M67001.AR.006698
MCB CAMP LEJUENE
5090.3a

FINAL FOCUSED SITE INSPECTION REPORT SITE UXO-06 MILCON AREA MCB CAMP LEJEUNE NC

03/01/2007

CH2M HILL

Final

Focused Site Inspection Report
Site UXO-06 MILCON Area

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Contract Task Order 0109

March 2007

Prepared for

Department of the Navy

Naval Facilities Engineering Command

Under the

NAVFAC CLEAN III Program

Contract No. N62470-02-D-3052

Prepared by

CH2MHILL

Herndon, Virginia

Contents

1.0 Introduction 1-1
1.1 Background and Project Objectives 1-1
1.2 Site History and Description 1-1
1.3 Report Organization 1-2
2.0 Field Investigation Activities 2-1
2.1 Introduction 2-1
2.2 Support and Site Preparation 2-1
2.2.1 MEC Support 2-1
2.2.2 Surveying 2-1
2.2.3 Land Clearing 2-2
2.3 Digital Geophysical Mapping 2-2
2.4 Environmental Sampling 2-3
2.4.1 Overview 2-3
2.4.2 Soil Sampling 2-3
2.4.3 Groundwater Sampling 2-4
2.4.4 IDW Management 2-5
2.5 Sample Analysis and Validation 2-5
2.5.1 Sample Analysis 2-5
2.5.2 Data Validation 2-5
3.0 Investigation Results 3-1
3.1 Digital Geophysical Mapping 3-1
3.2 Site Lithology 3-1
3.3 Soil Analytical Results 3-2
3.3.1 Surface Soil 3-2
3.3.2 Subsurface Soil 3-2
3.4 Groundwater Analytical Results 3-2
3.5 Preliminary Risk Screening 3-3
3.5.1 Human Health Risk Screening 3-3
3.5.2 Environmental Risk Screening 3-4
4.0 Summary and Conclusions 4-1
5.0 References 5-1

Tables

2.1 Analytical Methods

3.1 Concentrations Detected in Soil

3.2 Concentrations Detected in Groundwater

4.1 Summary of Preliminary Screening

Figures

1.1 Area Map

1.2 Site Location

2.1 Armory Area Demolition Plan

2.2 Extended Parking Area Demolition Plan

2.3 Soil and Groundwater Sampling Locations

3.1 Digital Geophysical Mapping Results

Acronyms and Abbreviations

ASR	archives search report
COPCs	chemicals of potential concern
DGM	Digital Geophysical Mapping
DQOs	data quality objectives
EED	electronic data deliverable
EIMS	Environmental Information Management System
GPO	geophysical prove-out
GPS	geographic positioning system
HSP	Health and Safety Plan
HTW	hazardous and toxic waste
MCB	Marine Corps Base
MEC	munitions and explosives of concern
MILCON	military construction
MRP	Munitions Response Program
msl	mean sea level
NC2LGW	North Carolina Groundwater 2L Standards
NCDENR	North Carolina Department of Environment and Natural Resources
NCSSL	North Carolina Soil Screening Levels
ORNL	Oak Ridge National Laboratories
PCBs	pesticides/polychlorinated biphenyls
PID	photo ionization detector
PPE	personal protective equipment
PRGs	Preliminary remediation Goals
RTK	Real-Time Kinematic
SEPI	SEPI Engineering Group, Inc.
Shaw	Shaw Environmental and Infrastructure
SI	Site Inspection
SOPS	standard operating procedures
SVOCs	semi-volatile organic compounds

TOC	total organic carbon
TOX	total organic halogens
TPH	total petroleum hydrocarbons
US DOE	US Department of Energy
USAE	USA Environmental, Inc.
USEPA	United States Environmental Protection Agency
VOCs	volatile organic compounds
TPH	total petroleum hydrocarbons
WP	white phosphorus

1.0 Introduction

1.1 Background and Project Objectives

Marine Corps Base (MCB) Camp Lejeune is planning a military construction (MILCON) project that includes the construction of an armory and extended parking area, collectively referred to in this Focused Site Inspection (SI) Report as the "MILCON Area". This MILCON area, which is adjacent to Gonzalez Blvd. between Anderson Street and McHugh Blvd (**Figures 1.1** and **1.2**), is located within the boundaries of Munitions Response Program (MRP) Site UXO-06, which was identified in the Range Identification and Preliminary Range Assessment (Lowder, 2005) as D-27, Fortified Beach Assault Area. The following types of munitions were identified as having been employed at this site: small arms, 3.5-inch practice rocket, rifle grenade (practice), hand grenade (smoke), and hand grenade (white phosphorus [WP]).

Due to its location within an MRP site, a focused SI was conducted at the MILCON area in an effort to determine the presence or absence of munitions and explosives of concern (MEC) and hazardous and toxic waste (HTW) within the MILCON footprint.

The focused SI was based on the Scope of Work dated August 16, 2006, which formed Attachment A to the NAVFAC Mid-Atlantic Request for Proposal dated August 18, 2006. A Focused SI Work Plan was prepared to present the technical approach for conducting field investigation activities. The Focused SI Work Plan also contained a Geophysical Prove-out Plan, Geophysical Investigation Plan, Health and Safety Plan (HSP), and standard operating procedures (SOPs).

The objectives of the focused SI were to:

1. Identify the presence and nature of any HTW contamination that may exist in the MILCON area by conducting an investigation of groundwater and soil in and immediately surrounding the 4.4-acre MILCON Area; and
2. Estimate the number and density of geophysical anomalies that may represent subsurface MEC by conducting digital geophysical mapping across the MILCON footprint.

1.2 Site History and Description

Site UXO-06 was identified in the Range Identification and Preliminary Assessment as D-27, Fortified Beach Assault Area. The Range Identification and Preliminary Assessment reported that this 177-acre range was in use from 1953 until approximately 1977, and listed the following types of munitions as having been employed at this range:

- Small arms

- 3.5-inch Practice Rocket
- Rifle Grenade, Practice
- Hand Grenade, Smoke
- Hand Grenade, WP

The Range Identification and Preliminary Assessment did not uncover any information on range clearances specific to this site.

The planned MILCON Area lies within the boundaries of Site UXO-06 and consists of a 2.0-acre armory area on the south side of Gonzales Blvd. and a 2.4-acre extended parking area on the north side of Gonzales Blvd. These areas are located between Anderson St. and McHugh Blvd as shown on **Figures 1.1** and **1.2**.

No existing data concerning site lithology, hydrogeology, and groundwater quality within the vicinity of the MILCON area was known at the beginning of the investigation. However, during the field investigation, a monitoring well identified as PP-3 was located in a wooded area approximately 200 feet southeast of the center of the proposed armory demolition area. Monitoring well PP-3 was constructed as 2-inch diameter, 28 feet deep with a well screen from 18 feet to 28 feet below ground surface (ft bgs). No other information is known about well PP-3.

The topography of the planned MILCON Area is gently sloping with little elevation relief. Elevations at the armory area, south of Gonzalez Blvd., range from approximately 29 feet above mean sea level (msl) at the eastern site boundary to approximately 21 feet above msl at the western boundary. Elevations at the extended parking area, north of Gonzalez Blvd., range from approximately 25 feet above msl at the northern boundary to approximately 22 feet above msl in southern portion of the site.

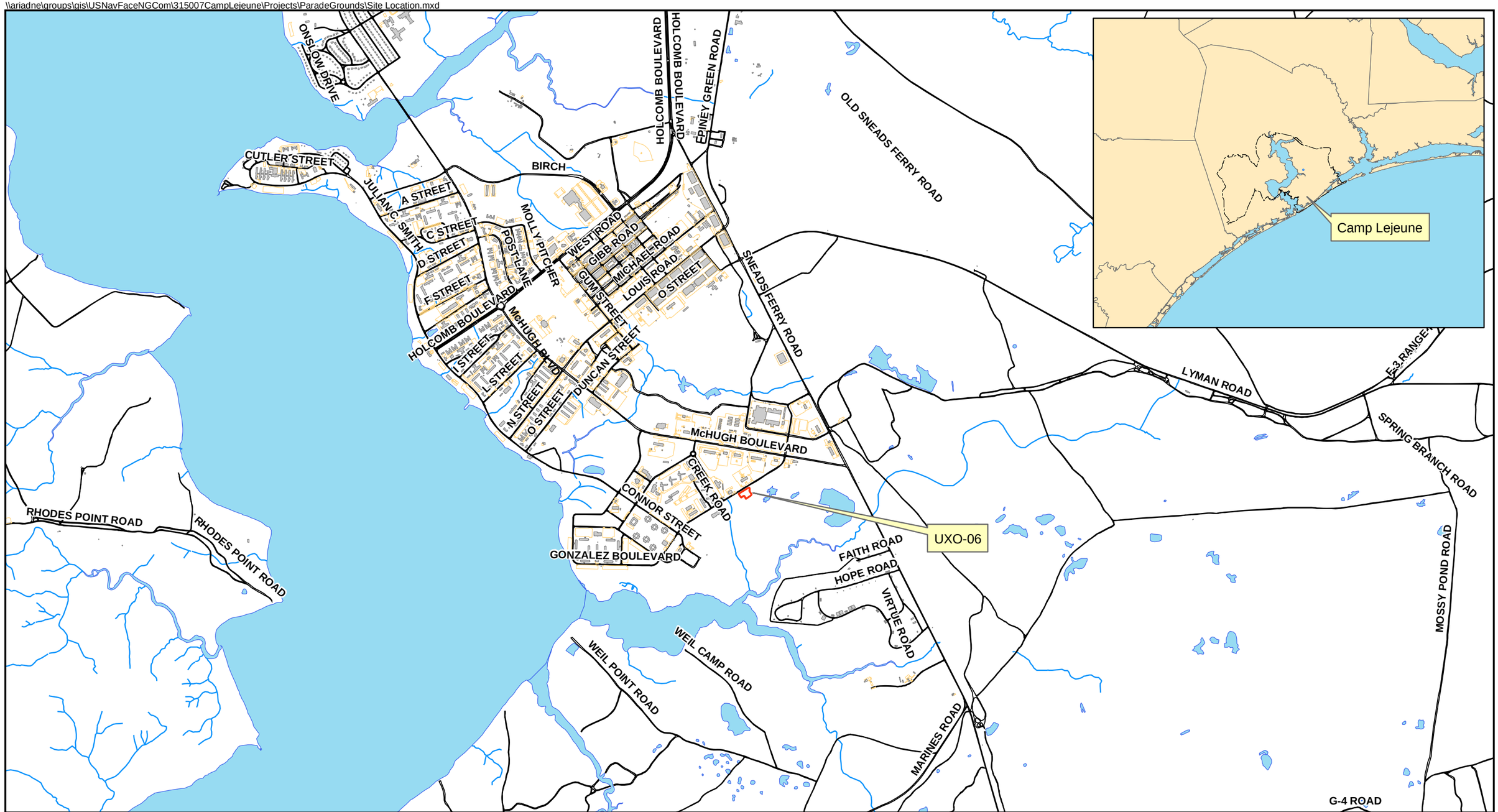
No water features are present within the MILCON boundaries. The MILCON area was heavily wooded prior to the performance of the Focused SI. As discussed in Section 2, the area was clear cut prior to the start of field investigation activities. All trees were removed from the site and the remaining vegetation and stumps were cut or ground to within six inches of the ground surface.

1.3 Report Organization

This Focused SI Report was prepared to document the site investigation activities conducted at the Site UXO-06 MILCON Area and to present the findings of the field investigation.

Site-specific and project-specific background information was provided in this section of the document. Section 2 summarizes the field investigation activities conducted for the Focused SI. Section 3 presents the investigation results, including the geophysical investigation, soil and groundwater sampling program. Conclusions and recommendations for further study are presented in Section 4.

\\ariadne\groups\gis\USNavFaceNGCom\315007CampLejeune\Projects\ParadeGrounds\Site Location.mxd



Legend

- Demo Area
- Buildings
- Vehicle Parking
- Roads

N
W E
S

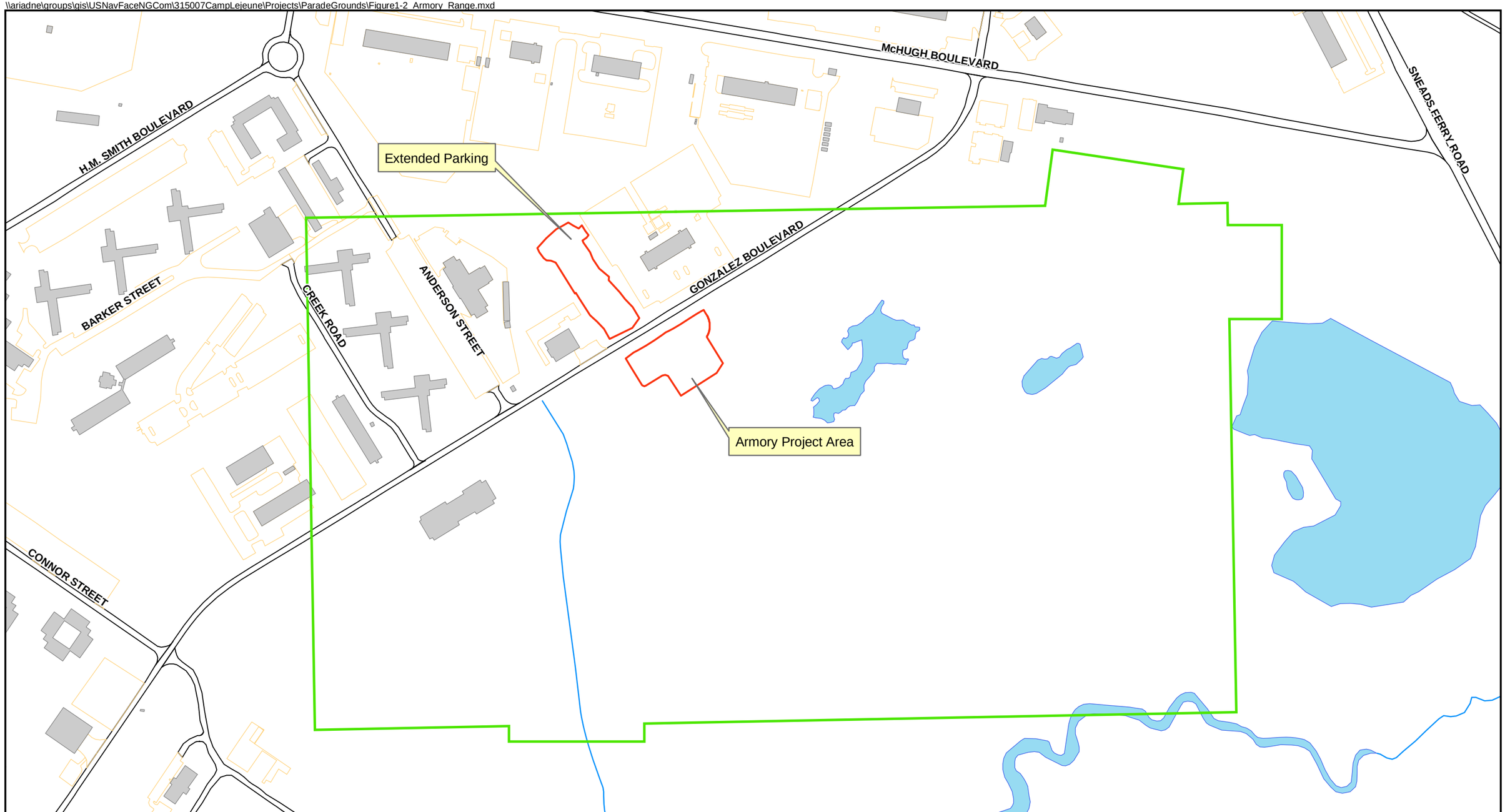
0 450 900 Meters

1,500 0 1,500 3,000 Feet

Figure 1-1
Site Location
MRP Site UXO-06 MILCON SI
Camp Lejeune, North Carolina

CH2MHILL

\\ariadne\groups\gis\USNavFaceNGCom\315007CampLejeune\Projects\ParadeGrounds\Figure1-2_Armory_Range.mxd



Legend

- Buildings
- Vehicle Parking
- Roads
- Demo Area
- Site UXO-06, Fortified Beach Assault Area

N
W E
S

0 60 120 Meters

100 0 100 200 300 400 Feet

Figure 1-2
MILCON Area Location Map
Site UXO-06, Fortified Beach Assault Area
Camp Lejeune, North Carolina

CH2MHILL

2.0 Field Investigation Activities

2.1 Introduction

The MILCON Area Focused SI was performed in accordance with the following tasks, which are discussed in more detail in the remainder of this section:

- Support and Site Preparation
  - MEC Support
  - Surveying
  - Land Clearing
- Digital Geophysical Mapping (DGM)
- Environmental Sampling
  - Groundwater Sampling
  - Surface Soil Sampling
  - Subsurface Soil Sampling
- Sample Analysis and Validation

The Focused SI Work Plan discussed the preparation of an archives search report (ASR). Due to funding and schedule constraints, the ASR will be conducted as part of a future Site SI that encompasses all of Site UXO-06.

2.2 Support and Site Preparation

The primary support and site preparation activities for the Focused SI at UXO-06 were MEC support, land surveying, and land clearing.

2.2.1 MEC Support

MEC avoidance support during all onsite activities was provided by USA Environmental, Inc. (USAE) of Tampa, FL. An MEC Avoidance Plan was provided as an appendix to the site-specific HSP in the Focused SI Work Plan.

2.2.2 Surveying

Land surveying was conducted under subcontract by SEPI Engineering Group, Inc. (SEPI) of Raleigh, NC. All work was conducted under the supervision of a professional land surveyor licensed in the State of North Carolina.

Prior to the performance of any other onsite activities, the extent of the area to be clear cut MILCON, as shown on the demolition plans on **Figures 2.1** and **2.2**, were surveyed in and marked.

Following completion of clear cutting activities, the Digital Geophysical Mapping (DGM) grid network was surveyed in and grid corner markers were placed for use by the DGM subcontractor personnel. The surveying subcontractor also determined the coordinates of the soil and groundwater sampling locations.

2.2.3 Land Clearing

The planned MILCON area was heavily wooded in its pre-investigation condition. Because clear cutting of the area would be required prior to construction activities, and because 100% DGM coverage was desired, clear cutting of the MILCON area was conducted prior to the start of field investigation activities.

Timber harvesting was conducted by a firm that was contracted by the Camp Lejeune Base Forester. USAE, under contract to CH2M HILL, provided MEC avoidance support to the timber harvesting contractor.

East Coast Land Improvement of Swansboro, NC, provided site vegetation cleanup services. Limbs and debris remaining from tree harvesting were chipped and spread across the site. Brush that wasn't included in the tree harvesting was also chipped and spread. Tree trunks from the harvested trees were chipped to ground level. East Coast Land Improvement also moved non-vegetative debris from the site to aid in the performance of the DGM effort. Non-vegetative debris included concertina wire, fence posts, concrete, and other construction debris.

2.3 Digital Geophysical Mapping

A geophysical services subcontractor, NAEVA Geophysics of Charlottesville, VA, used DGM equipment to map geophysical anomalies that could potentially represent subsurface MEC across the 4.4-acre MILCON area. The DGM effort was conducted in accordance with the Geophysical Investigation Plan that formed an appendix to the Focused SI Work Plan.

Prior to commencing the DGM survey, the selected geophysical equipment and survey methodologies were tested, evaluated, and demonstrated as meeting project data quality objectives (DQOs) using a geophysical prove-out (GPO). The information collected during the GPO was analyzed and used to confirm that the selected geophysical system would meet the DQOs established for the geophysical survey. The GPO was conducted at the existing GPO plot that was established at the UXO-04 Knox Trailer Park site. The GPO was performed in accordance with the GPW Work Plan that was provided as an appendix to the Focused SI Work Plan.

The MILCON Area was divided in a 100-meter grid network oriented north-south. The DGM effort was conducted using a single-coil EM61-MK2 with a Trimble Real-Time Kinematic (RTK) geographic positioning system (GPS) for location control. Coverage of the MILCON area was 100% with the exception of approximately 4500 square feet along the area boundary lines in the northern parking area. In this area, logging was not conducted up to the surveyed MILCON Area boundary, so DGM could not be conducted to the boundary lines.

2.4 Environmental Sampling

2.4.1 Overview

Environmental sampling was conducted November 14-16, 2006, and included the following activities:

- Collection of 10 surface soil samples
- Collection of 10 subsurface soil samples by DPT sampling
- Collection of 5 groundwater samples from DPT borings

Surface soil samples were collected using manual methods as described in Section 2.4.2. All other subsurface soil and groundwater samples were collected using direct-push technology (DPT) sampling methods.

Ten DPT sampling locations were selected as shown on **Figure 2.3**. Surface soil and subsurface soil samples were collected from each of the ten DPT locations, while groundwater samples were collected from five of the DPT locations. Further details of soil and groundwater sampling methods are discussed in Sections 2.4.2 and 2.4.3.

2.4.2 Soil Sampling

On November 14, 2006, ten surface soil samples (MR06-SS01 through SS10) were collected from the locations shown on **Figure 2-3**. Surface samples for volatile organic compound analysis were collected as a grab sample using Encore samplers. Surface soil samples for analysis of semi-volatile organic compounds, pesticides/polychlorinated biphenyls (PCBs), explosives residues, metals, cyanide, total organic carbon, total organic halogens, total petroleum hydrocarbons, and perchlorate were collected following the "TR-02-1" approach, which is summarized below and described in U.S. Army Corps of Engineers Technical Report ERDC/CRREL TR-02-1, "Guide for Characterization of Sites Contaminated with Energetic Materials" (Thiboutot, et.al., 2002).

Each surface sampling location was defined as an area 1 meter x 1 meter in size. The grab sample for VOC analysis was collected using Encore samplers in the center of the 1 meter squared area. Once the VOC sample had been collected, multi-increment composite soil samples for the remaining analytical parameters were collected by compositing ten sample increments from random locations within each 1 meter squared sampling location. The sample increments were approximately equal in the amount of soil and were collected from depths of 0-2 inches. The sample increments at each location were then mixed into a single composite sample prior to being transferred to the appropriate sample containers.

On November 15-16, 2006, after surface soil sampling was completed, subsurface soil sampling and surface soil sampling for analyses other than explosives residues and metals was conducted at each of the 10 locations using DPT. The center of each of the ten (1 m x 1 m) surface soil sampling areas was used for the DPT subsurface soil sampling. Each location was sampled continuously for lithological characterization and field screening, allowing for the discrete depth selection for a soil sample to be collected for laboratory

analysis. Continuous cores were advanced using a 5-foot Geoprobe® Macrocore sampler to a depth just below the water table, which ranged from 10 feet to 14 feet bgs. Field screening of the soil samples was performed using a photo ionization detector (PID), but no elevated levels were detected during field activities. Ten subsurface soil samples (MR06-IS01 through IS10) were collected just above the water table at the locations shown on **Figure 2-3**.

The DPT sampling equipment included an open core barrel and piston sampling device along with disposable Teflon liners. Down-hole sampling equipment was decontaminated and a new liner was used in collecting each continuous sample from the ground surface down to the bottom of the borehole. All DPT boreholes were abandoned by grouting from the bottom of the boring to the ground surface.

Soil samples were analyzed by a fixed-base laboratory for the following constituents:

- Volatile organic compounds (VOCs)
- Semi-volatile organic compounds (SVOCs)
- Pesticides/PCBs
- Total petroleum hydrocarbons (TPH)
- Perchlorate
- Metals
- Cyanide
- Total organic carbon (TOC)
- Total organic halogens (TOX)
- Explosives residues.

Soil analytical methods for the constituents listed above are provided in **Table 2.1**. Sample analysis and data validation are discussed in more detail in Section 2.5.

2.4.3 Groundwater Sampling

On November 15-16, 2006, discrete groundwater samples were collected from the surficial and intermediate aquifer units at the site to assess the groundwater quality. Groundwater samples were collected from the surficial aquifer at four (IS01, IS06, IS08, and IS10) of the ten DPT sampling locations. Sampling intervals were 10-14 ft bgs at one location and 15-19 ft bgs at three locations. One additional groundwater sample was collected from the intermediate aquifer at a sampling interval of 36-40 ft bgs at location IS10.

The groundwater sampling system consisted of a four-foot stainless steel screen attached to DPT rods. When the target depth was reached in each borehole, the screen on the sampler was deployed and groundwater samples were collected using polyethylene tubing and a peristaltic pump. New clean tubing was used to collect groundwater samples from each sampling location.

Groundwater samples were analyzed by a fixed-base laboratory for the following constituents:

- VOCs

- SVOCs
- Pesticides/PCBs
- TPH
- Perchlorate
- Total metals and cyanide
- Filtered metals and cyanide
- TOC
- TOX
- Explosives residues.

Groundwater analytical methods for the constituents listed above are provided in **Table 2.1**. Sample analysis and data validation are discussed in more detail in Section 2.5.

2.4.4 IDW Management

Soil and water IDW generated during DPT soil and groundwater sampling activities were containerized in 55-gallon drums and staged near the drilling activities. The drums were provided by the Base Remedial Action Contractor (RAC), Shaw Environmental and Infrastructure (Shaw). IDW will be properly disposed of by subcontractors within 90 days of generation, based on the results of the waste characterization. Disposable equipment, including personal protective equipment (PPE), DPT soil sleeves, sample tubing, poly sheeting, paper towels, and aluminum foil, was disposed of in a separate 55-gallon drum as solid waste.

2.5 Sample Analysis and Validation

2.5.1 Sample Analysis

Environmental samples were analyzed by a subcontracted laboratory, CompuChem Labs of Cary, NC. Soil and groundwater analytical methods are provided in **Table 2.1**.

2.5.2 Data Validation

DataQual Environmental Services, LLC, of St. Louis, MO, validated all laboratory analytical data. The Level IV data was validated per the CLP criteria as outlined in the following documents:

- United States Environmental Protection Agency (USEPA), Hazardous Site Control Division, Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses. 1991.
- USEPA, Office of Emergency and Remedial Response, Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses. 1988.

CH2M HILL will submit electronic updates to the MCB Camp Lejeune Environmental Information Management System (EIMS) in accordance with the EIMS electronic data deliverable (EDD) format. This will include location coordinates for newly installed or abandoned wells and analytical data. All data will be submitted within 30 days following the completion of the site database.

Figure 2.1 - Amory Area Demolition Plan

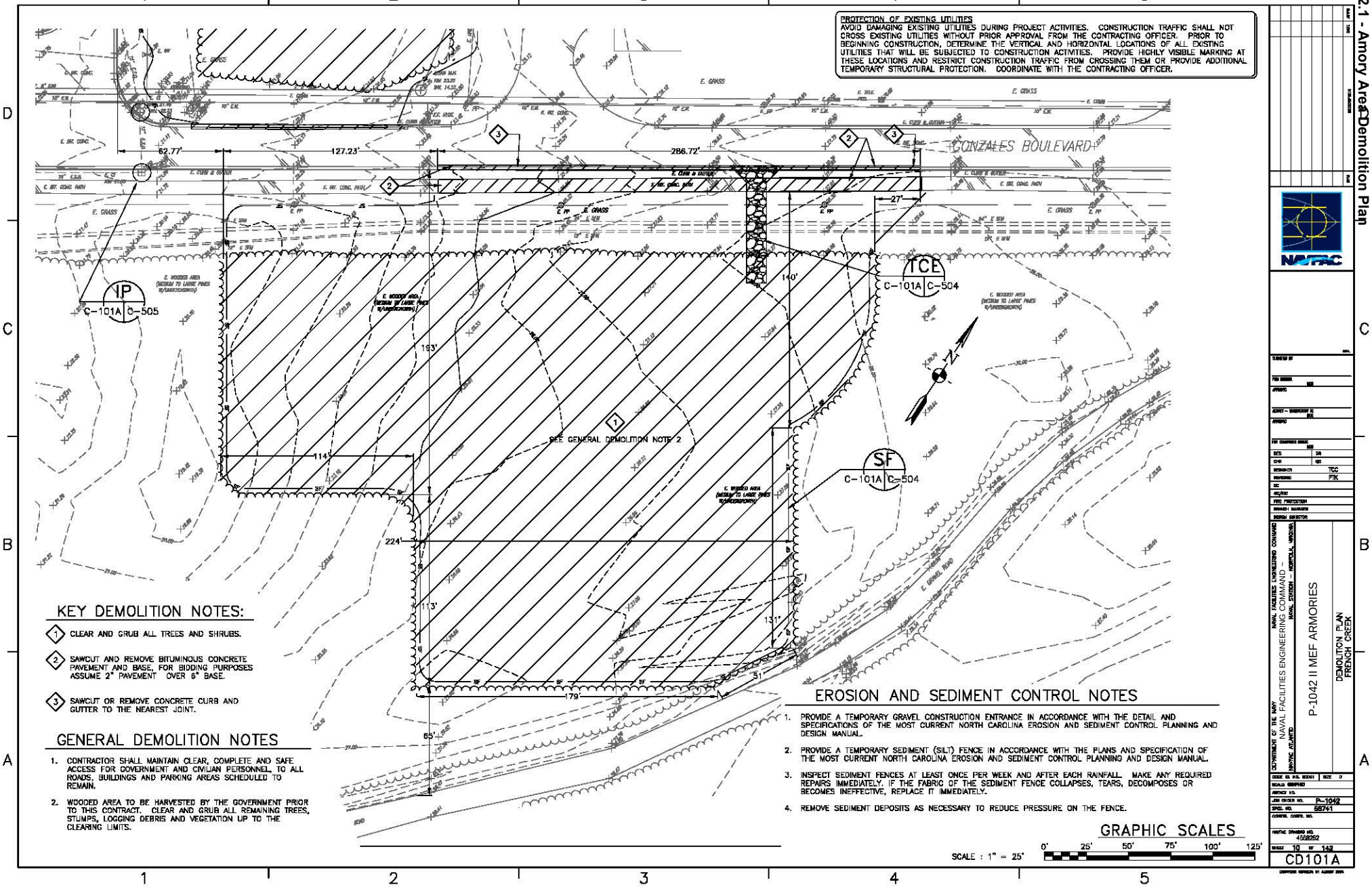
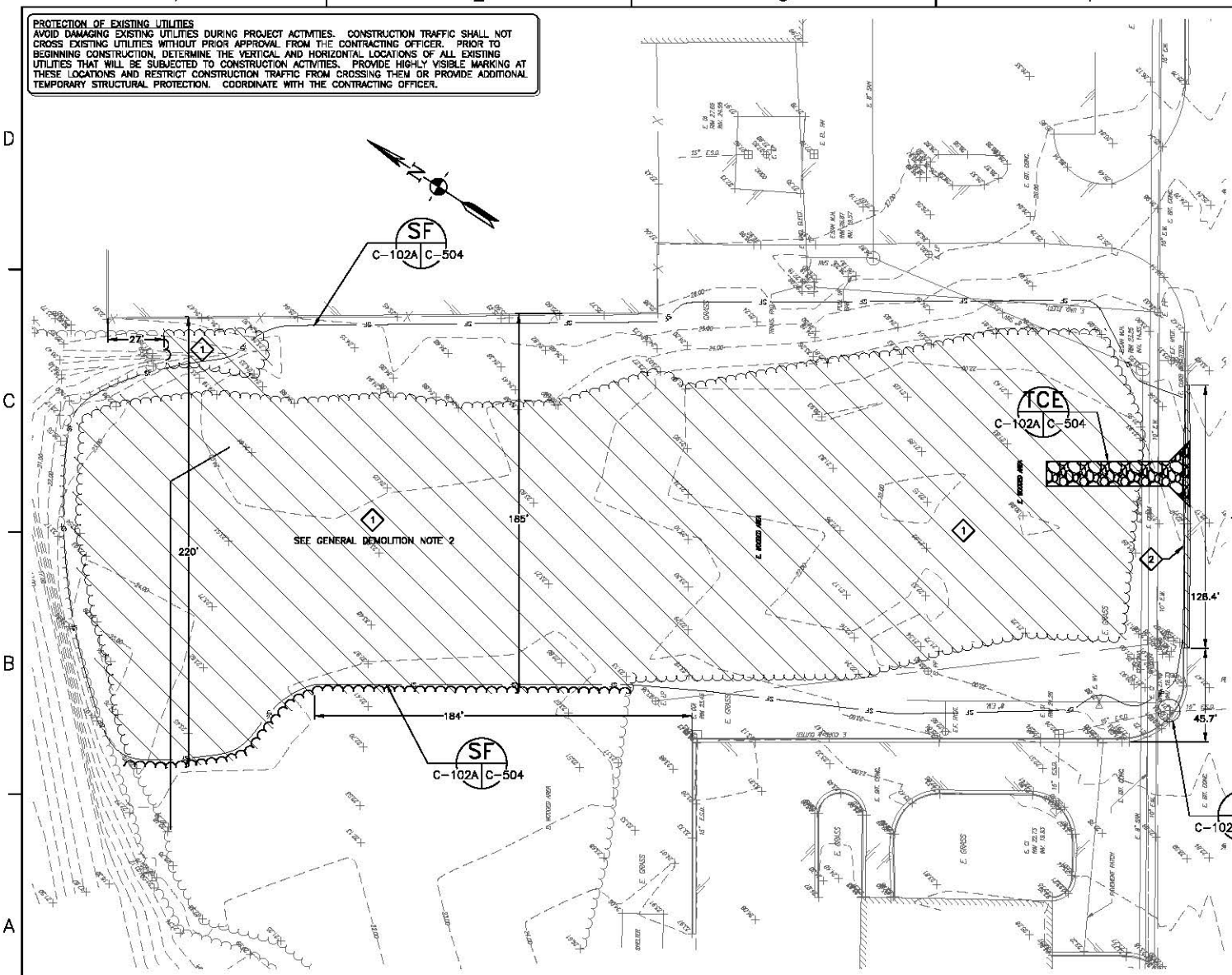


Figure 2.2 - Extended Parking Area Demolition Plan



PROTECTION OF EXISTING UTILITIES
AVOID DAMAGING EXISTING UTILITIES DURING PROJECT ACTIVITIES. CONSTRUCTION TRAFFIC SHALL NOT CROSS EXISTING UTILITIES WITHOUT PRIOR APPROVAL FROM THE CONTRACTING OFFICER. PRIOR TO BEGINNING CONSTRUCTION, DETERMINE THE VERTICAL AND HORIZONTAL LOCATIONS OF ALL EXISTING UTILITIES THAT WILL BE SUBJECTED TO CONSTRUCTION ACTIVITIES. PROVIDE HIGHLY VISIBLE MARKING AT THESE LOCATIONS AND RESTRICT CONSTRUCTION TRAFFIC FROM CROSSING THEM OR PROVIDE ADDITIONAL TEMPORARY STRUCTURAL PROTECTION. COORDINATE WITH THE CONTRACTING OFFICER.

EROSION AND SEDIMENT CONTROL NOTES

1. PROVIDE A TEMPORARY GRAVEL CONSTRUCTION ENTRANCE IN ACCORDANCE WITH THE DETAIL AND SPECIFICATIONS OF THE MOST CURRENT NORTH CAROLINA EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL.
2. PROVIDE A TEMPORARY SEDIMENT (SILT) FENCE IN ACCORDANCE WITH THE PLANS AND SPECIFICATION OF THE MOST CURRENT NORTH CAROLINA EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL.
3. INSPECT SEDIMENT FENCES AT LEAST ONCE PER WEEK AND AFTER EACH RAINFALL. MAKE ANY REQUIRED REPAIRS IMMEDIATELY. IF THE FABRIC OF THE SEDIMENT FENCE COLLAPSES, TEARS, DECOMPOSES OR BECOMES INEFFECTIVE, REPLACE IT IMMEDIATELY.
4. REMOVE SEDIMENT DEPOSITS AS NECESSARY TO REDUCE PRESSURE ON THE FENCE.

KEY DEMOLITION NOTES:

1. CLEAR AND GRUB ALL TREES AND SHRUBS.
2. SAWCUT OR REMOVE CONCRETE CURB AND GUTTER TO THE NEAREST JOINT.

GENERAL DEMOLITION NOTES

1. CONTRACTOR SHALL MAINTAIN CLEAR, COMPLETE AND SAFE ACCESS FOR GOVERNMENT AND CIVILIAN PERSONNEL, TO ALL ROADS, BUILDINGS AND PARKING AREAS SCHEDULED TO REMAIN.
2. WOODED AREA TO BE HARVESTED BY THE GOVERNMENT PRIOR TO THIS CONTRACT. CLEAR AND GRUB ALL REMAINING TREES, STUMPS, LOGGING DEBRIS AND VEGETATION UP TO THE CLEARING LIMITS.
3. SEE SHEET C-001 FOR SURVEY NOTES AND LEGEND.
4. SEE SHEET ED001A FOR ELECTRICAL DEMOLITION.

NAVFAC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL STATION – NORFOLK, VIRGINIA
NAVFAC ATLANTIC

P-1042 II MEF ARMORIES

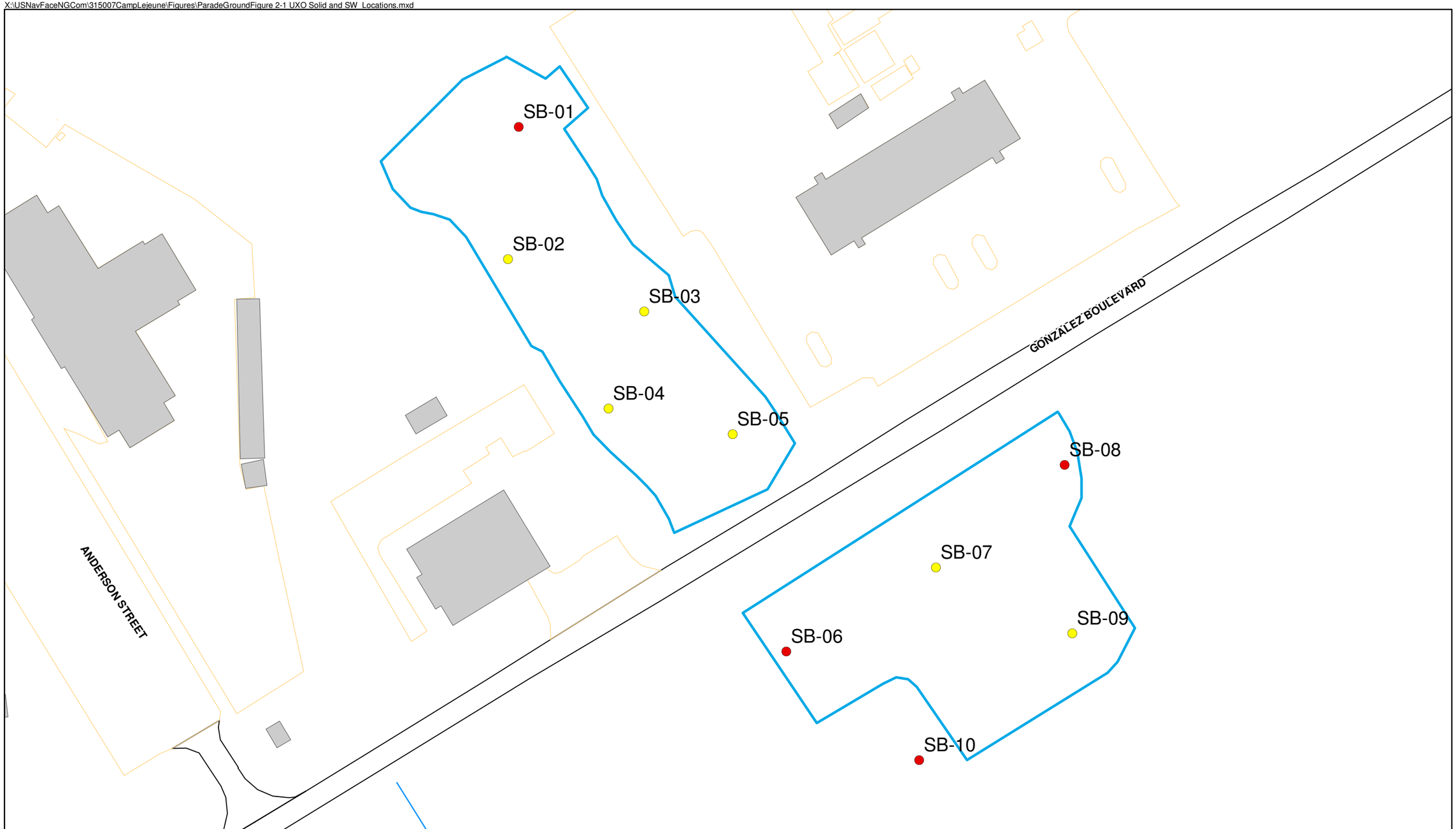
DEMOLITION – EXTENDED PARKING
FRENCH CREEK

CODE ID. NO. 80091 SIZE D
SCALE: SEE PLAN
AGENCY NO.
JOB ORDER NO. P-1042
SPEC. NO. 58741
CONSTR. CONTR. NO.
NAVFAC DRAWING NO. 4558253
SHEET 11 OF 142
CD102A

SUBMITTED BY
PM MEMBER DATE
APPROVED
ACTIVITY - DIVISION/ACTIVITY 10 DATE
APPROVED
NAV CONSTRUCT WKVFC DATE
DES DR
CHK QC
CHECKED TCC
REVIEWED PTK
QC
AE/CO
FIRE PROTECTION
BRANCH MANAGER
DESIGN DIRECTOR

REV DATE DESCRIPTION BY

X:\USNavFaceNGCom\315007CampLejeune\Figures\ParadeGroundFigure 2-1 UXO Solid and SW_Locations.mxd



Legend

- Demo Area
- Buildings
- Vehicle Parking
- Road Area
- Soil Sampling Locations
- Soil and Groundwater Sampling Locations

N

0 50 100 200 Feet

Figure 2-3
Soil & Groundwater Sampling Locations
MRP Site UXO-06 MILCON SI
Camp Lejeune, North Carolina

CH2MHILL

TABLE 2.1
Analytical Methods
Site UXO-06 MILCON Area Focused Site Inspection
MCB Camp Lejeune, Jacksonville NC

Media	Analysis	Method
Soil	TCL VOCs	OLM04
	Total Organic Halogens	SW-846 9020B
	TCL SVOCs	OLM04
	Explosives Residues	SW-846 8330
	Perchlorate	DoD 4554
	TCL Pesticides/PCBs	OLM04
	TAL Metals/Cyanide	ILM05
	Total Petroleum Hydrocarbons (full range)	EPA 418.1 SW9071A-IR MOD
	Total Organic Carbon	EPA 415.2 / SW-846 9060
Groundwater	TCL VOCs	OLM04
	Total Organic Halogens	SW-846 9020B
	TCL SVOCs	OLM04
	Explosives Residues	SW-846 8330
	Perchlorate	DoD 4554
	TCL Pesticides/PCBs	OLM04
	Total and Filtered TAL Metals	ILM05
	Cyanide	ILM05
	Total Petroleum Hydrocarbons (full range)	EPA 418.1
	Total Dissolved Solids	E 160.3

Notes
TAL = Target Analyte List
TCL = Target Compound List
VOCs = Volatile Organic Compounds
SVOCs = semivolatile organic compounds
PCBs = polychlorinated biphenyls

3.0 Investigation Results

3.1 Digital Geophysical Mapping

A total of 5.7 acres were geophysically surveyed at the project site using a man-portable single-coil EM61-MK2 system. The areas covered by the survey are shown on Figure 3-1. As discussed in Section 2.3, data gaps along boundaries of the parking area, north of Gonzalez Blvd., resulted from logging not being conducted to the surveyed MILCON Area boundaries.

The DGM results shown on **Figure 3-1** indicate a high density of anomalies due to metallic items. The planned parking area north of Gonzalez Blvd. shows a significantly greater concentration of anomalies than does the planned armory area south of Gonzalez Blvd. An example of a single grid is presented as **Figure 3-2**.

Anomalies that represent potential subsurface MEC items were identified based on their geophysical signatures. Approximately 1,300 anomalies representing subsurface metal were selected from the data as representing potential subsurface MEC items. An average of 364 anomalies per acre were identified as representing potential subsurface MEC in the planned parking area north of Gonzalez Blvd., while an average of 141 anomalies per acre were identified as representing potential subsurface MEC in the planned armory area south of Gonzalez Blvd.

It is important to note that it is not possible to determine from the DGM results whether the anomalies actually represent MEC or munitions debris, as opposed to non-munitions related metallic debris. Non-munitions related metallic debris can present geophysical signatures that are similar to those of the target MEC item, and these signatures vary with depth, orientation, size, and mass of the metallic item generating the anomaly.

3.2 Site Lithology

Within the vicinity of UXO-06, soils within the upper undifferentiated formation varied in composition from fine silty sands to fine sandy clays. A discontinuous zone of clay was generally present within the surface soils on the north side of Gonzalez Boulevard, ranging in thickness from 1 feet (IS01) to 6.5 feet (IS05) bgs (Figure 2-1). South of Gonzalez Boulevard, a discontinuous clay zone was also present within the surficial soils and ranged in thickness from 5 feet (IS09) to 8 feet (IS10) bgs. Fine sands to silty sands were generally present below the surficial clays throughout the site. Shell fragments were identified at approximately 24 ft bgs at location IS10. Soil boring logs are provided in **Attachment A**.

3.3 Soil Analytical Results

A total of twenty surface and subsurface samples were obtained during the field activities at UXO-06. Surface soil samples were collected from 0 inches to 2 inches, while the subsurface samples were generally collected in the range of 5 ft to 12 ft below the ground surface. The detected concentrations of VOCs, SVOCs, Pesticides/PCBs, explosives residues, and metals from the surface and subsurface sampling are reported in **Table 3.1** along with North Carolina Soil Screening Levels (NCSSL). Comparison to other risk-based concentrations is discussed in Section 3.5.

3.3.1 Surface Soil

One VOC was detected in surface soil samples, but did not exceed NCSSL (**Table 3.1**).

One SVOC was detected in surface soil samples, but did not exceed NCSSL.

Eleven pesticides/PCBs were detected in surface soil samples, but only Dieldrin exceeded NCSSL where such values have been established.

No explosives residues were detected in surface soil samples.

Nineteen metals were detected in surface soil samples, but of those metals with NCSSL values, only iron exceeded this value.

3.3.2 Subsurface Soil

Two SVOCs were detected in subsurface soil samples, but did not exceed established NCSSL values (**Table 3.1**).

No pesticides/PCBs or explosives residues were detected in subsurface soil samples.

Nineteen metals were detected in subsurface soil samples, but of those metals with NCSSL values, only iron exceeded this value.

3.4 Groundwater Analytical Results

Five groundwater samples were obtained during the field activities at UXO-06. Four groundwater samples were collected from the surficial aquifer at intervals of 10-14 ft. bgs or 15-19 ft. bgs. One groundwater sample was collected from the intermediate aquifer at an interval of 36-40 ft. bgs. The concentrations of analytes detected in groundwater are reported in **Table 3.2** along with North Carolina Groundwater 2L Standards (NC2LGW). Comparison to other risk-based levels is discussed in Section 3.5.

One VOC was detected in the surficial aquifer groundwater samples, but did not exceed NC2LGW values. No VOCs were detected in the intermediate aquifer groundwater sample.

One SVOC, bis(2-ethylhexyl)phthalate, was detected in surficial aquifer groundwater samples at a concentration that exceeded NC2LGW. However, bis(2-ethylhexyl)phthalate is

a common laboratory contaminant and therefore the detection may be due to laboratory procedures. No SVOCs were detected in the intermediate aquifer groundwater sample.

No pesticides/PCBs were detected in groundwater samples from either aquifer.

Perchlorate was the only explosives residue detected in the surficial aquifer groundwater samples and in the intermediate aquifer groundwater sample. There is currently not an NC2LGW value for this analyte.

Eighteen total metals and 13 dissolved metals were detected in surficial aquifer groundwater samples. Of those metals with NC2LGW values, only total iron and total manganese concentrations exceeded these values; no dissolved metals exceeded NC2LGW values in surficial aquifer groundwater samples.

Nineteen total metals and 14 dissolved metals were detected in intermediate aquifer groundwater samples. Of those metals with NC2LGW values, total cadmium, total chromium, total iron, total manganese, total nickel, and total zinc exceeded these values; no dissolved metals exceeded NC2LGW values in intermediate aquifer groundwater samples.

3.5 Preliminary Risk Screening

Preliminary risk screening was conducted to determine whether concentrations of analytes in groundwater and soil exceeded human health or environmental risk values.

3.5.1 Human Health Risk Screening

3.5.1.1 Soil Risk Screening

In Table B.1 in Attachment B, soil data were compared to USEPA Region 9 residential soil Preliminary Remediation Goals (PRGs) (USEPA, October, 2004). PRGs based on noncarcinogenic effects were divided by 10 to account for exposure to multiple constituents. PRGs based on carcinogenic effects were used as presented in the PRG table. If newer toxicity values are available for a constituent, a new PRG was calculated using the equations from the USEPA Region 9 PRG table and the updated toxicity values. The soil data were also compared to the Camp Lejeune background soil data from the *Final Base Background Soil Study Report*, Marine Corps Base Camp Lejeune, North Carolina, Baker Environmental, April 25, 2001. The background values used were two times the average site background soil concentration.

The comparison of soil data to the screening values above indicated that the maximum detected concentrations of aluminum, arsenic, iron, and vanadium exceed the screening values and are retained as chemicals of potential concern (COPCs).

3.5.1.2 Groundwater Screening

In Table B.2 in Attachment B, groundwater data were compared to USEPA Region 9 tap water PRGs (USEPA, October 2004). PRGs based on noncarcinogenic effects were divided by 10 to account for exposure to multiple constituents. PRGs based on carcinogenic effects

were used as presented in the PRG table. If newer toxicity values are available for a constituent, a new PRG was calculated using the equations from the USEPA Region 9 PRG table and the updated toxicity values. The groundwater data were also compared to the Camp Lejeune background groundwater data from the *Final Base Background Soil Study Report, Marine Corps Base Camp Lejeune, North Carolina*, (Baker Environmental, 2001). The background values used were two times the average site background groundwater concentration.

The comparison of the groundwater data to the screening values above indicated that the maximum detected concentrations of chloroform and bis(2-ethylhexyl)phthalate exceed screening values. In unfiltered groundwater samples, aluminum, antimony, arsenic, beryllium, chromium, iron, lead, manganese, nickel, vanadium, and zinc exceed screening values. For the filtered groundwater samples, however, the only inorganics retained as COPCs are iron and manganese.

3.5.2 Environmental Risk Screening

3.5.2.1 Overview

Soil and groundwater data were screened for potential effects to the environment by comparing the maximum detected concentrations to effects concentrations published in scientific literature and ecological screening values from guidance documents. Although ecological receptors are unlikely to be exposed to subsurface soils, the maximum detected concentration in all soil samples was used for this preliminary screening evaluation. Additionally, it was conservatively assumed that aquatic organisms would be exposed directly to groundwater. Chemicals that were not detected in any sample were not considered to present an unacceptable risk to the environment.

The majority of the values that soil data were screened against are conservative values meant to be protective of environmental resources that include soil microbes, earthworms, plants, and wildlife. Similarly, the screening values for groundwater are conservative values meant to be protective of aquatic organisms such as aquatic plants, aquatic invertebrates, and fish. Preference in selection of screening benchmarks was given to values published in guidance documents from regulatory agencies such as the USEPA or the North Carolina Department of Environment and Natural Resources (NCDENR). The other main sources of screening criteria were compendiums of data for toxicological effects to environmental resources published by Oak Ridge National Laboratories (ORNL) funded by the US Department of Energy (US DOE). The specific sources of the values used for each compound are shown in **Tables B.3** and **B.4**, which present the soil and water benchmarks, respectively.

3.5.2.2 Environmental Screening of Soil

Screening of soil data for detected constituents suggests that risks to the environment are not likely (**Table B.5**) for most compounds. Detected constituents in soil include one VOC, two SVOCs, 11 pesticides, and 17 inorganics. Maximum concentrations of total petroleum hydrocarbons (TPH), Dieldrin, Endrin, aluminum, chromium, iron, manganese, and vanadium exceed the screening values. However, risks to the terrestrial environment

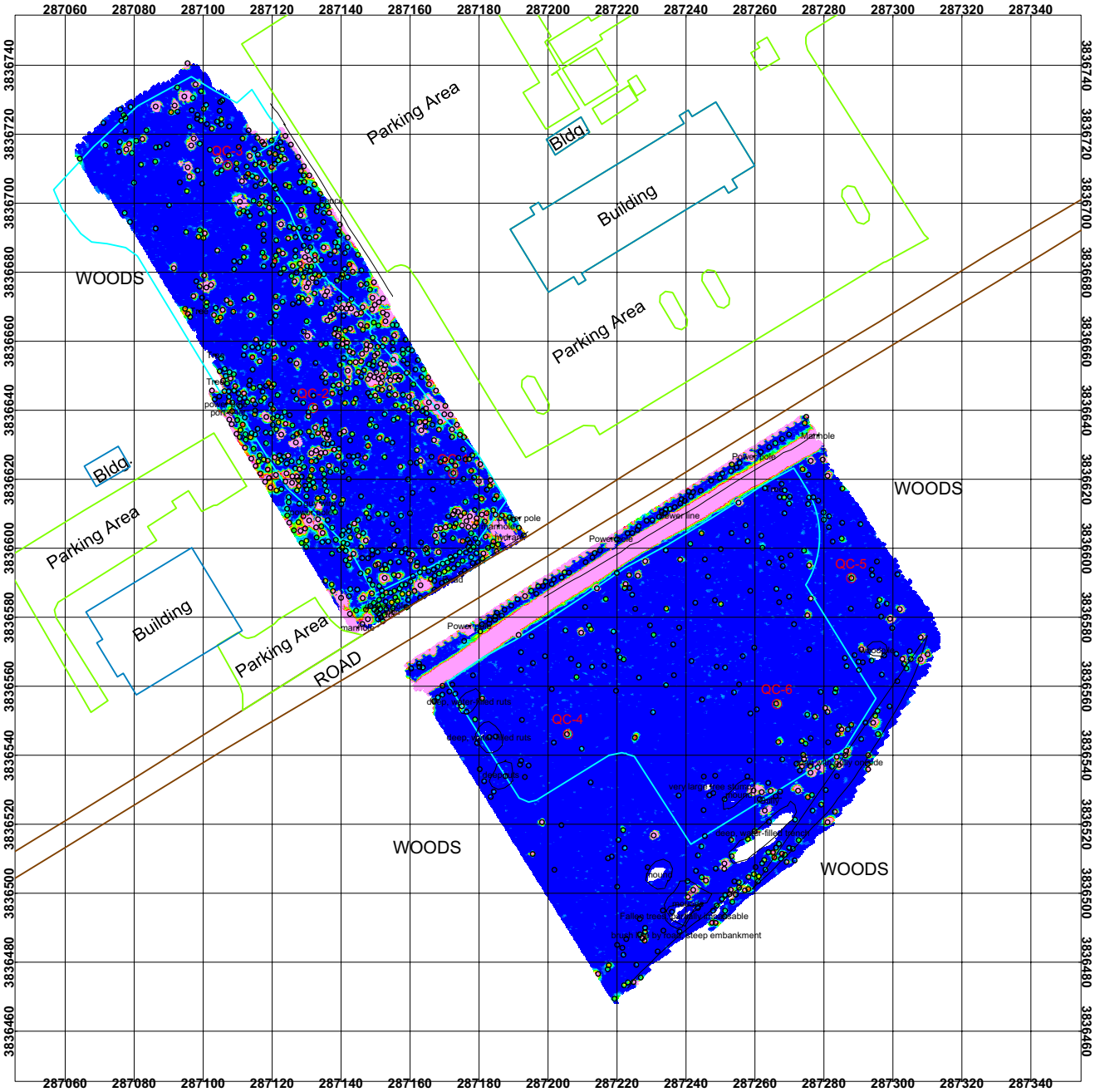
associated with these constituents are likely minimal. Most concentrations are less than background, are well below a host of other screening values, or are not toxic except in extremely alkaline or acidic soil. Thus there is no unacceptable ecological risk in soil at the site.

3.5.2.3 Environmental Screening of Groundwater

Screening of groundwater data for detected constituents suggests that adverse effects to ecological organisms are possible (Table B.6) for some compounds. Detected constituents in groundwater include chloroform, bis(2-ethylhexyl)phthalate, perchlorate, and 20 inorganics. Maximum concentrations of toluene, bis(2-ethylhexyl)phthalate exceed ecological screening values. In filtered groundwater samples, iron, and zinc, exceed the screening values.

However, risks to the aquatic environment associated with these constituents are uncertain. Aquatic organisms are not directly exposed to groundwater, thus concentrations in groundwater do not necessarily reflect concentrations to which aquatic organism would be exposed in the environment, i.e., the risk is overstated. Additionally, for several of the constituents exceeding North Carolina and EPA Region IV screening values, these constituents do not exceed many alternate screening values or National Recommended Ambient Water Quality Criteria.

Total concentrations of chromium, copper, lead, and nickel exceed screening values but the values or for dissolved fractions and the dissolved fractions do not exceed the screening values. In summary, the risk of adverse effects to aquatic receptors posed by exposure to groundwater measured at the UXO-06 MILCON Area is uncertain. In general, either consideration of fate and transport to the receiving water at which exposure to aquatic organisms would be exposed or direct evaluation of the receiving waters would necessary to better understand the likelihood of these risks.



EM61-MK2 Survey

Channel 2

Mosaic

Site UXO-06
Camp Lejeune, NC

LEGEND

○ Anomaly selected from data

QC-1 QC Seed Location and ID

Site Boundary

Additional text on map highlights cultural features observed at site.

mV
CH2

1 2 3 4 5 6 7 8 9 10 12 13 15 16 18 19

Prepared for:

NAVFAC Naval Facilities Engineering Command

Scale 1:455

10 0 10 20 30
meters
NAD83 / UTM zone 18N

Map created by: TLK

Created on: 12/11/2006

CH2MHILL

NAEVA GEOPHYSICS INC.

Figure 3-1

Table 3.1
Concentrations Detected in Soil
Site UXO-06 MILCON Area Focused Site Inspection
MCB Camp Lejeune, Jacksonville, NC

Sample ID	NCSSL May 2005	MR06-IS01-4-5-06D	MR06-IS02-9-10-06D	MR06-IS03-6-8-06D	MR06-IS04-6-10-06D	MR06-IS05-6-8-06D	MR06-IS06-6-7-06D	MR06-IS07-10-12-06D
Sample Date		11/15/06	11/15/06	11/16/06	11/16/06	11/16/06	11/15/06	11/15/06
Chemical Name								
Volatile Organic Compounds (UG/KG)								
2-BUTANONE	17,100	10 U	10 U	11 U	11 U	12 U	11 U	11 U
Semivolatile Organic Compounds (UG/KG)								
BIS(2-ETHYLHEXYL) PHTHALATE	6,670	370 U	390 U	400 U	380 U	390 U	390 U	360 U
DI-N-OCTYL PHTHALATE	10,000,000	370 U	390 U	400 U	380 U	390 U	390 U	360 U
Pesticide/Polychlorinated Biphenyls (UG/KG)								
ALDRIN	--	1.9 U	2 U	2 U	2 U	2 U	2 U	1.8 U
ALPHA-CHLORDANE	--	1.9 U	2 U	2 U	2 U	2 U	2 U	1.8 U
DIELDRIN	1.13	3.7 U	3.9 U	4 U	3.8 U	3.9 U	3.9 U	3.6 U
ENDOSULFAN I	--	1.9 U	2 U	2 U	2 U	2 U	2 U	1.8 U
ENDOSULFAN II	--	3.7 U	3.9 U	4 U	3.8 U	3.9 U	3.9 U	3.6 U
ENDOSULFAN SULFATE	--	3.7 U	3.9 U	4 U	3.8 U	3.9 U	3.9 U	3.6 U
ENDRIN	440	3.7 U	3.9 U	4 U	3.8 U	3.9 U	3.9 U	3.6 U
ENDRIN ALDEHYDE	--	3.7 U	3.9 U	4 U	3.8 U	3.9 U	3.9 U	3.6 U
ENDRIN KETONE	--	3.7 U	3.9 U	4 U	3.8 U	3.9 U	3.9 U	3.6 U
GAMMA-CHLORDANE	--	1.9 U	2 U	2 U	2 U	2 U	2 U	1.8 U
METHOXCHLOR	56,100	19 U	20 U	20 U	20 U	20 U	20 U	18 U
Explosives (MG/KG)								
No Detections								
Total Metals (MG/KG)								
ALUMINUM	--	5,370	7,850	9,410	9,050	8,970	5,560	4,040
ARSENIC	5.24	1.1 U	2.1	1.1 J	1.9	1.1 U	4.7	1.1 U
BARIUM	848	12.1 J	11.9 J	20.5	19.9	12.9	10.6 J	7.4 J
BERYLLIUM	3.38	0.023 J	0.034 J	0.6 U	0.57 U	0.57 U	0.014 J	0.54 U
CALCIUM	--	557 U	593 U	136	122	572 U	595 U	536 U
CHROMIUM	27.2	5.7	10.7	14	13.5	10.1	8.2	5.8
COPPER	704	2.8 U	3 U	0.88	1.2	0.88	3 U	2.7 U
IRON	151	2,350	3,140	8,660	3,960	1,520	4,900	1,710
LEAD	270	3.3	4.5	5.2	5.2	4.5	3.9	2.7
MAGNESIUM	--	557 U	593 U	413	408	198	595 U	536 U
MANGANESE	65.2	4.9 J	3.3 J	3.6	4	3.3	1.8 J	3.6 J
NICKEL	56.4	1.2 J	1.1 J	1.2	1.4	1	0.73 J	1 J
POTASSIUM	--	557 U	593 U	326	398	359	595 U	536 U
SELENIUM	12.2	3.9 U	4.2 U	4.2 U	4 U	4 U	0.31 J	3.8 U
SODIUM	--	557 U	593 U	61	73.3	572 U	595 U	536 U
VANADIUM	--	7.8	17.3	21.3	18.9	10.6	12.5	6
ZINC	550	1.9 J	2.5 J	3.7	3.6	2.5	1.9 J	1.4 J
Wet Chemistry								
% SOLIDS	--	89	84.4	83.9	84.1	81.7	83.1	89.7
TOC (MG/KG)	--	3,970	3,210	5,750	4,770	1,730	2,190	5,480
TPH (MG/KG)	--	30	31.9	74.3	76.4	35.7	69.2	71.5

Notes:
NCSSL - North Carolina Soil Screening Level
U- Analyte not detected
J- Reported value is estimated
Shading represents detection

Table 3.1 (continuted)
Concentrations Detected in Soil
Site UXO-06 MILCON Area Focused Site Inspection
MCB Camp Lejeune, Jacksonville, NC

Sample ID	**NCSSL May 2005**	MR06-IS08-11-12-06D	MR06-IS09-8-12-06D	MR06-IS10-9-10-06D	MR06-SS01-0-1-06D	MR06-SS02-0-1-06D	MR06-SS03-0-1-06D	MR06-SS04-0-1-06D
Sample Date		11/15/06	11/15/06	11/16/06	11/14/06	11/14/06	11/14/06	11/14/06
Chemical Name								
Volatile Organic Compounds (UG/KG)								
2-BUTANONE	17,100	13 U	11 U	11 U	11 U	9	11 U	14 U
Semivolatile Organic Compounds (UG/KG)								
BIS(2-ETHYLHEXYL) PHTHALATE	6,670	350 U	90 J	350 U	400 U	380 U	420 U	430 U
DI-N-OCTYL PHTHALATE	10,000,000	350 U	87 J	350 U	400 U	380 U	420 U	430 U
Pesticide/Polychlorinated Biphenyls (UG/KG)								
ALDRIN	--	1.8 U	1.8 U	1.8 U	2 U	1.9 U	2.2 U	2.2 U
ALPHA-CHLORDANE	--	1.8 U	1.8 U	1.8 U	2 U	1.9 U	2.2 U	0.72 J
DIELDRIN	1.13	3.5 U	3.6 U	3.5 U	0.94 J	3.8 U	4.2 U	4.3 U
ENDOSULFAN I	--	1.8 U	1.8 U	1.8 U	2 U	1.9 U	2.2 U	2.2 U
ENDOSULFAN II	--	3.5 U	3.6 U	3.5 U	4 U	3.8 U	4.2 U	4.3 U
ENDOSULFAN SULFATE	--	3.5 U	3.6 U	3.5 U	4 U	3.8 U	4.2 U	4.3 U
ENDRIN	440	3.5 U	3.6 U	3.5 U	4 U	3.8 U	4.2 U	4.3 U
ENDRIN ALDEHYDE	--	3.5 U	3.6 U	3.5 U	4 U	3.8 U	4.2 U	4.3 U
ENDRIN KETONE	--	3.5 U	3.6 U	3.5 U	4 U	3.8 U	4.2 U	0.93 J
GAMMA-CHLORDANE	--	1.8 U	1.8 U	1.8 U	2 U	0.66 J	2.2 U	0.67 J
METHOXCHLOR	56,100	18 U	18 U	18 U	20 U	19 U	22 U	22 U
Explosives (MG/KG)								
No Detections								
Total Metals (MG/KG)								
ALUMINUM	--	2,070	1,340	2,300	8,620	4,240	3,220	3,570
ARSENIC	5.24	1.1 U	1.1 U	1 U	0.94 J	1.1 U	1.3 U	1.3 U
BARIUM	848	3 J	2.1 J	4	17.6 J	11.5 J	5.9 J	8.4 J
BERYLLIUM	3.38	0.53 U	0.54 U	0.5 U	0.036 J	0.014 J	0.63 U	0.64 U
CALCIUM	--	528 U	539 U	500 U	574 U	562 U	630 U	636 U
CHROMIUM	27.2	2.9	2.1	2.9	10.4	3.6	3.7	4.9
COPPER	704	2.6 U	2.7 U	0.41	2.9 U	2.8 U	3.1 U	3.2 U
IRON	151	448	234	556	4,740	1,720	1,230	1,440
LEAD	270	1.8	2.2	2.2	4.9	4.4	4	7
MAGNESIUM	--	528 U	539 U	59.9	574 U	562 U	630 U	636 U
MANGANESE	65.2	1.1 J	0.98 J	1.4	10.1 J	7.3 J	6.6 J	27.7 J
NICKEL	56.4	0.29 J	0.26 J	0.35 J	1.7 J	1 J	0.92 J	1.2 J
POTASSIUM	--	528 U	539 U	139	574 U	562 U	630 U	636 U
SELENIUM	12.2	3.7 U	3.8 U	3.5 U	0.37 J	3.9 U	4.4 U	4.5 U
SODIUM	--	528 U	539 U	500 U	574 U	562 U	630 U	636 U
VANADIUM	--	4 J	2.3 J	3	15.1	5.6 J	5.3 J	6.1 J
ZINC	550	1.2 J	0.89 J	0.95	4.3 J	2.7 J	3.6 J	8.1
Wet Chemistry								
% SOLIDS	--	91.5	78.4	95.3	84.2	83.6	80.6	74.4
TOC (MG/KG)	--	2,920	2,300	2,980	12,300	7,620	14,900	24,100
TPH (MG/KG)	--	32.6	33.3	77.5	160	92.8	148	172

Notes:
NCSSL - North Carolina Soil Screening Level
U- Analyte not detected
J- Reported value is estimated
Shading represents detection

Table 3.1 (continuted)
Concentrations Detected in Soil
Site UXO-06 MILCON Area Focused Site Inspection
MCB Camp Lejeune, Jacksonville, NC

Sample ID	**NCSSL May 2005**	MR06-SS05-0-1-06D	MR06-SS06-0-1-06D	MR06-SS07-0-1-06D	MR06-SS08-0-1-06D	MR06-SS09-0-1-06D	MR06-SS10-0-1-06D	MR06-SS10D-0-1-06D
Sample Date		11/14/06	11/14/06	11/14/06	11/14/06	11/14/06	11/14/06	11/14/06
Chemical Name								
Volatile Organic Compounds (UG/KG)								
2-BUTANONE	17,100	15 U	12 U	12 U	15 U	12 U	13 U	14 U
Semivolatile Organic Compounds (UG/KG)								
BIS(2-ETHYLHEXYL) PHTHALATE	6,670	490 U	400 U	380 U	380 U	400 U	370 U	370 U
DI-N-OCTYL PHTHALATE	10,000,000	490 U	400 U	380 U	380 U	93 J	370 U	370 U
Pesticide/Polychlorinated Biphenyls (UG/KG)								
ALDRIN	--	0.85 J	2 U	2 U	2 U	2.1 U	1.9 U	1.9 U
ALPHA-CHLORDANE	--	0.57 J	2 U	0.52 J	0.78 J	0.42 J	0.46 J	0.42 J
DIELDRIN	1.13	4.9 U	4 U	3.8 U	3.8 U	1.8 J	3.7 U	3.7 U
ENDOSULFAN I	--	2.5 U	2 U	2 U	0.52 J	2.1 U	1.9 U	1.9 U
ENDOSULFAN II	--	4.9 U	4 U	3.8 U	3.8 U	2.5 J	3.7 U	3.7 U
ENDOSULFAN SULFATE	--	4.9 U	4 U	3 J	0.87 J	1.1 J	1.9 J	3.7 U
ENDRIN	440	4.9 U	4 U	4.8 J	1.3 J	0.87 J	3.7 U	3.7 U
ENDRIN ALDEHYDE	--	1.9 J	1.1 J	3.8 U	1.5 J	4 U	3.7 U	3.7 U
ENDRIN KETONE	--	4.9 U	4 U	0.96 J	3.8 U	4 U	3.7 U	3.7 U
GAMMA-CHLORDANE	--	0.93 J	0.99 J	2 U	2.2	0.42 J	1.9 U	0.59 J
METHOXCHLOR	56,100	25 U	4.3 J	5 J	20 U	21 U	19 U	19 U
Explosives (MG/KG)								
No Detections								
Total Metals (MG/KG)								
ALUMINUM	--	1,910	765	482	645	1,530	376	341
ARSENIC	5.24	1.5 U	1.2 U	1.2 U	1.1 U	1.2 U	1.1 U	1.1 U
BARIUM	848	21.7 J	4.8 J	5 J	6.2 J	6.7 J	5.7 J	5.5 J
BERYLLIUM	3.38	0.73 U	0.6 U	0.58 U	0.57 U	0.59 U	0.56 U	0.55 U
CALCIUM	--	1,550	602 U	582 U	572 U	588 U	563 U	548 U
CHROMIUM	27.2	2.4	1.1 J	0.95 J	1 J	2	0.76 J	0.76 J
COPPER	704	3.7 U	3 U	2.9 U	2.9 U	2.9 U	2.8 U	2.7 U
IRON	151	935	312	357	959	1,080	360	323
LEAD	270	7.6	3.8	9.9	7.5	6.1	2.7	2.3
MAGNESIUM	--	732 U	602 U	582 U	572 U	588 U	563 U	548 U
MANGANESE	65.2	30.9 J	2.8 J	3.7 J	18.3 J	7 J	2.8 J	3.2 J
NICKEL	56.4	0.84 J	0.18 J	0.18 J	0.24 J	0.51 J	4.5 U	4.4 U
POTASSIUM	--	732 U	602 U	582 U	572 U	588 U	563 U	548 U
SELENIUM	12.2	5.1 U	4.2 U	4.1 U	4 U	4.1 U	3.9 U	3.8 U
SODIUM	--	732 U	602 U	582 U	572 U	588 U	563 U	548 U
VANADIUM	--	4.6 J	2.3 J	2.4 J	2.6 J	3.9 J	1.5 J	1.5 J
ZINC	550	7.8 J	2 J	1.1 J	1.6 J	3 J	1.1 J	0.85 J
Wet Chemistry								
% SOLIDS	--	67.4	80	86.1	86.3	82.3	89.8	90.4
TOC (MG/KG)	--	81,800	12,100	11,400	14,100	13,900	10,300	9,520
TPH (MG/KG)	--	79.4	74.8	95.1	99	105	128	91.3

Notes:
NCSSL - North Carolina Soil Screening Level
U- Analyte not detected
J- Reported value is estimated
Shading represents detection

Table 3-2.
Concentrations Detected in Groundwater
Site UXO-06 MILCON Area Focused Site Inspection
MCB Camp Lejeune, Jacksonville, NC

Sample ID	**NC2LGW May 2005**	MR06-GW-IS01-15-19-06D	MR06-GW-IS06-10-14-06D	MR06-GW-IS08-15-19-06D	MR06-GW-IS10-15-19-06D	MR06-GW-IS10-36-40-06D	MR06-GW-IS10D-15-19-06D
Sample Date		11/15/06	11/15/06	11/15/06	11/16/06	11/16/06	11/16/06
Chemical Name							
Volatile Organic Compounds (UG/L)							
CHLOROFORM	70	10 U	65	37	22	13	19
Semivolatile Organic Compounds (UG/L)							
BIS(2-ETHYLHEXYL) PHTHALATE	2.5	10 U	13	10 U	10 U	10 U	10 U
Pesticide/Polychlorinated Biphenyls (UG/L)							
No Detections							
Explosives (UG/L)							
Perchlorates	--	0.13 J	0.2 U	0.07 J	0.2 U	8.7	0.2 U
Total Metals (UG/L)							
ALUMINUM	--	10,300	794	200 U	552	28,200	200 U
ANTIMONY	--	3.7 J	60 U	2.7 J	2.4 J	7.6 J	60 U
ARSENIC	50	5.4 J	10 U	10 U	10 U	19.7	10 U
BARIUM	2,000	50.8 J	38.8 J	46.2 J	200 U	200 U	200 U
BERYLLIUM	--	5 U	5 U	5 U	5 U	14.1	5 U
CALCIUM	--	5000 U	5000 U	5000 U	2,170 J	37,300	2,040 J
CHROMIUM	50	39.5	2.7 J	10 U	6.4 J	461	10 U
COPPER	1,000	9.2 J	25 U	25 U	25 U	93.2	25 U
IRON	300	10,900	2,510	2,580	2,340	110,000	997
LEAD	15	4.3 J	10 U	10 U	10 U	23.3	10 U
MAGNESIUM	--	5000 U	5000 U	5000 U	5000 U	7,300	5000 U
MANGANESE	50	66 J	44.1 J	39.1 J	29.9 J	964 J	11.8 J
MERCURY	1.05	0.2 U	0.2 U	0.2 U	0.2 U	0.043 J	0.2 U
NICKEL	100	25.4 J	3.9 J	3.6 J	4.4 J	220	2.4 J
POTASSIUM	--	1,600 J	947 J	2,050 J	1,490 J	5,310	1,400 J
SODIUM	--	7,190	9,340	11,200	17,100	6,090	16,800
VANADIUM	--	18.4 J	1.9 J	0.86 J	1.8 J	117	50 U
ZINC	1,050	231	8.3 J	7.9 J	11.2 J	1,400	5.4 J
Dissolved Metals (UG/L)							
ALUMINUM	--	200 U	200 U	200 U	200 U	90.8 J	30.8 J
BARIUM	2,000	26.1 J	36.8 J	44.6 J	68.6 J	8.6 J	68.8 J
CALCIUM	--	5000 U	5000 U	5000 U	5000 U	7,530	5000 U
CHROMIUM	50	1.2 J	10 U	10 U	10 U	2.2 J	10 U
IRON	300	2,770	3,060	2,200	536	961	870
MANGANESE	50	28.6	66.3	31.7	6.2 J	118	13 J
NICKEL	100	14.6 J	5.6 J	3.4 J	1.7 J	21.1 J	2.2 J
POTASSIUM	--	675 J	971 J	2,030 J	1,450 J	1,120 J	1,410 J
SODIUM	--	6,970	9,280	10,800	16,000	5,920	15,900
VANADIUM	--	50 U	50 U	50 U	50 U	0.66 J	50 U
ZINC	1,050	148	60 U	60 U	60 B	89.7	60 U
Wet Chemistry (MG/L)							
TOC	--	5 U	5 U	5 U	5 U	1.6 J	5 U
TOTAL ORGANIC HALOGENS	--	30 U	57.2	30 U	30 U	30 U	30 U

Notes:
U- Analyte not detected
J- Reported value is estimated
B- Not detected substatnially above the lever reported in lab or field blanks
Shading represents detection

4.0 Summary and Conclusions

The presence of potential subsurface MEC was evaluated through the use of DGM at the UXO-06 MILCON Area. Approximately 1300 geophysical anomalies were identified as representing potential subsurface MEC. It is not possible to discriminate between MEC and metallic debris through non-intrusive geophysical techniques, so the actual presence of subsurface MEC can be determined only through intrusive investigation that entails the excavation and examination of anomaly sources.

Soil and groundwater at the UXO-06 MILCON Area were sampled and analyzed for a range of constituents. The maximum concentrations of detected constituents were compared to NCSSL for soil samples and to NC2LGW for groundwater samples. Preliminary risk screening for human health and ecological concerns was also conducted on the analytical data.

As shown on **Table 4.1**, these screening efforts determined that nine constituents in soil samples exceeded NCSSL values, human health screening values, and or ecological screening values. As also shown on **Table 4.1**, three constituents in groundwater exceeded NC2LGW values and/or human health screening values. Perchlorate is also shown in **Table 4.1** because its presence may trigger Navy reporting requirements even though no preliminary screening values have been developed for this constituent.

The constituents listed on **Table 4.1** represent only a preliminary evaluation of potential risks to human health and the environment and this table was developed under the following limitations:

- A complete evaluation of analytical data with respect to background data has not been performed; maximum concentrations that exceed preliminary screening values for certain constituents may be within the background range of concentrations for such constituents

- A conceptual model has not been developed to evaluate complete exposure pathways; even though maximum concentrations may exceed preliminary screening values, complete pathways may not exist for all constituents in all media

- Preliminary screening values were not available for all constituents detected in soil and groundwater at the site; these constituents were not evaluated for potential risks posed to human health and the environment

TABLE 4.1. SUMMARY OF PRELIMINARY SCREENING
Site UXO-06 MILCON Area Focused Site Inspection
MCB Camp Lejeune, Jacksonville, NC

Media	Analyte	Exceeded NCSSL (Soil) or NC2LGW (Water)	Potential Human Health COPC	Potential Ecological COPC
Soil	Dieldrin	X		X
	Endrin			X
	Aluminum		X	X
	Arsenic		X	
	Chromium			X
	Iron	X	X	X
	Manganese			X
	Vanadium		X	X
	Total Petroleum Hydrocarbons (TPH)			X
Groundwater	bis(2-Ethylhexyl)phthalate	X		
	Perchlorate[1]			
	Iron (Dissolved) [2]	X	X	
	Manganese (Dissolved) [2]	X	X	

Notes:

1 – Perchlorate did not exceed any screening values but is shown in this list because of reporting requirements (see text for further discussion).
2 – For metals in groundwater, only exceedances of dissolved (filtered) values are included in this table because they are presumed to be more indicative of groundwater quality (see text for further discussion).

5.0 References

Adema, D.M.M., and L. Henzen. 1989. A comparison of plant toxicities of some industrial chemicals in soil culture and soilless culture. Ecotoxicol. Environ. Saf. 18:219-229.

Baker Environmental. *Final Base Background Soil Study Report, Marine Corps Base Camp Lejeune, North Carolina*. April 25, 2001.

Canadian Council of Ministers of the Environment (CCME), 2001. Canadian Soil Quality Guidelines for the Protection of the Environmental and Human Health.

Dutch Ministry of Housing, Spatial Planning and Environment (MHSPE), February 4, 2000. Circular on Target Values and Intervention Values for Soil remediation., Directorate-General for Environmental Protection, Department of Soil Protection, the Hague, The Netherlands.

Efroymson, R., BE Sample, MJ Peterson. 2004. Ecotoxicity test data for total petroleum hydrocarbons in soil: plants and soil-dwelling invertebrates. *Human and Ecological Risk Assessment* 10:207-231.

Efroymson, R., Sample, B.E., Suter, G.W, II, Beauchamp, J.J., Aplin, M.S. and Will, M.E. 1997a. Development and validation of literature-based models for the uptake of chemicals from soil by plants. Oak Ridge National Laboratory. ES/ER/TM-218.

Efroymson, R.A., M.E. Will, and G.W. Suter II, 1997b. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. U.S. Department of Energy, Oak Ridge National Laboratory. ES/ER/TM-126/R2.

Lowder, Bob. "Closed Range List and Maps for Marine Corps Base, Camp Lejeune, NC." Camp Lejeune Environmental Management Division, October 2005.

Mulder J., N. Van Breeman, L. Rasmussen, and C. T. Driscoll. 1989. "Aluminum Chemistry of Acidic Sandy Soils with Various Inputs of Acidic Deposition in the Netherlands and Denmark." Chapter 10 in T. E. Lewis (ed.) *Environmental Chemistry and Toxicology of Aluminum*. Lewis Publishers, pp. 171-194.

NAVFAC. NAVFAC Drawing No. 4558252: "P-1042 IIMEF Armories, Demolition Plan, French Creek." Naval Facilities Engineering Command, Naval Station – Norfolk, VA. August 2004.

Phillips, C.T., R.T. Checkai, and R.S. Wentsel. 1993. Toxicity of Selected Munitions and Munition-Contaminated Soil on the Earthworm (*Eisenia Foetida*). Edgewoof Research, Development and Engineering Center, Aberdeen Proving Ground, MD.

Thiboutot, S.; Ampleman, G.; Hewitt, A.D. February 2002. Technical Report ERDC/CRREL TR-02-1, "Guide for Characterization of Sites Contaminated with Energetic Materials." US Army Corps of Engineers, Engineer Research and Development Center.

USEPA, 1995. Revised Region III BTAG Screening Levels. August 9, 1995.

USEPA, 2003. *Ecological Soil Screening Level for Aluminum Interim Final*. OSWER Directive 9285.7-60. November.

USEPA, 2005. Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs), OSWER Directive 9285.7-55, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Issued November 2003, Revised February 2005.

USEPA. Region 9 Preliminary Remediation Goals Table. http://www.epa.gov/region09/waste/sfund/prg/index.html#prgtable. October 2004.

Attachment A – Soil Borings Logs

PROJECT NUMBER	BORING NUMBER	
330966	IS-01	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : MRP-UXO-06 LOCATION : Camp Lejeune, NC

ELEVATION : DRILLING CONTRACTOR : Probe Technology, Inc.

DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology (6610DT Geoprobe)

WATER LEVELS : START : 11/15/2006 END : 11/15/2006 LOGGER : Jonathan Burton / CLT

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. FID (ppm) PID (ppm):
					Light brown clayey sand (**SC**), low plasticity	0 - 1 ft bgs
					Light gray poorly graded sand (**SP**)	1 - 4 ft bgs
5						
10					Yellowish orange very fine sand (**SW**)	6 - 10 ft bgs
						Water Table at approx. 10.5 ft PID same as background (0.2 - 0.3 ppm) throughout soil column
15						
20						
25						

Legend

PID - Photo-ionization detector

FID - Flame-ionization detector T - Time

PROJECT NUMBER	BORING NUMBER	
330966	IS-02	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : MRP-UXO-06 LOCATION : Camp Lejeune, NC

ELEVATION : DRILLING CONTRACTOR : Probe Technology, Inc.

DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology (6610DT Geoprobe)

WATER LEVELS : START : 11/15/2006 END : 11/15/2006 LOGGER : Jonathan Burton / CLT

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. FID (ppm) PID (ppm):
					Light brown clay (**CL**), w/ fines, medium plasticity	0 - 3.5 ft bgs
5						
10					Yellowish orange silty sand (**SM**)	3.5 - 10 ft bgs
					Light brown clay sand (**SC**)	10 - 12.5 ft bgs
15						Water table at approx. 12.5 ft PID same as background (0.2 - 0.3 ppm) throughout soil column
20						
25						

Legend

PID - Photo-ionization detector

FID - Flame-ionization detector T - Time

PROJECT NUMBER	BORING NUMBER	
330966	IS-03	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : MRP-UXO-06 LOCATION : Camp Lejeune, NC

ELEVATION : DRILLING CONTRACTOR : Probe Technology, Inc.

DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology (6610DT Geoprobe)

WATER LEVELS : START : 11/16/2006 END : 11/16/2006 LOGGER : David Seed / RDU

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. FID (ppm)	PID (ppm):
					Light brown clay (**CL**)	0 - 3 ft bgs	
5					Light brown silt (**ML**)	5 - 6.5 ft bgs	
10					Yellow orange silt (**ML**)	6.5 - 10 ft bg	0.0 ppm
					Yellow orange fine sand (**SM**)	10 - 13 ft bgs	0.0 ppm
15						Water table at approx. 13 ft.	
20							
25							

Legend

PID - Photo-ionization detector

FID - Flame-ionization detector T - Time

PROJECT NUMBER	BORING NUMBER	
330966	IS-04	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : MRP-UXO-06 LOCATION : Camp Lejeune, NC

ELEVATION : DRILLING CONTRACTOR : Probe Technology, Inc.

DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology (6610DT Geoprobe)

WATER LEVELS : START : 11/16/2006 END : 11/16/2006 LOGGER : David Seed / RDU

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. FID (ppm)	PID (ppm):
					Dark brown silt (**ML**)	0 - 0.5 ft bgs	
					Light brown silt (**ML**)	0.5 - 3 ft	
5					Light brown sand (**SM**)	3 - 5 ft bgs	0.0 ppm
					Yellowish orange clay (**CL**)	5 - 7 ft bgs	
10					Light brown clay (**CL**)	7 - 10 ft bgs	0.0 ppm
					Yellowish orange fine sand (**SM**)	10 - 11 ft bgs	
						Water table at approx. 11 ft	
15							
20							
25							

Legend

PID - Photo-ionization detector

FID - Flame-ionization detector T - Time

PROJECT NUMBER	BORING NUMBER	
330966	IS-05	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : MRP-UXO-06 LOCATION : Camp Lejeune, NC

ELEVATION : DRILLING CONTRACTOR : Probe Technology, Inc.

DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology (6610DT Geoprobe)

WATER LEVELS : START : 11/16/2006 END : 11/16/2006 LOGGER : David Seed / RDU

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. FID (ppm) PID (ppm):
5					Light brown clay (**CL**)	0 - 6.5 ft bgs
10					Yellowish orange and light grey fine sands (**SM**), mottled	6.5 - 10 ft bgs 0.0 ppm
15					Light grey fine sand (**SM**)	Water table at approx. 10.5 ft 10 - 15 ft bgs 0.0 ppm
20						
25						

Legend

PID - Photo-ionization detector

FID - Flame-ionization detector T - Time

PROJECT NUMBER	BORING NUMBER	
330966	IS-06	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : MRP-UXO-06 LOCATION : Camp Lejeune, NC

ELEVATION : DRILLING CONTRACTOR : Probe Technology, Inc.

DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology (6610DT Geoprobe)

WATER LEVELS : START : 11/15/2006 END : 11/15/2006 LOGGER : Jonathan Burton / CLT

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. FID (ppm) PID (ppm):
					Light grey silty sand (**SM**)	1 - 3 ft bgs
5					Greenish grey silty sand (**SM**)	3 - 5 ft bgs
					Yellowish orange very fine sand (**SW**)	5 - 7 ft bgs
10						Water table at approx. 7.5 to 8 ft PID same as background (0.2 - 0.3 ppm) throughout soil column
15						
20						
25						

Legend

PID - Photo-ionization detector

FID - Flame-ionization detector T - Time

PROJECT NUMBER	BORING NUMBER	
330966	IS-07	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : MRP-UXO-06 LOCATION : Camp Lejeune, NC

ELEVATION : DRILLING CONTRACTOR : Probe Technology, Inc.

DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology (6610DT Geoprobe)

WATER LEVELS : START : 11/15/2006 END : 11/15/2006 LOGGER : Jonathan Burton / CLT

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. FID (ppm) PID (ppm):
					Light grey fine sand (**SW**)	0 - 1.5 ft bgs
5					Yellowish orange silty sand (**ML**)	1.5 - 8 ft bgs
10					Light grey fine sand (**SW**), slightly moist	8 - 10 ft bgs
					Yellowish orange poorly graded sand (**SP**), some fines	10 - 11 ft bgs
15						Water tabel is at approx. 13 ft PID same as background (0.2 - 0.3 ppm) throughout soil column
20						
25						

Legend

PID - Photo-ionization detector

FID - Flame-ionization detector T - Time

PROJECT NUMBER	BORING NUMBER	
330966	IS-08	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : MRP-UXO-06 LOCATION : Camp Lejeune, NC

ELEVATION : DRILLING CONTRACTOR : Probe Technology, Inc.

DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology (6610DT Geoprobe)

WATER LEVELS : START : 11/15/2006 END : 11/15/2006 LOGGER : Jonathan Burton / CLT

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. FID (ppm) PID (ppm):
5					Light brown silty sand (**SM**)	0.5 - 8 ft bgs
10					Light grey well graded sand (**SW**), little fines	8 - 14 ft
15						Water table at approx. 14 ft PID same as background (0.2 - 0.3 ppm) throughout soil column
20						
25						

Legend

PID - Photo-ionization detector

FID - Flame-ionization detector T - Time

PROJECT NUMBER	BORING NUMBER	
330966	IS-09	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : MRP-UXO-06 LOCATION : Camp Lejeune, NC

ELEVATION : DRILLING CONTRACTOR : Probe Technology, Inc.

DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology (6610DT Geoprobe)

WATER LEVELS : START : 11/15/2006 END : 11/15/2006 LOGGER : David Seed / RDU

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.	FID (ppm)	PID (ppm):
5					Light brown clay (**CL**)	0 - 5 ft bgs		1.0
10					Yellowish orange clayey sand (**SC**)	5 - 11 ft bgs		
					Light grey silty sand (**SM**)	11 - 13 ft bgs		
15					Greenish grey silty sand (**SM**)	13 - 15 ft bgs		1.0
20								
25								

Legend

PID - Photo-ionization detector

FID - Flame-ionization detector T - Time

PROJECT NUMBER	BORING NUMBER	
330966	IS-10	SHEET 1 OF 1

SOIL BORING LOG

PROJECT : MRP-UXO-06 LOCATION : Camp Lejeune, NC

ELEVATION : DRILLING CONTRACTOR : Probe Technology, Inc.

DRILLING METHOD AND EQUIPMENT USED : Direct Push Technology (6610DT Geoprobe)

WATER LEVELS : START : 11/16/2006 END : 11/16/2006 LOGGER : Jonathan Burton / CLT

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION. FID (ppm) PID (ppm):
5					Yellowish orange clay (**CL**), medium plasticity, some silt, little sands	0.5 - 5 ft bgs
					Yellowish orange clayey sand (**SC**)	6 - 8 ft bgs
10					Light grey fine sand (**SP**), trace fines	8 - 12 ft bgs
15					Yellowish orange clayey sand (**SC**)	Water table at approx. 14 ft PID same as background (0.2 - 0.3 ppm) throughout soil column 15 - 17 ft bgs
20					Light grey fine sand (**SP**), little fines	17 - 20 ft bgs
					Light grey fine sand (**SP**)	20 - 24 ft bgs
25					Reddish orange silty sand (**SM**), contains shell fragments	24 - 25 ft bgs
					no recovery	25 - 28 ft bgs boring terminated

Legend

PID - Photo-ionization detector

FID - Flame-ionization detector T - Time

Attachment B – Preliminary Risk Screening Tables

TABLE B.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
UXO-06 MILCON Area Focused Site Inspection
Camp Lejeune, Jacksonville, NC

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Soil*	**VOCs**														
	78-93-3	2-BUTANONE	9.0E-03	9.0E-03	mg/kg	MR06-SS02-0-1-06D	1/21	0.01 - 0.015	9.0E-03	NA	2.2E+03 nc	17.1	NCSSL	NO	BSL
	67-64-1	ACETONE	4.0E-03 J	1.1E-01	mg/kg	MR06-SS03-0-1-06D	6/21	0.01 - 0.015	1.1E-01	NA	1.4E+03 nc	2.8E+00	NCSSL	NO	BSL
	75-09-2	METHYLENE CHLORIDE	3.0E-03 J	5.0E-03 J	mg/kg	MR06-IS07-10-12-06D	6/21	0.01 - 0.015	5.0E-03	NA	9.1E+00 ca	2.0E-02	NCSSL	NO	BSL
	SVOCs														
	98-86-2	ACETOPHENONE	8.2E-02 J	8.2E-02 J	mg/kg	MR06-SS10D-0-1-06D	1 / 21	0.35 - 0.49	8.2E-02	NA	7.8E+02 nc	NA		NO	BSL
	117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	9.0E-02 J	9.0E-02 J	mg/kg	MR06-IS09-8-12-06D	1 / 21	0.35 - 0.49	9.0E-02	NA	3.5E+01 ca*	6.67	NCSSL	NO	BSL
	117-84-0	DI-N-OCTYL PHTHLATE	8.7E-02 J	9.3E-02 J	mg/kg	MR06-SS09-0-1-06D	2 / 21	0.35 - 0.49	9.3E-02	NA	2.4E+03 nc	1.0E+04	NCSSL	NO	BSL
	Pesticides/PCBs														
	309-00-2	ALDRIN	8.5E-04 JP	8.5E-04 JP	mg/kg	MR06-SS05-0-1-06D	1 / 21	0.0018 - 0.0022	8.5E-04	NA	2.9E-02 ca*	NA		NO	BSL
	5103-71-9	ALPHA-CHLORDANE	4.2E-04 JP	7.8E-04 JP	mg/kg	MR06-SS08-0-1-06D	7 / 21	0.0018 - 0.0022	7.8E-04	NA	1.6E+00 ca*	NA		NO	BSL
	60-57-1	DIELDRIN	9.4E-04 JP	1.8E-03 J	mg/kg	MR06-SS09-0-1-06D	2 / 21	0.0035 - 0.0049	1.8E-03	NA	3.0E-02 ca*	1.1E-03	NCSSL	NO	BSL
	959-98-8	ENDOSULFAN I	5.2E-04 JP	5.2E-04 JP	mg/kg	MR06-SS08-0-1-06D	1 / 21	0.0018 - 0.0022	5.2E-04	NA	3.7E+01 nc	NA		NO	BSL
	33213-65-9	ENDOSULFAN II	2.5E-03 JP	2.5E-03 JP	mg/kg	MR06-SS09-0-1-06D	1 / 21	0.0035 - 0.0049	2.5E-03	NA	3.7E+01 nc	NA		NO	BSL
	1031-07-8	ENDOSULFAN SULFATE	8.7E-04 JP	3.0E-03 J	mg/kg	MR06-SS07-0-1-06D	4 / 21	0.0035 - 0.0049	3.0E-03	NA	3.7E+01 nc	NA		NO	BSL
	72-20-8	ENDRIN	8.7E-04 JP	4.8E-03 P	mg/kg	MR06-SS07-0-1-06D	3 / 21	0.0035 - 0.0049	4.8E-03	NA	1.8E+00 nc	4.4E-01	NCSSL	NO	BSL
	7421-93-4	ENDRIN ALDEHYDE	1.1E-03 J	1.9E-03 J	mg/kg	MR06-SS05-0-1-06D	3 / 21	0.0035 - 0.0049	1.9E-03	NA	1.8E+00 nc	NA		NO	BSL
		ENDRIN KETONE	9.3E-04 JP	9.6E-04 JP	mg/kg	MR06-SS07-0-1-06D	2 / 21	0.0035 - 0.0049	9.6E-04	NA	1.8E+00 nc	NA		NO	BSL
		GAMMA-CHLORDANE	5.9E-04 J	2.2E-03	mg/kg	MR06-SS08-0-1-06D	7 / 21	0.0018 - 0.0022	2.2E-03	NA	1.6E+00 ca*	NA		NO	BSL
	72-43-5	METHOXCHLOR	4.3E-03 JP	5.0E-03 JP	mg/kg	MR06-SS07-0-1-06D	2 / 21	0.018 - 0.022	5.0E-03	NA	3.1E+01 nc	5.6E+01	NCSSL	NO	BSL
	Inorganics														
	7429-90-5	ALUMINUM	3.4E+02	9.4E+03	mg/kg	MR06-IS03-6-8-06D	21 / 21	NA	9.4E+03	5.5E+03	7.6E+03 nc	NA		YES	ASL
	7440-36-0	ANTIMONY	2.7E-01 JN	6.1E-01 J	mg/kg	MR06-IS03-6-8-06D	19 / 21	NA	6.1E-01	3.6E-01	3.1E+00 nc	5.4E+00	NCSSL	NO	BSL
	7440-38-2	ARSENIC	1.1E+00	4.7E+00	mg/kg	MR06-IS06-6-7-06D	5 / 21	NA	4.7E+00	6.3E-01	3.9E-01 ca*	5.2E+00	NCSSL	YES	ASL
	7440-39-3	BARIUM	2.1E+00 J	2.2E+01 J	mg/kg	MR06-SS05-0-1-06D	21 / 21	NA	2.2E+01	1.4E+01	1.5E+03 nc	8.5E+02	NCSSL	NO	BSL
	7440-41-7	BERYLLIUM	1.4E-02 J	5.0E-02 J	mg/kg	MR06-IS04-6-10-06D	8 / 21	NA	5.0E-02	1.0E-01	1.5E+01 nc	3.4E+00	NCSSL	NO	BSL
	7440-70-2	CALCIUM	1.7E+01 J	1.6E+03	mg/kg	MR06-SS05-0-1-06D	21 / 21	NA	1.6E+03	4.4E+02	NA	NA		NO	NUT
	7440-47-3	CHROMIUM	7.6E-01 J	1.4E+01	mg/kg	MR06-IS03-6-8-06D	21 / 21	NA	1.4E+01	6.1E+00	2.2E+01 ca**	2.7E+01	NCSSL	NO	BSL
	7440-48-4	COBALT	9.6E-02 J	9.6E-02 J	mg/kg	MR06-IS04-6-10-06D	1 / 21	NA	9.6E-02	2.9E-01	1.4E+02 ca**	NA		NO	BSL
	7440-50-8	COPPER	3.6E-01 J	2.9E+00 J	mg/kg	MR06-SS05-0-1-06D	21 / 21	NA	2.9E+00	2.6E+00	3.1E+02 nc	7.0E+02	NCSSL	NO	BSL
	7439-89-6	IRON	2.3E+02	8.7E+03	mg/kg	MR06-IS03-6-8-06D	21 / 21	NA	8.7E+03	3.2E+03	2.3E+03 nc	1.5E+02	NCSSL	YES	ASL
	7439-92-1	LEAD	1.8E+00	9.9E+00	mg/kg	MR06-SS07-0-1-06D	21 / 21	NA	9.9E+00	8.5E+00	4.0E+02 nc	270	NCSSL	NO	BSL
	7439-95-4	MAGNESIUM	2.5E+01 J	4.1E+02	mg/kg	MR06-IS03-6-8-06D	21 / 21	NA	4.1E+02	2.4E+02	NA	NA		NO	NUT
	7439-96-5	MANGANESE	9.8E-01 J	3.1E+01 E	mg/kg	MR06-SS05-0-1-06D	21 / 21	NA	3.1E+01	9.2E+00	1.8E+02 nc	65.2	NCSSL	NO	BSL
	7440-02-0	NICKEL	1.8E-01 J	1.7E+00 J	mg/kg	MR06-SS01-0-1-06D	19 / 21	NA	1.7E+00	1.2E+00	1.6E+02 nc	56.4	NCSSL	NO	BSL
	2023-69-5	POTASSIUM	3.9E+01 J	4.0E+02	mg/kg	MR06-IS04-6-10-06D	21 / 21	NA	4.0E+02	1.2E+02	NA	NA		NO	NUT
	7782-49-2	SELENIUM	3.1E-01 J	3.7E-01 J	mg/kg	MR06-SS01-0-1-06D	2 / 21	NA	3.7E-01	5.0E-01	3.9E+02 nc	1.2E+01	NCSSL	NO	BSL
	7440-23-5	SODIUM	3.8E+01 J	7.4E+01 J	mg/kg	MR06-SS05-0-1-06D	21 / 21	NA	7.4E+01	6.8E+01	NA	NA		NO	NUT
	7440-62-2	VANADIUM	1.5E+00 J	2.1E+01	mg/kg	MR06-IS03-6-8-06D	21 / 21	NA	2.1E+01	8.9E+00	7.8E+00 nc	NA		YES	ASL
	1314-84-7	ZINC	8.5E-01 J	8.1E+00	mg/kg	MR06-SS04-0-1-06D	21 / 21	NA	8.1E+00	6.6E+00	2.3E+03 nc	5.5E+02	NCSSL	NO	BSL

TABLE B.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
UXO-06 MILCON Area Focused Site Inspection
Camp Lejeune, Jacksonville, NC

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection

*soil = combined surface and subsurface soil

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values are the lower of two times the arithmetic mean basewide background surface soil or subsurface soil concentrations.
Background values are from *Final Base Background Soil Study Report, Marine Corps Base Camp Lejeune, North Carolina* , Baker Environmental, April 25, 2001.

[4] EPA Region 9 PRGs Table, Residential Soil, October, 2004, U.S. EPA Region 9 (based on 10^{-6} for carcinogens and HQ of 0.1 for noncarcinogens).
PRGs were updated if updated toxicity values were available.
PRG value for chlordane is used as surrogate for alpha and gamma chlordane.
PRG value for endosulfan is used as surrogate for endosulfan I, endosulfan II, and endosulfan sulfate.
PRG value for endrin is used as surrogate for endrin aldehyde and endrin ketone.

[5] Rationale Codes
Selection Reason: Above Screening Levels (ASL)
Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
E = Concentration exceeded calibration range, sample was then diluted
P = Difference between the consentration on the two columns is greater than 20%
N = Spiked sample recovery was not within the control limits
ca = Carcinogenic
nc = Noncarcinogenic
ca* = Carcinogenic, where: nc < 100 X ca
ca**= Carcinogenic, where: nc < 10 X ca, therefore, nc PRG used
SSL = Soil Screening Level, Migration to Groundwater, DAF of 20, EPA Region 9 PRG Table

TABLE B.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
UXO-06 MILCON Area Focused Site Inspection
Camp Lejeune, Jacksonville, NC

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Tap Water	**VOCs**														
	67-66-3	CHLOROFORM	3.7E+01	6.5E+01	ug/L	MR06-GW-IS06-10-14-06D	2 / 6	10	6.5E+01	NA	1.7E-01 ca	7.0E+01	15A NCAC 2L	YES	ASL
	75-09-2	METHYLENE CHLORIDE	4.0E+00 J	4.0E+00 J	ug/L	MR06-GW-IS01-15-19-06D	3 / 6	10	4.0E+00	NA	4.3E+00 ca	5.0E+00	MCL	NO	BSL
												4.6E+00	15A NCAC 2L		
	108-88-3	TOLUENE	8.0E-01 J	8.0E-01 J	ug/L	MR06-GW-IS06-10-14-06D	1 / 6	10	8.0E-01	NA	7.2E+01 nc	1.0E+03	MCL, 15A NCAC 2L	NO	BSL
	SVOCs														
	117-81-7	bis(2-ETHYLHEXYL) PHTHALATE	1.3E+01 J	1.3E+01	ug/L	MR06-GW-IS06-10-14-06D	1 / 6	10	1.3E+01	NA	4.8E+00 ca	6.0E+00	MCL	YES	ASL
												2.5E+00	15A NCAC 2L		
	Exposives														
	7601-90-3	PERCHLORATE	7.0E-02 J	8.7E+00	ug/L	MR06-GW-IS10-36-40-06D (DL)	3 / 3	NA	8.7E+00	NA	2.6E+01 nc	NA		NO	BSL
	Inorganics (total)														
	7429-90-5	ALUMINUM	1.2E+02 J	2.8E+04	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	2.8E+04	1.9E+03	3.6E+03 nc	NA		YES	ASL
	7440-36-0	ANTIMONY	2.4E+00 J	7.6E+00 J	ug/L	MR06-GW-IS10-36-40-06D	4 / 6	60	7.6E+00	3.3E+00	1.5E+00 nc	6.0E+00	MCL	YES	ASL
	7440-38-2	ARSENIC	5.4E+00 J	2.0E+01	ug/L	MR06-GW-IS10-36-40-06D	2 / 6	10	2.0E+01	5.8E+00	4.5E-02 ca	1.0E+01	MCL	YES	ASL
												5.0E+01	15A NCAC 2L		
	7440-39-3	BARIUM	3.9E+01 J	1.7E+02 J	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	1.7E+02	8.6E+01	2.6E+02 nc	2.0E+03	MCL, 15A NCAC 2L	NO	BSL
	7440-41-7	BERYLLIUM	1.4E+01	1.4E+01	ug/L	MR06-GW-IS10-36-40-06D	1 / 6	5	1.4E+01	3.1E-01	7.3E+00 nc	4.0E+00	MCL	YES	ASL
	7440-43-9	CADMIUM	4.0E-01 J	8.9E-01 J	ug/L	MR06-GW-IS08-15-19-06D	3 / 6	5	8.9E-01	3.6E-01	1.8E+00 nc	5.0E+00	MCL	NO	BSL
												1.8E+00	15A NCAC 2L		
	7440-70-2	CALCIUM	1.2E+03 J	3.7E+04	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	3.7E+04	6.9E+04	NA	NA		NO	NUT
	7440-47-3	CHROMIUM	1.4E+00 J	4.6E+02	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	4.6E+02	3.1E+00	1.1E+01 nc	1.0E+02	MCL	YES	ASL
												5.0E+01	15A NCAC 2L		
	7440-48-4	COBALT	2.1E+00 J	2.6E+01 J	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	2.6E+01	3.4E+00	7.3E+01 nc	NA		NO	BSL
	7440-50-8	COPPER	9.2E+00 J	9.3E+01	ug/L	MR06-GW-IS10-36-40-06D	2 / 6	25	9.3E+01	2.8E+00	1.5E+02 nc	1.3E+03	MCL	NO	BSL
												1.0E+03	15A NCAC 2L		
	7439-89-6	IRON	1.0E+03	1.1E+05	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	1.1E+05	6.0E+03	1.1E+03 nc	3.0E+02	15A NCAC 2L	YES	ASL
	7439-92-1	LEAD	4.3E+00 J	2.3E+01	ug/L	MR06-GW-IS10-36-40-06D	2 / 6	10	2.3E+01	2.8E+00	1.5E+01	1.5E+01	MCL, 15A NCAC 2L	YES	ASL
	7439-95-4	MAGNESIUM	1.6E+03 J	7.3E+03	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	7.3E+03	6.4E+03	NA	NA		NO	NUT
	7439-96-5	MANGANESE	1.2E+01 JE	9.6E+02 E	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	9.6E+02	2.1E+02	8.8E+01 nc	5.0E+01	15A NCAC 2L	YES	ASL
	22967-92-6	MERCURY	4.3E-02 J	4.3E-02 J	ug/L	MR06-GW-IS10-36-40-06D	1 / 6	0.2	4.3E-02	1.0E-01	3.6E-01 nc	2.0E+00	MCL	NO	BSL
												1.1E+00	15A NCAC 2L		
	7440-02-0	NICKEL	2.4E+00 J	2.2E+02	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	2.2E+02	8.0E+00	7.3E+01 nc	1.0E+02	15A NCAC 2L	YES	ASL
	2023-69-5	POTASSIUM	9.5E+02 J	5.3E+03	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	5.3E+03	3.3E+03	NA	NA		NO	NUT, BBL
	7440-23-5	SODIUM	6.1E+03	1.7E+04	ug/L	MR06-GW-IS10-15-19-06D	6 / 6	NA	1.7E+04	2.3E+04	NA	NA		NO	NUT
	7440-62-2	VANADIUM	8.6E-01 J	1.2E+02	ug/L	MR06-GW-IS10-36-40-06D	5 / 6	50	1.2E+02	4.7E+00	3.6E+00 nc	NA		YES	ASL
	1314-84-7	ZINC	5.4E+00 J	1.4E+03	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	1.4E+03	4.2E+01	1.1E+03 nc	1.1E+03	15A NCAC 2L	YES	ASL
	Inorganics (dissolved)														
	7429-90-5	ALUMINUM	3.1E+01 J	9.1E+01 J	ug/L	MR06-GW-IS10-36-40-06D	3 / 6	NA	9.1E+01	1.9E+03	3.6E+03 nc	NA		NO	BSL
	7440-39-3	BARIUM	8.6E+00 J	6.9E+01 J	ug/L	MR06-GW-IS10D-15-19-06D	6 / 6	NA	6.9E+01	8.6E+01	2.6E+02 nc	2.0E+03	MCL, 15A NCAC 2L	NO	BSL
	7440-43-9	CADMIUM	3.8E-01 J	1.4E+00 J	ug/L	MR06-GW-IS10D-15-19-06D	6 / 6	5	1.4E+00	3.6E-01	1.8E+00 nc	5.0E+00	MCL	NO	BSL
												1.8E+00	15A NCAC 2L		
	7440-70-2	CALCIUM	1.4E+03 J	7.5E+03	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	7.5E+03	6.9E+04	NA	NA		NO	NUT
	7440-47-3	CHROMIUM	6.3E-01 J	2.2E+00 J	ug/L	MR06-GW-IS10-36-40-06D	3 / 6	NA	2.2E+00	3.1E+00	1.1E+01 nc	1.0E+02	MCL	NO	BSL
												5.0E+01	15A NCAC 2L		

TABLE B.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
UXO-06 MILCON Area Focused Site Inspection
Camp Lejeune, Jacksonville, NC

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	7440-48-4	COBALT	2.6E+00 J	5.8E+00 J	ug/L	MR06-GW-IS10D-15-19-06D	6 / 6	NA	5.8E+00	3.4E+00	7.3E+01 nc	NA		NO	BSL
	7439-89-6	IRON	5.4E+02	3.1E+03	ug/L	MR06-GW-IS06-10-14-06D	6 / 6	NA	3.1E+03	6.0E+03	1.1E+03 nc	3.0E+02	15A NCAC 2L	YES	ASL
	7439-95-4	MAGNESIUM	7.2E+02 J	3.3E+03 J	ug/L	MR06-GW-IS10D-15-19-06D	6 / 6	NA	3.3E+03	6.4E+03	NA	NA		NO	NUT
	7439-96-5	MANGANESE	6.2E+00 J	1.2E+02	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	1.2E+02	2.1E+02	8.8E+01 nc	5.0E+01	15A NCAC 2L	YES	ASL
	7440-02-0	NICKEL	1.7E+00 J	2.1E+01 J	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	2.1E+01	8.0E+00	7.3E+01 nc	1.0E+02	15A NCAC 2L	NO	BSL
	2023-69-5	POTASSIUM	6.8E+02 JE	2.0E+03 JE	ug/L	MR06-GW-IS08-15-19-06D	6 / 6	NA	2.0E+03	3.3E+03	NA	NA		NO	NUT, BBL
	7440-23-5	SODIUM	5.9E+03	1.6E+04	ug/L	MR06-GW-IS10-15-19-06D	6 / 6	NA	1.6E+04	2.3E+04	NA	NA		NO	NUT
	7440-62-2	VANADIUM	6.6E-01 J	6.6E-01 J	ug/L	MR06-GW-IS10-36-40-06D	1 / 6	50	6.6E-01	4.7E+00	3.6E+00 nc	NA		NO	BSL
	1314-84-7	ZINC	3.4E+00 J	1.5E+02	ug/L	MR06-GW-IS01-15-19-06D	6 / 6	NA	1.5E+02	4.2E+01	1.1E+03 nc	1.1E+03	15A NCAC 2L	NO	BSL

[1] Minimum/Maximum detected concentrations.
[2] Maximum concentration is used for screening.
[3] Background values are two times the arithmetic mean basewide background shallow groundwater concentrations.
Background values are from *Final Base Background Soil Study Report, Marine Corps Base Camp Lejeune, North Carolina*, Baker Environmental, April 25, 2001.
[4] EPA Region 9 PRGs Table, Tap Water, October, 2004, U.S. EPA Region 9 (based on 10^{6} for carcinogens and HQ of 0.1 for noncarcinogens).
PRGs were updated if updated toxicity values were available.
PRG 2-methylnaphthalene calculated using oral RfD from IRIS and equations from Region 9 PRG table.
PRG value for chlordane is used as surrogate for alpha and gamma chlordane.
[5] Rationale Codes
Selection Reason: Above Screening Levels (ASL)
Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Below Background Level (BBL)

MCL = Maximum Contaminant Level from EPA's National Primary Drinking Water Standards
15A NCAC 2L - Classifications and Groundwater Quality Standards, Amended April 1, 2005.

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/
To Be Considered

J = Estimated Value
E = Estimated concentration due to interference
ca = Carcinogenic
nc = Noncarcinogenic
ca* = Carcinogenic, where: nc < 100 X ca
ca**= Carcinogenic, where: nc < 10 X ca, therefore, nc PRG used

TABLE B.3
SOIL SCREENING VALUES
UXO-06 MILCON Area Focused Site Inspection
MCB Camp Lejeune, Jacksonville, NC

Parameter Name	EPA Region IV Soil ESV[1] (ppm)	Alternative Soil Screening Values (ppm)	Source of Alternative Soil Screening Value	Final Soil Screening Value (ppm)	Source of Final Screening Value
2-Butanone	NA	35	MHSPE, 1994[4]	35	MHSPE, 19944
Acetone	NA	5.03	adjusted value from PHYTOTOX, 1993	5.03	adjusted value from PHYTOTOX, 1993
Methylene chloride	2	27.22	PHYTOTOX, 1993	2	EPA Region IV ESV
Acetophenone	NA	NA	NA	NA	NA
bis(2-Ethylhexyl) phthalate	NA	10.64	adjusted LC50 for dimethyl phthalate from Neuhauser et al., 1986 in Efroymson et al., 1997a (invertebrates)[2]	10.64	adjusted LC50 for dimethyl phthalate from Neuhauser et al., 1986 in Efroymson et al., 1997a (invertebrates)2
Di-n-octyl phthalate	NA	10.64	adjusted LC50 for dimethyl phthalate from Neuhauser et al., 1986 in Efroymson et al., 1997a (invertebrates)[2]	10.64	adjusted LC50 for dimethyl phthalate from Neuhauser et al., 1986 in Efroymson et al., 1997a (invertebrates)2
TPH (Heavy Oil)	NA	28	10th percentile of EC25 values for lube oil from Saterbak et al. 1998 in Efroymson et al. 2004 (invertebrates)	28	10th percentile of EC25 values for lube oil from Saterbak et al. 1998 in Efroymson et al. 2004
Aldrin	0.0025	NA	NA	0.0025	EPA Region IV ESV
alpha-Chlordane	0.1	NA	NA	0.1	EPA Region IV ESV
Dieldrin	0.0005	NA	NA	0.0005	EPA Region IV ESV
Endosulfan I	0.1	NA	NA	0.1	EPA Region IV ESV
Endosulfan II	0.1	NA	NA	0.1	EPA Region IV ESV
Endosulfan sulfate	0.1	NA	NA	0.1	EPA Region IV ESV
Endrin	0.001	NA	NA	0.001	EPA Region IV ESV
Endrin aldehyde	0.1	NA	NA	0.1	EPA Region IV ESV
Endrin ketone	0.1	NA	NA	0.1	EPA Region IV ESV
gamma-Chlordane	0.1	NA	NA	0.1	EPA Region IV ESV
Methoxychlor	0.1	NA	NA	0.1	EPA Region IV ESV
Aluminum	50	NA	NA	50	EPA Region IV ESV
Antimony	3.5	78	Eco-SSL Value- Feb.-March, 2005 (invertebrate)	3.5	EPA Region IV ESV
Arsenic	10	18	Eco-SSL Value- Feb.-March, 2005 (plant)	10	EPA Region IV ESV
Barium	165	330	Eco-SSL Value- Feb.-March, 2005 (invertebrate)	165	EPA Region IV ESV

TABLE B.3
SOIL SCREENING VALUES
UXO-06 MILCON Area Focused Site Inspection
MCB Camp Lejeune, Jacksonville, NC

Parameter Name	EPA Region IV Soil ESV[1] (ppm)	Alternative Soil Screening Values (ppm)	Source of Alternative Soil Screening Value	Final Soil Screening Value (ppm)	Source of Final Screening Value
Beryllium	1.1	40	Eco-SSL Value- Feb.-March, 2005 (invertebrate)	1.1	EPA Region IV ESV
Calcium	NA	NA	NA	NA	NA
Chromium	0.4	0.4	Efroymson et al., 1997a (earthworms)[2]	0.4	EPA Region IV ESV
Cobalt	20	13	Eco-SSL Value- Feb.-March, 2005 (plant)	20	EPA Region IV ESV
Copper	40	61	Eco-SSL Value - July, 2000 (invertebrate)	40	EPA Region IV ESV
Iron	20	NA	NA	20	EPA Region IV ESV
Lead	50	110	Eco-SSL Value- Feb.-March, 2005 (plant)	50	EPA Region IV ESV
Magnesium	NA	NA	NA	NA	NA
Manganese	10	500	Efroymson et al., 1997b (plants)[3]	10	EPA Region IV ESV
Nickel	30	30	Efroymson et al., 1997b (plants)[3]	30	EPA Region IV ESV
Potassium	NA	NA	NA	NA	NA
Selenium	0.81	1	Efroymson et al., 1997b (plants)[3]	0.81	EPA Region IV ESV
Sodium	NA	NA	NA	NA	NA
Vanadium	2	2	Efroymson et al., 1997b (plants)[3]	2	EPA Region IV ESV
Zinc	50	120	Eco-SSL Value - July, 2000 (invertebrate)	50	EPA Region IV ESV

Notes:
[1] = Friday, G.P. "Ecological Screening Values for Surface Water, Sediment, and Soil." Westinghouse Savannah River Company, Savannah River Technology Center, Aiken, SC. November 1998.
[2] = Efroymson et al., 1997a. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. Lockheed Martin Energy Systems, Inc. ES/ER/TM-126/R2.
[3] = Efroymson et al., 1997b. Toxicological Benchmarks for screening Contaminants of Potential Concern for Effects on Terrestrial Plants. 1997 Revision. Lockheed Martin Energy Systems, Inc. ES/ER/TM-85/R3.
[4] = Ministry of Housing, Spatial Planning, and Environment (MHSPE). 9 May 1994. Intervention Values and Target values - Soil Quality Standards. Directorate-General for Environmental Protection, Department of Soil Protection, The Hague, The Netherlands
[5] = Richardson, G.M. 1982. Soil Criteria for Evaluating the Severity of Contamination under the *Dutch Soil Cleanup (Interim) Ac*t.
[6] = Texas-Specific Median Background Concentration (Figure 30 TAC 350.51(m)).
[7] = U.S. EPA. 2000. Ecological Soil Screening Level Guidance. Draft. Office of Emergency and Remedial Response. July 10, 2000.

TABLE B.4
WATER SCREENING VALUES
UXO-06 MILCON Area Focused Site Inspection
MCB Camp Lejeune, Jacksonville, NC

Parameter Name	EPA Region IV Freshwater CSV[1] (µg/L)	North Carolina Freshwater Water Quality Standard[2] (µg/L)	Alternative Freshwater Water Quality Standard (µg/L) (chronic)	Source of Alternative Freshwater Water Quality Standard	National Ambient Water Quality Criteria (µg/L) (chronic)	Oak Ridge National Laboratory Water Benchmarks - LCV (Suter and Tsao 1996) (µg/L)	Final Freshwater Screening Value (µg/L)	Source of Final Freshwater Screening Value
Chloroform	289	NA	890	TCEQ 2005	NA	NA	289	EPA Region IV
Methylene chloride	1930	NA	11000	TCEQ 2005	NA	NA	1930	EPA Region IV
Toluene	175	0.36	1450	TCEQ 2005	NA	NA	0.36	NCDENR
bis(2-Ethylhexyl) phthalate	0.3	NA	300	TCEQ 2005	NA	NA	0.3	EPA Region IV
Perchlorate	NA	NA	9260	Dean et al. 2004	NA	NA	9260	Dean et al. 2004
Aluminum	87	NA	87	TCEQ 2005	87	NA	87	EPA Region IV
Antimony	160	NA	30	TCEQ 2005	NA	30	160	EPA Region IV
Arsenic	190	50	150 D	TCEQ 2005	150 D	3.1	50	NCDENR
Barium	NA	NA	4	TCEQ 2005	NA	4	4	TCEQ 2005
Beryllium	0.53	6.5	5.3	TCEQ 2005	NA	0.66	0.53	EPA Region IV
Cadmium	0.66	0.4	0.6 D	TCEQ 2005	0.25 D	NA	0.4	NCDENR
Calcium	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	50	10.6 D	TCEQ 2005	11 D (Cr VI) or 74 D for Cr III)	NA	50	NCDENR
Cobalt	NA	NA	1500	TCEQ 2005	NA	23	1500	TCEQ 2005
Copper	6.54	7	7 D	TCEQ 2005	9 D	NA	6.54	EPA Region IV
Iron	1000	1000	1000	TCEQ 2005	1000	NA	1000	NCDENR
Lead	1.32	25	1 D	TCEQ 2005	2.5 D	NA	1.32	EPA Region IV
Magnesium	NA	NA	NA	NA	NA	82000	NA	NA
Manganese	NA	NA	120	TCEQ 2005	NA	120	120	TCEQ 2005
Mercury	0.012	0.012	1.3	TCEQ 2005	0.77 D	1.3 D	0.012	NCDENR
Nickel	87.71	88	87.4 D	TCEQ 2005	52 D	NA	87.71	EPA Region IV
Potassium	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	NA	NA	NA	NA	NA	680000	NA	NA
Vanadium	NA	NA	20	TCEQ 2005	NA	20	20	TCEQ 2005
Zinc	58.91	50	58.1 D	TCEQ 2005	120 D	NA	50	NCDENR

Notes:

[1] EPA Region IV = Based on US EPA's Region 4 Water Management Division, Water Quality Standards Unit's Screening List.

[2] NCDENR = NC DENR, "North Carolina Surface Water Quality Standard for Aquatic Life." NC Administrative Code 15A NCAC 02B .0100 & .0200. April 2003.

[3] TCEQ 2005 = September 2005 Update to Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas RG-263 (Revised)

D = criteria is for dissolved metal concentrations; all other criteria represent total concentrations

TABLE B.5
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN IN SOIL
UXO-06 MILCON Area Focused Site Inspection
MCB Camp Lejeune, Jacksonville, NC

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Hazard [5] Quotient Value	COPEC Flag	Rationale for [6] Contaminant Deletion or Selection
Soil*	**VOCs**													
	78-93-3	2-BUTANONE	9.0E-03	9.0E-03	mg/kg	MR06-SS02-0-1-06D	1/21	0.01 - 0.015	9.0E-03	NA	3.5E+01	2.6E-04	NO	BSL
	67-64-1	ACETONE	4.0E-03 J	1.1E-01	mg/kg	MR06-SS03-0-1-06D	6/21	0.01 - 0.015	1.1E-01	NA	5.0E+00	2.2E-02	NO	BSL
	75-09-2	METHYLENE CHLORIDE	3.0E-03 J	5.0E-03 J	mg/kg	MR06-IS07-10-12-06D	6/21	0.01 - 0.015	5.0E-03	NA	2.0E+00	2.5E-03	NO	BSL
	SVOCs													
	98-86-2	ACETOPHENONE	8.2E-02 J	8.2E-02 J	mg/kg	MR06-SS10D-0-1-06D	1 / 21	0.35 - 0.49	8.2E-02	NA	NA	NA	NO	BSL
	117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	9.0E-02 J	9.0E-02 J	mg/kg	MR06-IS09-8-12-06D	1 / 21	0.35 - 0.49	9.0E-02	NA	1.1E+01	8.5E-03	NO	BSL
	117-84-0	DI-N-OCTYL PHTHLATE	8.7E-02 J	9.3E-02 J	mg/kg	MR06-SS09-0-1-06D	2 / 21	0.35 - 0.49	9.3E-02	NA	1.1E+01	8.7E-03	NO	BSL
		TPH (Heavy Oil)	3.0E+01	1.7E+02	mg/kg	MR06-SS04-0-1-06D	21 / 21	NA	1.7E+02	NA	2.8E+01	6.1E+00	YES	ASL
	Pesticides/PCBs													
	309-00-2	ALDRIN	8.5E-04 JP	8.5E-04 JP	mg/kg	MR06-SS05-0-1-06D	1 / 21	0.0018 - 0.0022	8.5E-04	NA	2.5E-03	3.4E-01	NO	BSL
	5103-71-9	ALPHA-CHLORDANE	4.2E-04 JP	7.8E-04 JP	mg/kg	MR06-SS08-0-1-06D	7 / 21	0.0018 - 0.0022	7.8E-04	NA	1.0E-01	7.8E-03	NO	BSL
	60-57-1	DIELDRIN	9.4E-04 JP	1.8E-03 J	mg/kg	MR06-SS09-0-1-06D	2 / 21	0.0035 - 0.0049	1.8E-03	NA	5.0E-04	3.6E+00	YES	ASL
	959-98-8	ENDOSULFAN I	5.2E-04 JP	5.2E-04 JP	mg/kg	MR06-SS08-0-1-06D	1 / 21	0.0018 - 0.0022	5.2E-04	NA	1.0E-01	5.2E-03	NO	BSL
	33213-65-9	ENDOSULFAN II	2.5E-03 JP	2.5E-03 JP	mg/kg	MR06-SS09-0-1-06D	1 / 21	0.0035 - 0.0049	2.5E-03	NA	1.0E-01	2.5E-02	NO	BSL
	1031-07-8	ENDOSULFAN SULFATE	8.7E-04 JP	3.0E-03 J	mg/kg	MR06-SS07-0-1-06D	4 / 21	0.0035 - 0.0049	3.0E-03	NA	1.0E-01	3.0E-02	NO	BSL
	72-20-8	ENDRIN	8.7E-04 JP	4.8E-03 P	mg/kg	MR06-SS07-0-1-06D	3 / 21	0.0035 - 0.0049	4.8E-03	NA	1.0E-03	4.8E+00	YES	ASL
	7421-93-4	ENDRIN ALDEHYDE	1.1E-03 J	1.9E-03 J	mg/kg	MR06-SS05-0-1-06D	3 / 21	0.0035 - 0.0049	1.9E-03	NA	1.0E-01	1.9E-02	NO	BSL
		ENDRIN KETONE	9.3E-04 JP	9.6E-04 JP	mg/kg	MR06-SS07-0-1-06D	2 / 21	0.0035 - 0.0049	9.6E-04	NA	1.0E-01	9.6E-03	NO	BSL
		GAMMA-CHLORDANE	5.9E-04 J	2.2E-03	mg/kg	MR06-SS08-0-1-06D	7 / 21	0.0018 - 0.0022	2.2E-03	NA	1.0E-01	2.2E-02	NO	BSL
	72-43-5	METHOXCHLOR	4.3E-03 JP	5.0E-03 JP	mg/kg	MR06-SS07-0-1-06D	2 / 21	0.018 - 0.022	5.0E-03	NA	1.0E-01	5.0E-02	NO	BSL
	Inorganics													
	7429-90-5	ALUMINUM	3.4E+02	9.4E+03	mg/kg	MR06-IS03-6-8-06D	21 / 21	NA	9.4E+03	5.5E+03	5.0E+01	1.9E+02	YES	ASL
	7440-36-0	ANTIMONY	2.7E-01 JN	6.1E-01 J	mg/kg	MR06-IS03-6-8-06D	19 / 21	NA	6.1E-01	3.6E-01	3.5E+00	1.7E-01	NO	BSL
	7440-38-2	ARSENIC	1.1E+00	4.7E+00	mg/kg	MR06-IS06-6-7-06D	5 / 21	NA	4.7E+00	6.3E-01	1.0E+01	4.7E-01	NO	BSL
	7440-39-3	BARIUM	2.1E+00 J	2.2E+01 J	mg/kg	MR06-SS05-0-1-06D	21 / 21	NA	2.2E+01	1.4E+01	1.7E+02	1.3E-01	NO	BSL
	7440-41-7	BERYLLIUM	1.4E-02 J	5.0E-02 J	mg/kg	MR06-IS04-6-10-06D	8 / 21	NA	5.0E-02	1.0E-01	1.1E+00	4.5E-02	NO	BSL
	7440-70-2	CALCIUM	1.7E+01 J	1.6E+03	mg/kg	MR06-SS05-0-1-06D	21 / 21	NA	1.6E+03	4.4E+02	NA	NA	NO	NUT
	7440-47-3	CHROMIUM	7.6E-01 J	1.4E+01	mg/kg	MR06-IS03-6-8-06D	21 / 21	NA	1.4E+01	6.1E+00	4.0E-01	3.5E+01	YES	ASL
	7440-48-4	COBALT	9.6E-02 J	9.6E-02 J	mg/kg	MR06-IS04-6-10-06D	1 / 21	NA	9.6E-02	2.9E-01	2.0E+01	NA	NO	BSL
	7440-50-8	COPPER	3.6E-01 J	2.9E+00 J	mg/kg	MR06-SS05-0-1-06D	21 / 21	NA	2.9E+00	2.6E+00	4.0E+01	7.3E-02	NO	BSL
	7439-89-6	IRON	2.3E+02	8.7E+03	mg/kg	MR06-IS03-6-8-06D	21 / 21	NA	8.7E+03	3.2E+03	2.0E+01	4.3E+02	YES	ASL
	7439-92-1	LEAD	1.8E+00	9.9E+00	mg/kg	MR06-SS07-0-1-06D	21 / 21	NA	9.9E+00	8.5E+00	5.0E+01	2.0E-01	NO	BSL
	7439-95-4	MAGNESIUM	2.5E+01 J	4.1E+02	mg/kg	MR06-IS03-6-8-06D	21 / 21	NA	4.1E+02	2.4E+02	NA	NA	NO	NUT
	7439-96-5	MANGANESE	9.8E-01 J	3.1E+01 E	mg/kg	MR06-SS05-0-1-06D	21 / 21	NA	3.1E+01	9.2E+00	1.0E+01	3.1E+00	YES	ASL
	7440-02-0	NICKEL	1.8E-01 J	1.7E+00 J	mg/kg	MR06-SS01-0-1-06D	19 / 21	NA	1.7E+00	1.2E+00	3.0E+01	5.7E-02	NO	BSL
	2023-69-5	POTASSIUM	3.9E+01 J	4.0E+02	mg/kg	MR06-IS04-6-10-06D	21 / 21	NA	4.0E+02	1.2E+02	NA	NA	NO	NUT
	7782-49-2	SELENIUM	3.1E-01 J	3.7E-01 J	mg/kg	MR06-SS01-0-1-06D	2 / 21	NA	3.7E-01	5.0E-01	8.1E-01	4.6E-01	NO	BSL
	7440-23-5	SODIUM	3.8E+01 J	7.4E+01 J	mg/kg	MR06-SS05-0-1-06D	21 / 21	NA	7.4E+01	6.8E+01	NA	NA	NO	NUT
	7440-62-2	VANADIUM	1.5E+00 J	2.1E+01	mg/kg	MR06-IS03-6-8-06D	21 / 21	NA	2.1E+01	8.9E+00	2.0E+00	1.1E+01	YES	ASL
	1314-84-7	ZINC	8.5E-01 J	8.1E+00	mg/kg	MR06-SS04-0-1-06D	21 / 21	NA	8.1E+00	6.6E+00	5.0E+01	1.6E-01	NO	BSL

*soil = combined surface and subsurface soil

[1] Minimum/Maximum detected concentrations.
[2] Maximum concentration is used for screening.
[3] Background values are the lower of two times the arithmetic mean basewide background surface soil or subsurface soil concentrations.
Background values are from *Final Base Background Soil Study Report, Marine Corps Base Camp Lejeune, North Carolina* , Baker Environmental, April 25, 2001.
[4] EPA Region IV ecological soil screening values (US. EPA 2000) were used as available.
In cases where EPA Region IV values were lacking, alternate values were selected (see Table X.1).
[5] Hazard quotient is the maximum concentration divided by the screening value.
[6] Rationale Codes Selection Reason: Above Screening Levels (ASL) Deletion Reason: No Toxicity Information (NTX) Essential Nutrient (NUT) Below Screening Level (BSL)

COPEC = Chemical of Potential Ecological Concern
J = Estimated Value
E = Concentration exceeded calibration range, sample was then diluted
P = Difference between the consentration on the two columns is greater than 20%
N = Spiked sample recovery was not within the control limits

TABLE B.6
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN IN GROUNDWATER
UXO-06 MILCON Area Focused Site Inspection
MCB Camp Lejeune, Jacksonville, NC

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Hazard [5] Quotient Value	COPEC Flag	Rationale for [6] Contaminant Deletion or Selection
Tap Water	**VOCs**													
	67-66-3	CHLOROFORM	3.7E+01	6.5E+01	ug/L	MR06-GW-IS06-10-14-06D	2 / 6	10	6.5E+01	NA	2.9E+02	2.2E-01	NO	BSL
	75-09-2	METHYLENE CHLORIDE	4.0E+00 J	4.0E+00 J	ug/L	MR06-GW-IS01-15-19-06D	3 / 6	10	4.0E+00	NA	1.9E+03	2.1E-03	NO	BSL
	108-88-3	TOLUENE	8.0E-01 J	8.0E-01 J	ug/L	MR06-GW-IS06-10-14-06D	1 / 6	10	8.0E-01	NA	3.6E-01	2.2E+00	YES	ASL
	SVOCs													
	117-81-7	bis(2-ETHYLHEXYL) PHTHALATE	1.3E+01 J	1.3E+01	ug/L	MR06-GW-IS06-10-14-06D	1 / 6	10	1.3E+01	NA	3.0E-01	4.3E+01	YES	ASL
	Exposives													
	7601-90-3	PERCHLORATE	7.0E-02 J	8.7E+00	ug/L	MR06-GW-IS10-36-40-06D (DL)	3 / 3	NA	8.7E+00	NA	9.3E+03	9.4E-04	NO	BSL
	Inorganics (total)													
	7429-90-5	ALUMINUM	1.2E+02 J	2.8E+04	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	2.8E+04	1.9E+03	8.7E+01	3.2E+02	YES	ASL
	7440-36-0	ANTIMONY	2.4E+00 J	7.6E+00 J	ug/L	MR06-GW-IS10-36-40-06D	4 / 6	60	7.6E+00	3.3E+00	1.6E+02	4.7E-02	NO	BSL
	7440-38-2	ARSENIC	5.4E+00 J	2.0E+01	ug/L	MR06-GW-IS10-36-40-06D	2 / 6	10	2.0E+01	5.8E+00	5.0E+01	3.9E-01	NO	BSL
	7440-39-3	BARIUM	3.9E+01 J	1.7E+02 J	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	1.7E+02	8.6E+01	4.0E+00	4.4E+01	YES	ASL
	7440-41-7	BERYLLIUM	1.4E+01	1.4E+01	ug/L	MR06-GW-IS10-36-40-06D	1 / 6	5	1.4E+01	3.1E-01	5.3E-01	2.7E+01	YES	ASL
	7440-43-9	CADMIUM	4.0E-01 J	8.9E-01 J	ug/L	MR06-GW-IS08-15-19-06D	3 / 6	5	8.9E-01	3.6E-01	4.0E-01	2.2E+00	YES	ASL
	7440-70-2	CALCIUM	1.2E+03 J	3.7E+04	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	3.7E+04	6.9E+04	NA	NA	NO	NUT
	7440-47-3	CHROMIUM	1.4E+00 J	4.6E+02	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	4.6E+02	3.1E+00	5.0E+01	9.2E+00	YES	ASL
	7440-48-4	COBALT	2.1E+00 J	2.6E+01 J	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	2.6E+01	3.4E+00	1.5E+03	1.8E-02	NO	BSL
	7440-50-8	COPPER	9.2E+00 J	9.3E+01	ug/L	MR06-GW-IS10-36-40-06D	2 / 6	25	9.3E+01	2.8E+00	6.5E+00	1.4E+01	YES	ASL
	7439-89-6	IRON	1.0E+03	1.1E+05	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	1.1E+05	6.0E+03	1.0E+03	1.1E+02	YES	ASL
	7439-92-1	LEAD	4.3E+00 J	2.3E+01	ug/L	MR06-GW-IS10-36-40-06D	2 / 6	10	2.3E+01	2.8E+00	1.3E+00	1.8E+01	YES	ASL
	7439-95-4	MAGNESIUM	1.6E+03 J	7.3E+03	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	7.3E+03	6.4E+03	NA	NA	NO	NUT
	7439-96-5	MANGANESE	1.2E+01 JE	9.6E+02 E	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	9.6E+02	2.1E+02	1.2E+02	8.0E+00	YES	ASL
	22967-92-6	MERCURY	4.3E-02 J	4.3E-02 J	ug/L	MR06-GW-IS10-36-40-06D	1 / 6	0.2	4.3E-02	1.0E-01	1.2E-02	3.6E+00	YES	ASL
	7440-02-0	NICKEL	2.4E+00 J	2.2E+02	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	2.2E+02	8.0E+00	8.8E+01	2.5E+00	YES	ASL
	2023-69-5	POTASSIUM	9.5E+02 J	5.3E+03	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	5.3E+03	3.3E+03	NA	NA	NO	NUT, BBL
	7440-23-5	SODIUM	6.1E+03	1.7E+04	ug/L	MR06-GW-IS10-15-19-06D	6 / 6	NA	1.7E+04	2.3E+04	NA	NA	NO	NUT
	7440-62-2	VANADIUM	8.6E-01 J	1.2E+02	ug/L	MR06-GW-IS10-36-40-06D	5 / 6	50	1.2E+02	4.7E+00	2.0E+01	5.9E+00	YES	ASL
	1314-84-7	ZINC	5.4E+00 J	1.4E+03	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	1.4E+03	4.2E+01	5.0E+01	2.8E+01	YES	ASL
	Inorganics (dissolved)													
	7429-90-5	ALUMINUM	3.1E+01 J	9.1E+01 J	ug/L	MR06-GW-IS10-36-40-06D	3 / 6	NA	9.1E+01	1.9E+03	8.7E+01	1.0E+00	NO	ASL
	7440-39-3	BARIUM	8.6E+00 J	6.9E+01 J	ug/L	MR06-GW-IS10D-15-19-06D	6 / 6	NA	6.9E+01	8.6E+01	4.0E+00	1.7E+01	NO	ASL
	7440-43-9	CADMIUM	3.8E-01 J	1.4E+00 J	ug/L	MR06-GW-IS10D-15-19-06D	6 / 6	5	1.4E+00	3.6E-01	4.0E-01	3.5E+00	YES	ASL
	7440-70-2	CALCIUM	1.4E+03 J	7.5E+03	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	7.5E+03	6.9E+04	NA	NA	NO	NUT
	7440-47-3	CHROMIUM	6.3E-01 J	2.2E+00 J	ug/L	MR06-GW-IS10-36-40-06D	3 / 6	NA	2.2E+00	3.1E+00	5.0E+01	4.4E-02	NO	BSL
	7440-48-4	COBALT	2.6E+00 J	5.8E+00 J	ug/L	MR06-GW-IS10D-15-19-06D	6 / 6	NA	5.8E+00	3.4E+00	1.5E+03	3.9E-03	NO	BSL
	7439-89-6	IRON	5.4E+02	3.1E+03	ug/L	MR06-GW-IS06-10-14-06D	6 / 6	NA	3.1E+03	6.0E+03	1.0E+03	3.1E+00	YES	ASL
	7439-95-4	MAGNESIUM	7.2E+02 J	3.3E+03 J	ug/L	MR06-GW-IS10D-15-19-06D	6 / 6	NA	3.3E+03	6.4E+03	NA	NA	NO	NUT
	7439-96-5	MANGANESE	6.2E+00 J	1.2E+02	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	1.2E+02	2.1E+02	1.2E+02	9.8E-01	NO	BSL
	7440-02-0	NICKEL	1.7E+00 J	2.1E+01 J	ug/L	MR06-GW-IS10-36-40-06D	6 / 6	NA	2.1E+01	8.0E+00	8.8E+01	2.4E-01	NO	BSL
	2023-69-5	POTASSIUM	6.8E+02 JE	2.0E+03 JE	ug/L	MR06-GW-IS08-15-19-06D	6 / 6	NA	2.0E+03	3.3E+03	NA	NA	NO	NUT, BBL
	7440-23-5	SODIUM	5.9E+03	1.6E+04	ug/L	MR06-GW-IS10-15-19-06D	6 / 6	NA	1.6E+04	2.3E+04	NA	NA	NO	NUT
	7440-62-2	VANADIUM	6.6E-01 J	6.6E-01 J	ug/L	MR06-GW-IS10-36-40-06D	1 / 6	50	6.6E-01	4.7E+00	2.0E+01	3.3E-02	NO	BSL
	1314-84-7	ZINC	3.4E+00 J	1.5E+02	ug/L	MR06-GW-IS01-15-19-06D	6 / 6	NA	1.5E+02	4.2E+01	5.0E+01	3.0E+00	YES	ASL

[1] Minimum/Maximum detected concentrations.
[2] Maximum concentration is used for screening.
[3] Background values are two times the arithmetic mean basewide background shallow groundwater concentrations.
Background values are from *Final Base Background Soil Study Report, Marine Corps Base Camp Lejeune, North Carolina*, Baker Environmental, April 25, 2001
[4] North Carolina Surface Water Quality Stnadards for Aquatic Life (NCDENR 2003) or EPA Region IV Water Quality Standards (US. EPA 2000) were used as available.
In cases where North Carolina or EPA Region IV values were lacking, alternate values were selected (see Table X.2).
[5] Hazard quotient is the maximum concentration divided by the screening value.
[6] Rationale Codes
Selection Reason: Above Screening Levels (ASL)
Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Below Background Level (BBL)

COPEC = Chemical of Potential Ecological Concern
J = Estimated Value
E = Estimated concentration due to interference