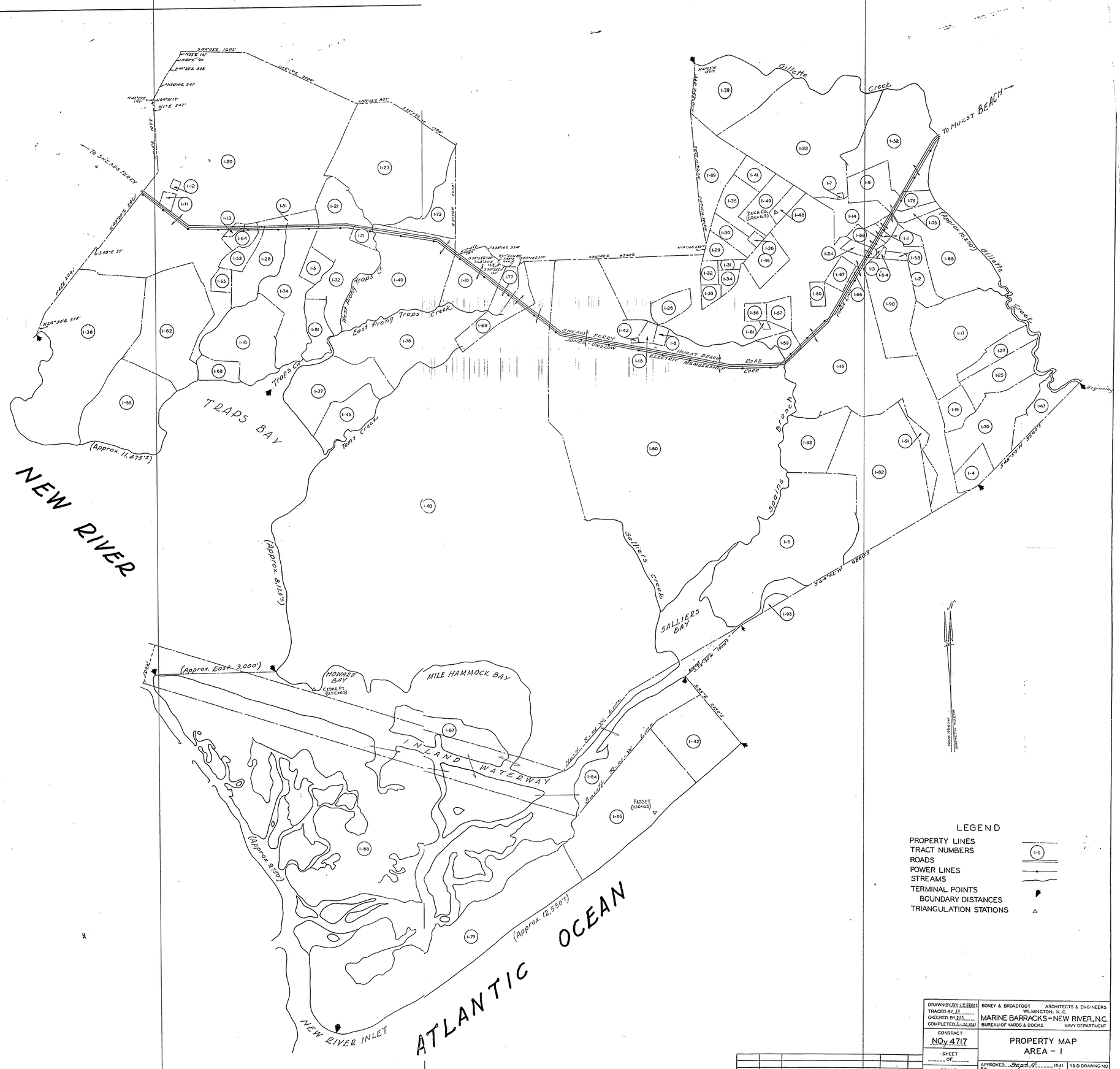
   No pertinent information found.

3. Marine Corps Gazette. (1948). Volume 32. United State Marine Corps. Quantico, VA.

   No pertinent information found.

Attachment B
Historical Maps and Photos

No.	Record Owner	Area
1-1	N.B. Henderson and Wife	8.9
1-2	J.L. Henderson	20.0
1-3	L. Gerling Arthur	0.59
1-4	N.B., J.L. and C.R. Henderson	14.8
1-5	Mrs. Mamie Simpson Parker	9.76
1-6	Southern Land Sales Corporation	178.0
1-7	Lewis Hurst, Moses Marshall and John White, Trustees Of The Baptist Church Of Brown Sound	0.52
1-8	E.B. Smith	3.06
1-9	Joseph Graham	25.7
1-10	Elias Ward Heirs	43.6
1-11	The Primitive Baptist Church	2.91
1-12	Benjamin Simmons, Elias Henderson and George Marine, Committee of District No. 3 Colored	1.01
1-13	J.H. Aman, R.L. Herritage, J.D. Coston, D.N. Russell and L.D. Bryan, Constituting the Board of Education	1.43
1-14	Clarence W. Ward	22.9
1-15	Adock Gibbs	3.72
1-16	Leon Henderson	422.0
1-17	J.G. Arthur and Wife, Elizabeth Arthur	98.0
1-18	L.F. Simpson	64.0
1-19	N.B. Henderson	14.8
1-20	Lewis Marine Estate	501.0
1-21	William Bell	23.6
1-22	B.B. Henderson	145.0
1-23	Ochara Bell Heirs	137.0
1-24	Southern Land Sales Corporation	5.02
1-25	N.B. Henderson and Wife	32.9
1-26	Belford Mantford	12.79
1-27	Elias Ward Heirs	15.02
1-28	L. Kelly Robinson	33.3
1-29	D.W. Russell	9.81
1-30	F.A. McCabe	12.13
1-31	N.P. Bell and Lucy J. Bell	3.73
1-32	J.B. Hurst	5.88
1-33	Carrie Fonville	5.29
1-34	Belford Mantford	5.75
1-35	N.B., J.L. and C.R. Henderson	20.3
1-36	Julia Mantford Heirs	2.04
1-37	Murray Prescott and Bernard Prescott	60.0
1-38	Thomas G. Samworth	186.0
1-39	Mrs. Carrie Gillette Heirs	39.3
1-40	W.F. Millis and L.T. Millis	100.0
1-41	E.L. Cox	10.63
1-42	Disputed Area Between A. Hurst Heirs and E.B. Smith	58.0
1-43	Elias Ward, C.W. Ward and Oliver White, Trustees of The Methodist Church Col. of Onslow County	0.5
1-45	Angie Millis	30.6
1-46	E.L. Cox	18.9
1-47	C.R. Henderson, J.L. Henderson and N.B. Henderson	19.8
1-48	E.B. Smith	7.55
1-49	Isaiah Hill (Herbert Hurst Heirs, Claimant)	18.58
1-50	George F. Gray Heirs	5.06
1-51	John Ball Millis	7.59
1-52	Miss Sallie Fonville	84.0
1-53	Warren W. Jones and Asa T. Jones, Jr.	9.16
1-54	White Citizens of Brown Sound	0.69
1-55	Katie Marine	84.5
1-56	Carrie H. Merritt	5.36
1-57	I.H. Hill (Rebecca Jones Heirs, Claimant)	9.10
1-58	N.B., J.L. and C.R. Henderson	2.5
1-59	Haywood Lee Craft	8.86
1-60	Katie Gornto	9.28
1-61	Walter Marshall	0.89
1-62	Ray Marine	97.0
1-64	John D. Warlick, Trustee	7.83
1-65	Hagard Whitfield	6.2
1-66	Leon Henderson (Ephriam F. Arthur Heirs, Claimant)	0.83
1-67	N.B. Henderson	8.28
1-68	B.B. McCabe	6.15
1-69	Isaiah Hill	23.8
1-70	Elias Ward Heirs	62.0
1-71	Eula Jones	58
1-72	L.H. Millis Heirs	53.4
1-73	Annie Millis	27.0
1-74	G.M. Simpson	59.6
1-75	Kate L. (Tishie) Fonville	6.5
1-76	James M. Fonville	8.3
1-77	Nora Hill Heirs	11.6
1-78	Annie Millis	91.0
1-79	Lewis O. Fonville, Sr. Heirs	234.0
1-80	Mary Moore Pearsall	731.0
1-81	J.B. Millis	17.9
1-82	Mrs. Carrie Gillette Heirs	138.0
1-83	E.B. Smith	1447.0
1-84	State of North Carolina	164.0
1-85	Miss Sallie Fonville	87.0
1-86	A.J. Hurst Heirs	123.0
1-87	North Carolina State Board of Education	25.3
1-88	North Carolina State Board of Education	510.0
1-89	Leon Henderson	40.4
1-90	Barkley Burgess Henderson	57.0
1-91	Barkley Burgess Henderson	10.4
1-92	Barkley Burgess Henderson	45.2
1-93	Thomas Henderson Estate	3.3



REVISION	DATE	BRIEF	RO IN CHGE	BY

DRAWN BY JWG & R.E.Gaskill
TRACED BY JW
CHECKED BY RRS
COMPLETED Jan. 26, 1942

BONEY & BROADFOOT ARCHITECTS & ENGINEERS
WILMINGTON, N. C.
MARINE BARRACKS – NEW RIVER, N.C.
BUREAU OF YARDS & DOCKS NAVY DEPARTMENT

CONTRACT NOy 4717
SHEET ___ OF ___

PROPERTY MAP
AREA – 1

SCALE 1 IN = 660 FT

APPROVED Sept. 4 1941
BY: [signature]
RESIDENT OFFICER IN CHARGE

Y & D DRAWING NO 162777

Appendix C
Sampling Analysis Plan Cross-Walk Table

UFP-QAPP Worksheet #	Required Information	Crosswalk to Related Information
A. Project Management		
Documentation		
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**
Project Organization		
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**
Project Planning/ Problem Definition		
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 of Work Plan**
11	Site-Specific Project Quality Objectives	**Section 1.1 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. Measurement Data Acquisition		
Sampling Tasks		
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 of Work Plan** **Sections 3.4 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**
Analytical Tasks		
23	Analytical SOPs	**See attached.**

UFP-QAPP Worksheet #	Required Information	Crosswalk to Related Information
	Analytical SOP References Table	
24	Analytical Instrument Calibration Table	**See attached**
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	**See attached**
Sample Collection		
26	Sample Handling System, Documentation Collection, Tracking, Archiving and Disposal Sample Handling Flow Diagram	**Section 6 of the Master QAPP**
27	Sample Custody Requirements, Procedures/SOPs Sample Container Identification Example Chain-of-Custody Form and Seal	**Section 6 of Master QAPP** **Section 4.2 of Master SAP** **Attachment 6 of Master SAP**
Quality Control Samples		
28	QC Samples Table Screening/Confirmatory Analysis Decision Tree	**See attached**
Data Management Tasks		
29	Project Documents and Records Table	**Section 3 of Work Plan** **Sections 6 and 9 of Master QAPP**
30	Analytical Services Table Analytical and Data Management SOPs	**See attached**
C. Assessment Oversight		
31	Planned Project Assessments Table Audit Checklists	**Section 11 of Master QAPP**
32	Assessment Findings and Corrective Action Responses Table	**Section 14 of Master QAPP**
33	QA Management Reports Table	**Section 11 of Master QAPP** **Data will be validated externally and reviewed by the chemist prior to loading to database.**
D. Data Review		
34	Verification (Step I) Process Table	**Section 9 of Master QAPP**
35	Validation (Steps IIa and IIb) Process Table	**Section 9 of Master QAPP**
36	Validation (Steps IIa and IIb) Summary Table	**Section 9 of Master QAPP**
37	Usability Assessment	**Section 2.5 of Work Plan** **Section 9 of Master QAPP**

Final

Site 67 Engineer's TNT Burn Site Quality Assurance Project Plan Attachment

Marine Corps Base Camp Lejeune Jacksonville, North Carolina

Contract Task Order 040

February 2010

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

Worksheet #2: SAP Identifying Information

Site Name/Number: Site 67 Engineer's TNT Burn Site
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:

Scoping Session	Date
NAVFAC RFP	2/15/09
CTO Award	3/31/09

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, NCDENR, 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.

Worksheet #3: Distribution List

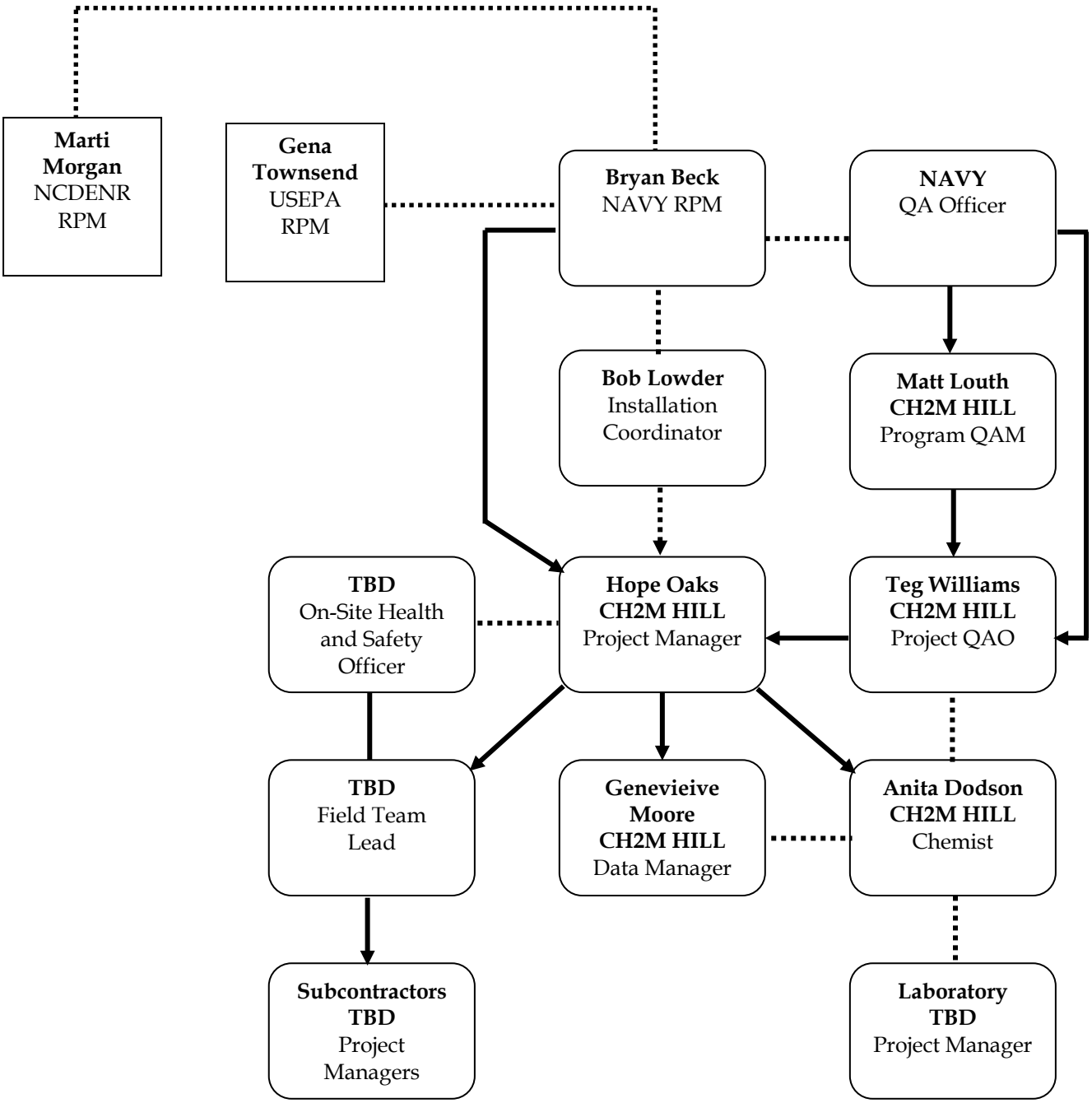
Name	Role/Title	Organization	Email Address
Bob Lowder	Environmental Management Department/Installation Restoration	MCB Camp Lejeune	Robert.A.Lowder@usmc.mil
Bryan Beck	Navy Environmental Technical Representative (Activity)	NAVFAC Mid-Atlantic	Bryan.Beck@navy.mil
Gena Townsend	USEPA Remedial Project Manager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

Worksheet #4 Project Personnel Sign-Off

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

Worksheet #5 Project Organization

Lines of Authority ——— Lines of Communication ·····



SAP Worksheet #12 -- Measurement Performance Criteria Table

Analytical Group: Explosives
Matrix: Aqueous

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Matrix spike/matrix spike duplicate (MS/MSD)	SW-846 8330 Water/ Empirical/SOP-327	One MS/MSD per 20 samples	Accuracy / Bias / Precision	DOD QSM limits, 30%RPD	A
Field Duplicates		As required per sampling event	Precision	Values > 5X QL: ± 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	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

SAP Worksheet #12-2 -- Measurement Performance Criteria Table

Analytical Group: Explosives
Matrix: Solid

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Matrix spike/matrix spike duplicate (MS/MSD)	SW-846 8330 Soil/ Empirical/SOP-327	One MS/MSD per 20 samples	Accuracy / Bias / Precision	DOD QSM limits, 30%RPD	A
Field Duplicates		As required per sampling event	Precision	Values > 5X QL: ± 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	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

SAP Worksheet #15 -- Reference Limits and Evaluation Table

Analytical Group: Explosives
Matrix: Aqueous

Analyte	CAS Number	Project Action Limit (ug/L)	Project Action Limit Reference	Project Quantitation Limit Goal (ug/L)	Laboratory-specific	
					QLs ug/L	MDLs ug/L
2,4,6-Trinitrotoluene	118-96-7	1.8	RSL Tap for Groundwater Adjusted	0.24	0.24	0.08
2-Amino-4,6-dinitrotoluene	35572-78-2	7.3	RSL Tap for Groundwater Adjusted	0.24	0.24	0.08
4-Amino-2,6-dinitrotoluene	19406-51-0	7.3	RSL Tap for Groundwater Adjusted	0.24	0.24	0.08

SAP Worksheet #15-2 -- Reference Limits and Evaluation Table

Analytical Group: Explosives
Matrix: Solid

Analyte	CAS Number	Project Action Limit (ug/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (ug/kg)	Laboratory-specific	
					QLs ug/KG	MDLs ug/KG
2,4,6-Trinitrotoluene	118-96-7	3600	RSL Residential Soil Adjusted	300	300	100
2-Amino-4,6-dinitrotoluene	35572-78-2	15000	RSL Residential Soil Adjusted	300	300	100
4-Amino-2,6-dinitrotoluene	19406-51-0	15000	RSL Residential Soil Adjusted	300	300	100

SAP Worksheet #19 -- Analytical SOP Requirements Table

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers	Sample volume	Preservation Requirements	Maximum Holding Time
Water	Explosives	SW-846 8330 SOP-327	Two 1-liter glass amber bottles	1000 ml	Cool to 4° Centigrade	7 days until extraction/40 days to analysis
Soil	Explosives	SW-846 8330 SOP-327	4 oz glass jar	2 grams	Cool to 4° Centigrade	14 days until extraction/40 days to analysis

SAP Worksheet #23 -- Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
Empirical SOP-327	Nitroaromatics and Nitamines by High Performance Liquid Chromatography (HPLC) Method 8330A and 8332, Rev. 14	Definitive	Organic/Extraction	Extraction/HPLC	Empirical	N
Empirical SOP-404	Laboratory Sample Receiving Log-in and Storage Standard Operating Procedures, Rev. 13	Definitive	Log-in	NA/ Log-in	Empirical	N
Empirical SOP-405	Analytical Laboratory Waste Disposal, Rev. 5	Definitive	Log-in	NA/ Log-in	Empirical	N
Empirical SOP-410	Standard Operating Procedures for Laboratory Sample Storage, Secure Areas, and Sample Custody, Rev. 7	Definitive	Log-in	NA/ Log-in	Empirical	N

SAP Worksheet #24 -- Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
High Performance Liquid Chromatography/ UV Detector	Initial Calibration - A minimum 5 point calibration is required.	Calibrate the instrument when it is received and after a major change or if the daily calibration fails.	The RSD for each compound must be ≤ 20%. A linear curve (≥ 0.995 correlation) or quadratic curve (≥0.99 correlation, minimum 6 points) for quantitation.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst/ Supervisor	Empirical SOP-327
High Performance Liquid Chromatography/ UV Detector	Continuing Calibration (CCV)	Analyze standard at the beginning and end of sequence and every 10 samples.	≤ 15% difference.	If percent difference (% D) > +15% and samples are < the QL, 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-327
High Performance Liquid Chromatography/ UV Detector	Initial calibration Verification (ICV)	Once after initial calibration	85-115%	Identify source of problem, correct, repeat calibration, rerun samples	Analyst/ Supervisor	Empirical SOP-327

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

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
High Performance Liquid Chromatograph/ UV Detector	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	Explosives	Check pump pressure, check for leaks, check for adequate mobile phase	Prior to initial calibration or as necessary	CCV $\leq$ 15% difference.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst/ Supervisor	Empirical SOP-327

SAP Worksheet #28 -- Laboratory QC Samples Table

Matrix	Water
Analytical Group	Explosives
Analytical Method / SOP Reference	8330/ SOP-327

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 target compounds ≥1/2 CRQL except common lab contaminants which should be < RL	Reclean, retest, re-extract, reanalyze, and/or qualify data	Analyst, Laboratory Supervisor and Data Validator	Bias / Contamination	No target compounds ≥1/2 CRQL except common lab contaminants which should be < RL
Surrogates	1per sample	DOD limits.	Reprep and reanalyze for confirmation of matrix interference when appropriate.	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Bias	DOD limits.
Laboratory Control Spike	One per batch of 20 or less	DOD limits.	Evaluate and reanalyze if possible If an MS/MSD was performed in the same 12 hour clock and acceptable narrate. If the LCS recoveries are high but the sample results are <QL narrate otherwise reprep and reanalyze	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	DOD Limits
Matrix spike / Matrix spike duplicate	One per SDG or every 20 samples.	DOD limits.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met If both the LCS and MS/MSD are unacceptable reprep the samples and QC.	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	DOD Limits

SAP Worksheet #28-2 -- Laboratory QC Samples Table

Matrix	Soil
Analytical Group	Explosives
Analytical Method / SOP Reference	8330/ SOP-327

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 target compounds ≥1/2 CRQL except common lab contaminants which should be < RL	Reclean, retest, re-extract, reanalyze, and/or qualify data	Analyst, Laboratory Supervisor and Data Validator	Bias / Contamination	No target compounds ≥1/2 CRQL except common lab contaminants which should be < RL
Surrogates	1per sample	DOD limits.	Reprep and reanalyze for confirmation of matrix interference when appropriate.	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Bias	DOD limits.
Laboratory Control Spike	One per batch of 20 or less	DOD limits.	Evaluate and reanalyze if possible If an MS/MSD was performed in the same 12 hour clock and acceptable narrate. If the LCS recoveries are high but the sample results are <QL narrate otherwise reprep and reanalyze	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	DOD Limits
Matrix spike / Matrix spike duplicate	One per SDG or every 20 samples.	DOD limits.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met If both the LCS and MS/MSD are unacceptable reprep the samples and QC.	Analyst, Laboratory Supervisor and Data Validator	Precision / Accuracy / Bias	DOD Limits

SAP Worksheet #30 -- Analytical Services Table

Matrix	Analytical Group	Sample Locations/ID Number	Analytical Method	Data Package Turnaround Time	Laboratory / Organization	Backup Laboratory / Organization
Aqueous	Explosives	IR67-GW01 IR67-GW02 IR67-GW03	8330	28 days	Empirical Laboratories, LLC 621 Mainstream Drive Suite 270 Nashville, TN 37228 Janice Shilling 615-345-1115	TBD
Solid	Explosives	IR67-IS01 IR67-IS02 IR67-IS03 IR67-IS04 IR67-IS05 IR67-IS06 IR67-IS07 IR67-IS08 IR67-SS01 IR67-SS02 IR67-SS03	8330			