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MCB CAMP LEJEUNE
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FINAL PRELIMINARY ASSESSMENT/SITE INSPECTION REPORT SITE UXO-12 NEW
RIVER 1,000 INCH RANGE AND UXO-18 - 50 FOOT SMALL BORE RANGE MCB CAMP
LEJEUNE NC
04/01/2011
CH2M HILL

Final

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

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina



Prepared for

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

Contract No.
N62470-08-D-1000
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April 2011

Prepared by

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Under the

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

Prepared by



CH2MHILL

Charlotte, North Carolina



Executive Summary

A Preliminary Assessment/Site Inspection (PA/SI) was performed at Sites Unexploded Ordnance (UXO)-12 (ASR #2.5) – New River 1,000-inch Range and UXO-18 – B-6 50-Foot Small Arms Range (ASR #2.44), Marine Corps Base Camp Lejeune (MCB CamLej), Jacksonville, North Carolina. Investigation activities were conducted in November 2009 and February 2010 to evaluate the presence and nature of munitions constituents (MC) contamination that may be present due to historical site use and to determine if additional investigation is warranted.

Between 1942 and 1961, the UXO-12/UXO-18 investigation area was used for small arms firing range activities. Small range activities have the potential to impact site media with metals contamination. The ranges located within this area include:

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

UXO-12 and UXO-18 were included in the same PA/SI effort due to the overlap between the range boundaries and because all ranges within this area were small arms ranges.

The site investigation area encompasses approximately 176 acres of predominantly wooded land located in the northwest portion of MCB CamLej north of Curtis Rd and east of United States Highway 17. The site topography is relatively level, sloping gently eastward towards an unnamed creek. Low-lying wetland areas were observed throughout the Site with persistent standing water present following rain events.

The site sampling effort commenced in November 2009. Heavy rainfall during the initial sampling effort caused flooding throughout the investigation area. Field efforts were suspended due to flooded conditions. Site sampling activities were completed in February 2010 following approval of a modified sampling approach by the Partnering Team. Site sampling activities were performed in accordance with the *Site Specific Work Plan Addendum for Preliminary Assessment/Site Inspection, Site UXO-12 New River 1,000-inch Range (ASR #2.5) and UXO-18 50-foot Small Bore Range (ASR #2.44)* (CH2M HILL, 2009a), the *Modified Sampling Approach for Preliminary Assessment/Site Inspection (PA/SI) at UXO-12 (ASR#2.5) New River 1,000-inch Range and UXO-18 (ASR#2.44) B-6 50-Foot Small Arms Range, Marine Corps Base Camp Lejeune (MCB CamLej)* (CH2M HILL, 2010), and the *Munitions Response Program Master Project Plan, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina* (CH2M HILL, 2008a).

X-ray fluorescence (XRF) screening of surface soil was performed during the November 2009 field effort; however, use of the XRF screening method was discontinued for the remainder of the sampling effort due to the saturated soils present at the site and because metals concentrations in site soils are for the most part less than the XRF instrument detection limits.

Surface soil, sediment, and surface water samples were analyzed by a fixed-base laboratory for antimony, arsenic, copper, lead, and zinc by USEPA Method 6010B. Total and dissolved metals samples were collected from the surface water sampling locations. The analytical results were compared to human health and ecological screening values to evaluate impacts to site media.

In environmental samples submitted for fixed-base laboratory analysis, concentrations of copper, lead, and zinc exceeded twice the mean Base background concentration at some sample locations but did not exceed regulatory screening criteria. Arsenic was the only target analyte detected in surface soil, sediment, and surface water at concentrations exceeding regulatory screening criteria and Base background concentrations. However, arsenic exceedances were of a similar order of magnitude throughout the site with no areas of elevated metals concentrations that would be consistent with the spatial distribution of metals impacts anticipated for former small arms range activity. As surface soil results did not exceed the North Carolina Soil Screening Levels, it is unlikely that leaching of metals constituents to subsurface soil and groundwater would occur.

Ecological and human health risk screenings were performed on surface soil, sediment, and surface water data. No unacceptable risk was identified for human or ecological receptors. Based on the results of the risk screenings and as no areas of elevated metals concentrations consistent with small arms range activities were identified during the sampling effort, no further environmental investigation of Site UXO-12/UXO-18 is recommended.

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Acronyms and Abbreviations

amsl	above mean sea level
ASR	Archive Search Report
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-term Environmental Action – Navy
COPC	constituent of potential concern
CSM	conceptual site model
CTO	contract task order
°F	degrees Fahrenheit
EcoSSL	Ecological Soil Screening Level
ERS	ecological risk screening
ESV	ecological screening value
HHRS	human health risk screening
HI	hazard index
HQ	hazard quotient
IDW	investigation-derived waste
µg/L	micrograms per liter
m	meter
MARCORSYSCOM	Marine Corps Systems Command
MC	munitions constituent
MCB CamLej	Marine Corps Base Camp Lejeune
MG	machine gun
mg/kg	milligrams per kilogram
MRP	Munitions Response Program
MS/MSD	matrix spike/matrix spike duplicate
NAVFAC	Naval Facilities Engineering Command
NC 2B	North Carolina 2B Surface Water Standards
NCDENR	North Carolina Department of Environment and Natural Resources
NC SSL	North Carolina Soil Screening Level
NIRIS	Naval Installation Restoration Information Solution
NRWQC	National Recommended Water Quality Criteria
PA/SI	Preliminary Assessment/Site Inspection
PPE	personal protective equipment
QA	quality assurance
QC	quality control

RSL	risk-based screening level
UCL	upper confidence limit
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UXO	Unexploded Ordnance
VOC	volatile organic compound
XRF	X-ray fluorescence

SECTION 1

Introduction

This report documents the field activities and analytical results of the Preliminary Assessment/Site Inspection (PA/SI) performed at Site Unexploded Ordnance (UXO)-12 – New River 1,000-inch Range (Archive Search Report [ASR]#2.5) and Site UXO-18 – B-6 50-Foot Small Arms Range (ASR#2.44) (hereinafter referred to collectively as Site UXO-12/UXO-18), Marine Corps Base Camp Lejeune (MCB CamLej), Jacksonville, North Carolina. Investigation activities were conducted in November 2009 and February 2010.

The original sampling approach was detailed in the *Site Specific Work Plan Addendum for Preliminary Assessment/Site Inspection, Site UXO-12 New River 1,000-inch Range (ASR #2.5) and UXO-18 50-foot Small Bore Range (ASR #2.44)* (CH2M HILL, 2009a) (hereinafter referred to as the Work Plan). However, due to heavy rainfall and localized flooding within the investigation area, a modified sampling approach was proposed in the February 2010 *Modified Sampling Approach for Preliminary Assessment/Site Inspection (PA/SI) at UXO-12 (ASR#2.5) New River 1,000-inch Range and UXO-18 (ASR#2.44) B-6 50-Foot Small Arms Range, Marine Corps Base Camp Lejeune (MCB CamLej)* (CH2M HILL, 2010).

This PA/SI was conducted by CH2M HILL under the Naval Facilities Engineering Command (NAVFAC), Comprehensive Long-term Environmental Action – Navy (CLEAN) Contract N62470-02-D-1000, Contract Task Order (CTO) 0040.

1.1 Objectives and Approach

MCB CamLej is in the process of investigating closed ranges following the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation process. The primary objective of this environmental investigation was to evaluate the potential presence and nature of impacts to environmental media resulting from historical munitions use at the site, and to evaluate whether additional investigation activities are necessary.

The general approach adopted by this PA/SI was as follows:

- Identify historical activities that may have resulted in environmental contamination by researching archival records and interviewing current and former installation personnel
- Evaluate the presence and nature of munitions constituent (MC) contamination that may exist
- Assess the potential risk to ecological and human receptors.

1.2 Report Organization

This PA/SI report is organized as follows:

- Section 1, Introduction
- Section 2, Site Background
- Section 3, Field Investigation Activities
- Section 4, Investigation Results
- Section 5, Human Health Risk Screening
- Section 6, Ecological Risk Screening
- Section 7, Conclusions and Recommendations
- Section 8, References

Site Background

This section presents a brief summary of the regional and site-specific information, including location, site setting, physical characteristics, and history.

2.1 MCB Camp Lejeune Location and Description

MCB CamLej was commissioned in 1942 as a training area to prepare Marines for combat. The MCB CamLej complex consists of six geographic locations under the jurisdiction of the Base command. These areas include Camp Geiger, Montford Point, Courthouse Bay, Mainside, the Greater Sandy Run Area, and the Rifle Range Area. MCB CamLej is home to an active duty, dependent, retiree, and civilian population of approximately 150,000 personnel, and provides housing, training facilities, logistical support, and administrative supplies for Fleet Marine Force units and other assigned units.

MCB CamLej is located on 236 square miles of land in Onslow County, North Carolina, adjacent to the southern side of the City of Jacksonville. Jacksonville is the largest city near MCB CamLej and contains approximately half of the county's total population. Since 1990, much of the MCB CamLej complex has been part of Jacksonville. The Base is bisected by the New River, which flows into the Atlantic Ocean in a southeasterly direction. The Base is bordered by the Atlantic Ocean to the east, U.S. Route 17 to the west and State Route 24 to the north (**Figure 2-1**).

2.2 Site UXO-12/UXO-18 Description

The site investigation area encompasses approximately 176 acres of predominantly wooded land located in the northwest portion of MCB CamLej, north of Curtis Rd and east of United States Route 17 (**Figure 2-2**). The investigation area is located in the Camp Geiger portion of MCB CamLej. The site topography is relatively level, sloping gently eastward towards an unnamed creek. The ground surface at the site is approximately 20 feet above mean sea level. Low-lying wetland areas were observed throughout the Site with persistent standing water present following rain events.

Figure 2-3 illustrates the historical range fan boundaries in the vicinity of the investigation area. The investigation area consists of the entirety of two former ranges,

- 1954 Site UXO-18 B-6 1,000-inch range (ASR #2.44)
- 1946 Site UXO-12 New River 1,000-inch range (ASR #2.5)

and portions of three former ranges:

- 1946 Site UXO-05 Former Miniature Anti-tank range (ASR #2.7a)
- 1951 Site UXO-18 B-6 50-foot small arms range (ASR #2.44)
- 1953 Site UXO-18 B-6 50-foot small arms range (ASR #2.44).

2.3 Site History

2.3.1 Site UXO-12/UXO-18

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

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

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

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

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

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

2.3.2 Site UXO-05 Range

Site UXO-05 Former Miniature Anti-tank Range overlaps the southwest corner of the Site UXO-12/UXO-18 investigation area. A separate PA/SI has been conducted at Site UXO-05 by CH2M HILL and the results are detailed in *Preliminary Assessment/Site Inspection Report MMRP Site UXO-05, Former Miniature Anti-tank Range and Site UXO-01, Former B-3 Gas Chamber* (CH2M HILL, 2009b).

Site UXO-05 was used between 1942 and 1944 with .22 caliber small arms fire directed at a moving target car located on a transverse track (USACE, 2001). This area was also used during World War II for blank fire and non-firing events (Lowder, 2005) and as a trailer park in the 1960s.

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

2.4 Regional Climate

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

2.5 Regional Geology and Hydrogeology

MCB CamLej is located within the Tidewater region of the Atlantic Coastal Plain Physiographic Province. The area is underlain by an eastward thickening wedge of marine and non-marine sediments ranging in age from early Cretaceous to Holocene. This wedge of sediments begins at the western boundary of the Atlantic Coastal Plain Physiographic Province, known as the Fall Line, and dips and thickens southeastward towards the coast. The sediments occur as layered interfingering beds and lenses of sands, silts, clays, calcareous clays, shell beds, sandstone, and limestone that were deposited over pre-Cretaceous crystalline basement rock. Sedimentary units are often distinguished by minor amounts of detrital carbonate shells, and secondary minerals (Cardinell, Berg, and Lloyd, 1993). Topographic elevations range from sea level at the waterways to 72 feet above mean sea level (amsl) between the New River and U.S. Route 17.

Within the MCB CamLej area, approximately 1,500 feet of a sedimentary sequence overlies the basement rock and is composed of seven aquifers and their associated confining units. These aquifers include the Surficial, Castle Hayne, Beaufort, Peedee, Black Creek, and Upper and Lower Cape Fear aquifers (Cardinell, Berg, and Lloyd, 1993). Confining units associated with specific aquifers are composed of less permeable beds of clay and silt.

The Surficial aquifer, Upper Castle Hayne Confining Unit, and Castle Hayne Aquifer at MCB CamLej have all been described (Cardinell, Berg, and Lloyd, 1993). The Surficial aquifer resides within the Undifferentiated Formation of Holocene and Pleistocene age sediments, and the Castle Hayne aquifer resides locally within the River Bend Formation. The upper portion of the River Bend Formation is composed of sands, silts, shell and fossil fragments, and trace amounts of clay. The Belgrade Formation, where present, typically acts as a confining unit between the Surficial and the Castle Hayne aquifers.

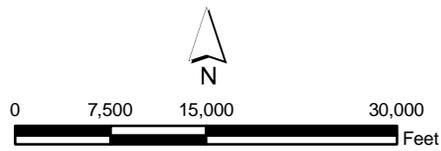
Aquifers of the Coastal Plain region are generally recharged within interstream areas. Natural discharge of groundwater from the Coastal Plain aquifer system is generally into streams, wetlands, and lakes.

2.6 Site Geology and Hydrogeology

Due to the unexpectedly wet conditions during the field investigation, intrusive sampling activities were limited to surface soils. Consequently, site-specific geologic and hydrogeologic information could not be obtained. However, surface soils generally consisted of silty sands and sandy silts. Based upon previous investigations of nearby Installation Restoration Site 35, the subject site is likely underlain by deposits of the Undifferentiated Fm., extending to depths of roughly 30 feet bgs. The unconfined Surficial aquifer is generally encountered within these shallow sediments, and based upon site topography, it is estimated that shallow groundwater flow would likely flow towards the southeast, and the New River.



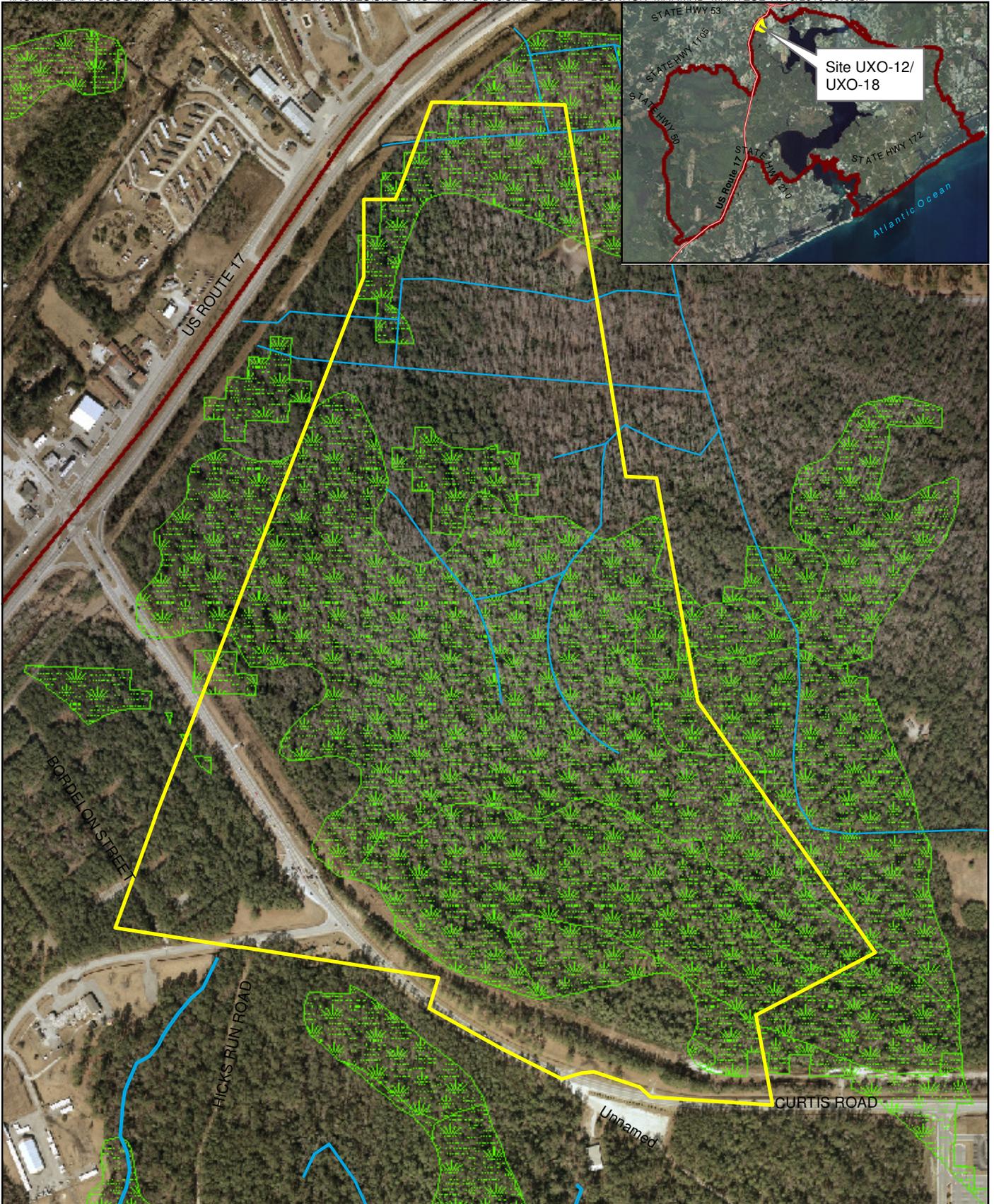
- Legend**
- Highways
 - Site UXO-12/UXO-18 Boundary
 - Installation Boundary



1 inch = 15,000 feet

Figure 2-1
Base Location Map
Site UXO-12/UXO-18
Preliminary Assessment/Site Inspection
MCB Camp Lej
North Carolina





Legend

- Surface Water
- Site UXO-12/UXO-18 Boundary
- Onslow County Wetlands
- Installation Boundary

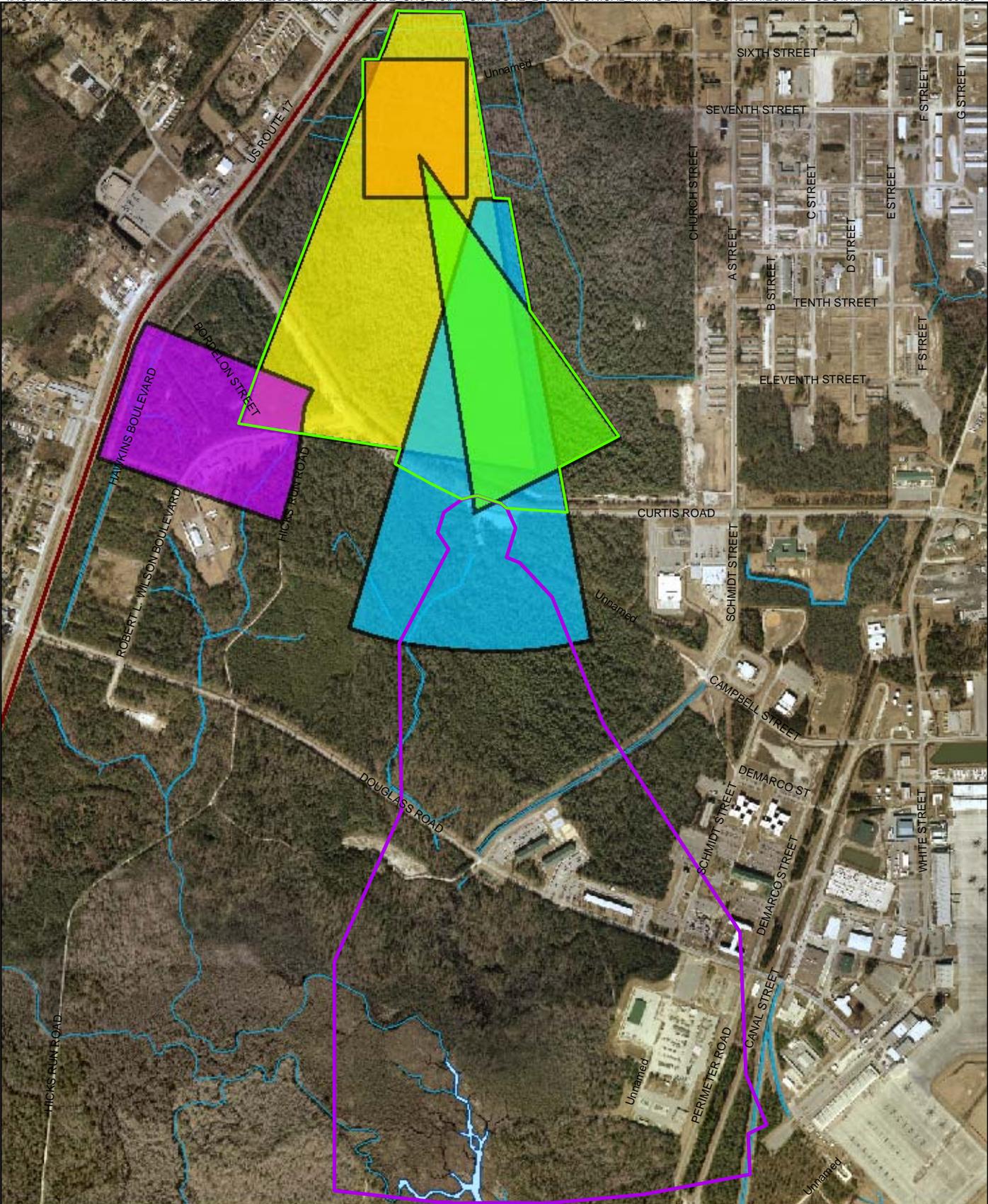


1 inch = 600 feet



Figure 2-2
 Site Location Map
 Site UXO-12/UXO-18
 Preliminary Assessment/Site Inspection
 MCB CamLej
 North Carolina





Legend

- Composite of B-12 Baffled Pistol Range
- 1951 UXO-18/B-6 50 Foot Small Arms Range
- 1946 UXO-12 New River 1,000-inch Range
- 1953 UXO-18/B-6 50 Foot Small Arms Range
- 1946 UXO-15 Former Miniature Anti-tank Range
- 1954 UXO-18/B-6 1,000-inch Range
- Site UXO-12/UXO-18 Boundary
- Surface Water
- Installation Boundary

Figure 2-3
Historical Range Fan Boundaries
Site UXO-12/UXO-18
Preliminary Assessment/Site Inspection
MCB CamLej
North Carolina



0 600 1,200
Feet

1 inch = 1,200 feet



Field Investigation Activities

The initial sampling approach at Site UXO-12/UXO-18 included field screening of surface soil samples by X-ray fluorescence (XRF) and fixed-base laboratory analysis of surface and subsurface soil, sediment, surface water, and groundwater (CH2M HILL, 2009a).

The field activities commenced in November 2009 and initially focused on the northern portion of the site. However, heavy rainfall caused flooding throughout the investigation area, resulting in the suspension of sampling activities. Despite a delay of several months, site conditions did not allow the implementation of the original Work Plan (CH2M HILL 2009a). Consequently, site sampling activities were completed in February 2010 following approval (by the Partnering Team) of a modified sampling approach. The modified approach eliminated the remainder of the XRF surface soil screening and postponed the subsurface soil and groundwater sampling pending the results of the surface soil sampling effort and risk screening (CH2M HILL, 2010). Subsequently, the subsurface soil and groundwater sampling was determined to be unnecessary based on the results of the surface soil sampling effort.

Following the modified sampling approach, the UXO-12/UXO-18 PA/SI included fixed-base laboratory analysis of surface soil, sediment, and surface water. A detailed description of the Site UXO-12/UXO-18 PA/SI is presented below.

3.1 Site Preparation and Support

3.1.1 Site Survey

Land surveying at Site UXO-12/UXO-18 was completed by Lanier Surveying, a North Carolina-licensed surveyor from Cedar Point, North Carolina. The surveying activities were completed in three phases:

- During **Phase 1**, the surveyor flagged vegetation clearance transects across the site.
- During **Phase 2**, the surveyor placed survey stakes to identify each environmental sampling location.
- During **Phase 3**, the surveyor surveyed the coordinates and elevations of the surface water and sediment sampling locations.

During land surveying and vegetation clearing activities, two suspected MPPEH items were identified. The items were subsequently identified as an expended M29 3.5" practice rocket and an expended Signal, Illum, Ground. MCB CamLej Range Control was notified by CH2M HILL personnel and MCB CamLej Explosive Ordnance Disposal personnel responded to the project site and removed the items for disposal. Marine Corps Systems Command (MARCORSYSCOM) was notified of this event. The Munitions Response Site Identification and Notification Report submitted to MARCORSYSCOM is presented in **Appendix B**.

3.1.2 Vegetation Clearing

Since most of the sampling locations were situated within areas of dense vegetation, Wetlands and Woodlands, a landscaping and brush clearing company, was subcontracted to clear vegetation to facilitate access. Vegetation less than three inches in diameter was cut to within 6 inches of the ground surface using a mechanized mulching-cutting machine, and left in place.

3.2 Environmental Investigation Activities

Environmental samples were collected in accordance with the Work Plan (CH2M HILL, 2009a) and the modified sampling approach (CH2M HILL, 2010).

3.2.1 XRF Surface Soil Screening

During the initial phase of field investigation, conducted in November 2009, surface soil from 118 of the proposed 536 screening locations was screened using a XL3T 600 XRF device. The XRF screening focused upon 5 metals commonly associated with small arms ranges, antimony, arsenic, copper, lead and zinc. The screening process was used to identify the presence of elevated metals concentrations (compared to site-specific background) and facilitate the selection of samples for fixed-base laboratory analysis. Surface soil samples were collected from a depth interval of 0 to 1 feet below ground surface (bgs), as described in Section 3.2.2. XRF surface soil screening locations are shown on **Figure 3-1**.

During the November 2009 event, 30 of the 118 surface soil samples screened using the XRF device, were analyzed by a fixed-base laboratory. As discussed in Section 4.1.1, a modified sampling approach was approved in February 2010 that eliminated the use of XRF screening.

3.2.2 Surface Soil

Surface soil sampling was performed in November 2009 and February 2010. The locations of the surface soil samples were biased toward the northern and eastern portions of the investigation area, based on the historical firing lines and target locations. Surface soil sample locations are shown on **Figure 3-2**.

In November 2009, 30 surface soil samples were collected from depths of 0 to 1 ft bgs using the TR-02-1 incremental sampling method. The TR-02-1 approach is described in USACE Technical Report ERDC/CRREL TR-02-1, "*Guide for Characterization of Sites Contaminated with Energetic Materials*" (Thiboutot, Ampleman, and Hewitt, 2002). Each sampling location consisted of an area of one meter (m) square. Composite soil samples were collected from each sample area by thoroughly mixing 30 aliquots collected from random locations within the 1 m × 1 m sampling area, in accordance with Appendix C of the Munitions Response Program (MRP) Master Project Plans, *Homogenization of Soil and Sediment Samples* (CH2M HILL, 2008a). Surface soil samples collected in November 2009 were also screened using an XRF device.

Surface soil sampling activities resumed in February 2010 in accordance with the modified sampling approach. In February 2010, 96 surface soil grab samples were collected using a stainless steel trowel, from a depth of 0 to 1 ft bgs. Samples were analyzed by a fixed-base

laboratory for antimony, arsenic, copper, lead, and zinc using United States Environmental Protection Agency (USEPA) Method 6010B. These metals constituents were selected for analysis as they are common contaminants associated with small arms ranges (ITRC, 2003).

3.2.3 Sediment and Surface Water

In February 2010, 10 co-located surface water and sediment samples were selected based on observed site conditions. Sampling locations are located throughout the northern and central portion of the investigation area. Surface water and sediment samples locations are shown on **Figure 3-2**. Surface water and sediment sampling was completed in accordance with the *Surface Water Sampling* and *Sediment Sampling* SOPs in Appendix C of the MRP Master Project Plans (CH2M HILL, 2008a). Samples were analyzed for fixed-base laboratory analysis for antimony, arsenic, copper, lead, and zinc by USEPA Method 6010B. Surface water samples were analyzed for total and dissolved metals.

3.2.4 Subsurface Soil and Groundwater

The subsurface soil and groundwater sampling activities proposed in the Work Plan (CH2M HILL, 2009a) were not conducted due to flooded site conditions. The modified sampling approach postponed subsurface soil and groundwater sampling pending the results of the surface soil sampling effort and risk screening. Subsequently, the subsurface soil and groundwater sampling was determined to be unnecessary based on the results of the surface soil sampling effort and risk screenings as presented in **Section 7**.

3.2.5 Quality Assurance/Quality Control Sampling

Quality assurance (QA)/quality control (QC) sampling was performed in accordance with the Work Plan, including field blanks, equipment blanks, field duplicates, and matrix spike/matrix spike duplicates (MS/MSDs). Required QA/QC samples and the frequency of collection are shown in **Table 3-1**.

3.3 Data Tracking and Validation

The management and tracking of data from the time of field collection to receipt of validated electronic analytical results reflects the overall quality of the analytical results. Field samples and their corresponding analytical tests were recorded on chain-of-custody forms, which were submitted with the samples to the laboratory. Chain-of-custody entries were checked against the Work Plan (CH2M HILL, 2009a) to verify that all designated samples were collected and submitted for the appropriate analyses. Upon receipt of the samples by the laboratory, a comparison to the field information was made to verify that each sample was analyzed for the correct parameters. In addition, a check was made to ensure that the correct number and types of QA/QC samples were collected. QA/QC samples included field blanks, equipment blanks, field duplicates, and MS/MSD samples.

Analytical data reports, in hard copy and electronic format, were submitted to Environmental Data Quality Incorporated for third-party validation. Procedures used for the validation process were *National Functional Guidelines for Inorganic Data Review* (USEPA, 2004). Data validation reports are provided in **Appendix C**. The electronic data was downloaded into the Naval Installation Restoration Information Solution (NIRIS) database.

These steps (third-party validation and electronic data handling) serve to reduce inherent uncertainties associated with data authenticity and usability.

3.4 Investigation-derived Waste Management

Investigation-derived waste (IDW) generated during field events consisted of decontamination fluids, disposable equipment, and personal protective equipment (PPE). The decontamination fluids were placed in labeled 55-gallon drums and staged at the waste staging area on Parachute Tower Road. IDW was disposed of in accordance with the Base Waste Management Plan (CH2M HILL, 2008b). PPE and other trash generated during field activities were disposed of in an on-Base dumpster.

TABLE 3-1
 QA/QC Sampling Program
Site UXO-12/UXO-18 Preliminary Assessment/Site Inspection
 MCB CamLej, North Carolina

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



Legend

- XRF Soil Screening Location
- Surface Water
- Site UXO-12/UXO-18 Boundary
- Installation Boundary

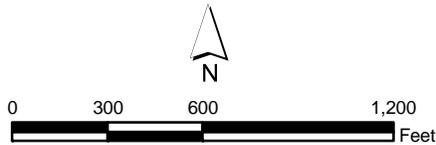


Figure 3-1
 XRF Screening Locations
 Site UXO-12/UXO-18
 Preliminary Assessment/Site Inspection
 MCB CamLej
 North Carolina





Legend

- Sediment/Surface Water Sample Location
- Surface Soil Sample Location
- Surface Water
- ▭ Site UXO-12/UXO-18 Boundary
- ▭ Installation Boundary



1 inch = 550 feet

Figure 3-2
 Environmental Sampling Locations
 Site UXO-12/UXO-18
 Preliminary Assessment/Site Inspection
 MCB CamLej
 North Carolina



Investigation Results

A discussion of the surface soil, sediment, and surface water results is presented below. Analytical services were provided by Empirical Laboratories of Nashville, Tennessee, a North Carolina-certified, Navy-approved laboratory. Raw analytical data are presented in **Appendix D**.

4.1 Surface Soil XRF Screening

Surface soil samples collected in November 2009 were screened using a XRF device to facilitate the selection of additional sample locations for laboratory analysis. The XRF samples that were collected were primarily focused in the northern portion of the site, near the likely location of the former B-6 range firing line. It was expected that potential impacts to site soils from the former B-6 Range activities would have been located within the northern portion of the site. However, XRF screening results did not identify elevated metals concentrations within the northern portion of the site. XRF screening results are presented in **Table 4-1**.

The majority of the surface soil metals concentrations were less than the detection limits of the XRF instrument, as presented in **Table 4-1**. For this reason, a correlation between the XRF results and the fixed-base laboratory results could not be drawn. Additionally, XRF screening is inaccurate for soils with moisture contents greater than 20% therefore XRF screening could not be performed under the saturated soil conditions at the site. As metals concentrations in site soils are for the most part less than the XRF instrument detection limits and saturated soils were present throughout much of the site, it was concluded that XRF screening is not an appropriate tool for soil screening at Site UXO-12/UXO-18.

4.2 Surface Soil

A total of 128 surface soil samples were collected for fixed-base laboratory analysis of antimony, arsenic, copper, lead, and zinc in November 2009 and February 2010 (**Figure 3-2**). Surface soil concentrations were screened against the North Carolina Hazardous Waste Site Soil Screening Levels (NC SSLs) (NCDENR, 2010) and the adjusted USEPA residential and industrial soil risk-based screen levels (RSLs) (USEPA, 2010)), and MCB CamLej background soil data from the *Final Base Background Soil Study Report* (Baker, 2001).

Surface soil analytical results were as follows:

- Arsenic was detected at concentrations ranging from 0.258 to 5.44 mg/kg, and exceeded regulatory screening criteria (residential or industrial RSLs) and twice the mean Base background concentration for surface soil (0.626 mg/kg) in 91 of 128 samples. However, arsenic did not exceed the NC SSL (5.8 mg/kg) at any sample location.

- Copper, lead, and zinc were detected in surface soil samples but did not exceed regulatory screening criteria and twice the mean Base background concentration in any sample.
- Antimony was not detected in any of the surface soil samples.

Surface soil analytical results are presented in **Table 4-2**. Surface soil exceedances of regulatory screening criteria and twice the mean Base background concentrations are shown on **Figure 4-1**.

4.3 Sediment Results

In February 2010, ten sediment samples (MR18-SD01 through MR18-SD10) were collected for fixed-base laboratory analysis of antimony, arsenic, copper, lead, and zinc. Target analyte concentrations were screened against USEPA residential and industrial soil RSLs (USEPA, 2010). Sediment analytical results were as follows:

- Arsenic was detected at concentrations ranging from 0.575 to 3.48 mg/kg, and exceeded the residential soil RSL (0.39 mg/kg) at all sediment sample locations except MR18-SD01. Arsenic also exceeded the industrial soil RSL (1.6 mg/kg) at 5 of 10 sample locations.
- Antimony, copper, lead, and zinc were detected in sediment samples but did not exceed regulatory screening criteria at any sample location.

Sediment analytical results are presented in **Table 4-3**. Sediment exceedances of regulatory screening criteria are shown on **Figure 4-2**.

4.4 Surface Water Results

In February 2010, ten surface water samples (MR18-SW01 through MR18-SW10) were collected for fixed-base laboratory analysis of antimony, arsenic, copper, lead, and zinc. Surface water samples were analyzed for total and dissolved metals. Target analyte concentrations were screened against North Carolina 2B (NC 2B) surface water standards (NCDENR, 2007) and USEPA National Recommended Water Quality Criteria (NRWQC) (USEPA, 2009a). Surface water analytical results for total metals were as follows:

- Arsenic was detected at concentrations ranging from 0.761 to 1.06 micrograms per liter ($\mu\text{g/L}$) and exceeded the NRWQC (0.018 $\mu\text{g/L}$) at 5 of 10 surface water sample locations. Arsenic did not exceed the NC 2B standard (10 $\mu\text{g/L}$) at any sample location.
- Antimony, copper, lead, and zinc were detected in surface water samples but did not exceed regulatory screening criteria at any of the sample location.

Surface water samples were also analyzed for dissolved metals for use in the ecological risk screening. Total and dissolved metals results for surface water are presented in **Table 4-4**. Surface water exceedances of regulatory screening criteria are shown on **Figure 4-3**.

TABLE 4-1

Surface Soil XRF Screening Data
 Site UXO-12/UXO-18 Preliminary Assessment/Site Inspection
 MCB CamLej, North Carolina

Chemical Name		Total Metals (mg/kg)				
Sample ID	Sample Date	Antimony	Arsenic	Copper	Lead	Zinc
MR18-XRF001	11/11/2009	--	< 5.9	< 15.4	17	19
MR18-XRF002	11/11/2009	--	< 4.9	< 15.4	< 6.8	14
MR18-XRF003	11/11/2009	--	< 5.3	< 16.2	< 7.4	< 7.9
MR18-XRF004	11/11/2009	--	< 8.3	< 16.8	< 9	21
MR18-XRF005	11/11/2009	--	< 5.3	< 15.4	9	7
MR18-XRF006	11/11/2009	--	< 5.2	< 14.5	9	10
MR18-XRF007/SS02	11/11/2009	--	< 5.3	< 15.4	< 7.5	< 9.0
MR18-XRF008	11/11/2009	--	< 5.2	< 14.7	< 7.4	13
MR18-XRF009	11/11/2009	--	< 5.3	< 15.7	< 7.2	12
MR18-XRF010	11/11/2009	--	< 5.4	< 16.6	< 7.2	< 9.0
MR18-XRF011/SS01	11/11/2009	--	6	< 15.2	< 7.0	< 8.4
MR18-XRF012	11/11/2009	--	< 5.4	< 14.4	< 7.3	9
MR18-XRF013/SS03	11/11/2009	--	< 5.1	< 16.4	< 6.8	< 8.0
MR18-XRF014	11/11/2009	--	< 4.8	< 16.3	< 6.5	< 8.6
MR18-XRF015	11/11/2009	--	< 5.5	< 16.1	< 7.7	< 8.6
MR18-XRF016/SS04	11/11/2009	--	< 5.4	< 18.3	< 7.3	< 9.0
MR18-XRF017	11/11/2009	--	< 5.2	< 15.9	< 7.2	6
MR18-XRF018/SS05	11/11/2009	--	< 5.0	< 17.5	< 6.7	< 9.1
MR18-XRF019	11/11/2009	--	< 3.7	< 12.1	< 4.9	< 6.6
MR18-XRF020/SS06	11/11/2009	--	< 4.8	< 16.9	< 6.8	< 7.9
MR18-XRF021	11/11/2009	--	< 4.6	< 16.2	< 6.2	< 8.4
MR18-XRF022	11/11/2009	--	< 5.6	< 14.2	5	< 7.6
MR18-XRF023	11/11/2009	< 70.1	< 5.7	< 17.5	< 8.1	7
MR18-XRF024	11/11/2009	--	< 7.1	< 28.2	< 9.9	<14.2
MR18-XRF025	11/11/2009	--	< 4.7	< 15.3	< 6.8	< 8.4
MR18-XRF026	11/11/2009	--	< 5.0	< 15.0	<6.7	9
MR18-XRF027/SS07	11/11/2009	< 68.8	< 5.0	< 16.2	< 6.7	< 8.7
MR18-XRF028	11/11/2009	--	< 5.4	< 16.0	< 7.2	< 8.3
MR18-XRF029/SS08	11/11/2009	--	< 6.3	24	< 8.8	14
MR18-XRF030	11/11/2009	< 49.1	< 5.7	564	10	83
MR18-XRF031/SS09	11/11/2009	--	< 5.3	18.0	< 7.8	< 9.0
MR18-XRF032	11/11/2009	< 141.3	< 5.9	< 20.4	< 8.4	< 10.6
MR18-XRF033/SS10	11/11/2009	< 191.1	< 4.8	< 15.1	< 6.7	9.0
MR18-XRF034	11/11/2009	--	< 5.1	< 14.8	< 7.3	11.0
MR18-XRF035	11/11/2009	--	< 5.7	< 18.2	< 8.1	< 9.9
MR18-XRF036	11/11/2009	--	< 5.2	< 13.2	11.0	10.0
MR18-XRF037	11/11/2009	--	< 4.8	15.0	14.0	12.0
MR18-XRF038	11/11/2009	--	< 4.8	< 14.8	< 7.1	10.0
MR18-XRF039	11/11/2009	--	< 5.9	23.0	16.0	15.0
MR18-XRF040	11/11/2009	< 72.4	< 4.8	< 14.5	< 6.9	< 7.4
MR18-XRF041/SS11	11/11/2009	--	< 4.6	< 15.5	< 6.7	< 7.9
MR18-XRF042	11/11/2009	--	< 4.7	< 15.8	< 6.7	15.0
MR18-XRF043/SS12	11/11/2009	< 40.6	< 8.7	25.0	69.0	13.0
MR18-XRF044	11/11/2009	<72.2	< 9.5	94.0	100.0	14.0
MR18-XRF045/SS13	11/11/2009	--	< 10.6	39.0	112.0	10.0
MR18-XRF046	11/11/2009	< 317.3	< 16.7	54.0	308	24.0
MR18-XRF047	11/11/2009	--	< 4.9	< 14.1	< 6.8	< 6.8

TABLE 4-1

Surface Soil XRF Screening Data
 Site UXO-12/UXO-18 Preliminary Assessment/Site Inspection
 MCB CamLej, North Carolina

Chemical Name		Total Metals (mg/kg)				
Sample ID	Sample Date	Antimony	Arsenic	Copper	Lead	Zinc
MR18-XRF048	11/11/2009	--	< 4.9	< 15.7	< 7.1	9.0
MR18-XRF049	11/11/2009	--	< 6.3	< 14.0	23	< 7.5
MR18-XRF050	11/11/2009	< 68.7	< 6.1	21	14	< 8.6
MR18-XRF051	11/11/2009	<223.6	< 13.7	56	199	57
MR18-XRF052/SS14	11/11/2009	--	< 4.8	< 14.7	< 6.7	< 7.7
MR18-XRF053	11/11/2009	< 105.9	< 5.1	< 14.4	< 6.9	< 8.0
MR18-XRF054/SS15	11/11/2009	--	< 4.4	<15.2	< 6.5	< 7.2
MR18-XRF055	11/11/2009	--	< 5.1	< 14.8	< 7.2	< 7.5
MR18-XRF056/SS16	11/11/2009	--	< 4.2	< 16.2	< 6.0	< 7.9
MR18-XRF057	11/11/2009	--	< 6.5	< 14.8	24	< 7.6
MR18-XRF058/SS17	11/11/2009	--	< 4.9	< 15.3	< 7.1	< 8.9
MR18-XRF059	11/11/2009	--	< 5.0	<15.0	< 7.2	< 7.5
MR18-XRF061	11/11/2009	< 17.0	< 7.4	< 13.9	68	11
MR18-XRF063	11/11/2009	< 17.5	< 4.2	< 12.7	< 5.8	< 6.5
MR18-XRF064	11/11/2009	< 17.7	< 4.1	< 10.9	< 5.9	7
MR18-XRF065	11/11/2009	< 14.2	< 4.7	16	12	< 53.9
MR18-XRF066	11/11/2009	< 17.0	< 4.7	< 14.8	< 6.7	< 7.4
MR18-XRF067	11/11/2009	< 16.5	< 5.5	< 13.2	22	7
MR18-XRF068	11/11/2009	< 18.4	< 4.5	40	< 6.4	12
MR18-XRF069	11/11/2009	< 13.6	< 4.3	< 11.1	11	< 5.8
MR18-XRF070/SS20	11/11/2009	< 19.5	< 4.1	< 12.7	< 6.2	< 6.3
MR18-XRF071	11/11/2009	< 16.7	< 4.5	< 13.6	< 6.7	11
MR18-XRF072/SS21	11/11/2009	< 26.5	< 4.3	< 14.2	< 6.1	< 7.7
MR18-XRF073	11/11/2009	< 15.6	< 4.7	< 13.1	8	< 6.5
MR18-XRF074/SS22	11/11/2009	< 17.8	< 3.9	< 13.2	< 5.5	< 6.4
MR18-XRF075	11/11/2009	< 17.3	< 4.7	< 13.2	12	< 7.0
MR18-XRF076/SS23	11/11/2009	< 19.4	< 4.7	< 14.3	< 6.5	< 7.0
MR18-XRF077	11/11/2009	< 19.0	< 4.4	< 12.7	< 6.6	< 6.3
MR18-XRF078/SS24	11/11/2009	< 17.9	5	< 14.3	< 6.3	7.8
MR18-XRF079	11/11/2009	< 22.4	< 4.5	< 13.2	< 6.4	9
MR18-XRF080/SS25	11/11/2009	< 18.8	< 4.4	< 13.0	< 6.3	< 6.8
MR18-XRF101	11/11/2009	< 22.1	< 4.3	< 13.0	< 6.1	< 7.0
MR18-XRF102	11/11/2009	< 17.0	< 4.2	< 12.2	< 5.9	< 6.8
MR18-XRF103	11/11/2009	< 20.6	< 4.0	< 14.8	< 6.0	< 7.5
MR18-XRF104	11/11/2009	< 18.3	< 4.4	< 14	< 6.4	13
MR18-XRF105	11/11/2009	< 19.2	< 4.5	< 11.5	9	< 5.8
MR18-XRF106	11/11/2009	< 19.3	< 3.9	< 13.5	< 5.9	< 7.6
MR18-XRF107	11/11/2009	< 22.6	< 4	< 13.8	< 6.1	< 7.1
MR18-XRF360	11/14/2009	--	< 4.6	< 15.4	< 6.6	< 8.6
MR18-XRF372/SS96	11/14/2009	--	< 4.7	< 14.7	< 7.0	< 7.5
MR18-XRF373	11/14/2009	--	< 5.4	20	< 7.7	72
MR18-XRF375/SS97	11/14/2009	--	< 6.7	< 15.6	24	353
MR18-XRF397	11/14/2009	--	< 4.8	< 16.2	< 6.9	< 8.9
MR18-XRF410/SS105	11/14/2009	--	< 4.4	< 16.2	< 6.8	23
MR18-XRF411	11/14/2009	< 130.1	< 4.5	< 15.5	< 6.5	< 8.5
MR18-XRF412	11/14/2009	--	< 4.9	< 15.0	< 6.8	14
MR18-XRF426	11/14/2009	--	< 9.2	< 16.6	< 6.8	< 8.6
MR18-XRF429/SS110	11/14/2009	< 215.2	< 4.0	< 13.6	< 5.5	< 7.1
MR18-XRF435/SS113	11/14/2009	--	< 4.2	< 14.7	< 6.1	< 7.4
MR18-XRF436/SS114	11/14/2009	--	< 4.2	< 15.1	< 6.1	< 7.8
MR18-XRF437	11/14/2009	--	< 4.6	< 16.3	< 6.4	< 8.7

TABLE 4-1

Surface Soil XRF Screening Data
 Site UXO-12/UXO-18 Preliminary Assessment/Site Inspection
 MCB CamLej, North Carolina

Chemical Name		Total Metals (mg/kg)				
Sample ID	Sample Date	Antimony	Arsenic	Copper	Lead	Zinc
MR18-XRF438	11/14/2009	< 384.6	< 4.0	< 15.0	< 5.9	< 7.7
MR18-XRF448	11/14/2009	--	< 4.5	< 14.3	< 6.6	< 7.0
MR18-XRF449	11/14/2009	--	< 4.5	< 15.6	< 6.9	9
MR18-XRF458	11/14/2009	--	< 3.9	< 14.5	< 6.6	9
MR18-XRF466	11/14/2009	--	< 4.3	< 15.5	< 6.4	< 8.4
MR18-XRF467	11/14/2009	--	< 3.9	< 16.2	< 5.4	< 7.9
MR18-XRF468	11/14/2009	--	< 3.5	14	< 5.4	< 6.8
MR18-XRF475	11/14/2009	< 129.6	< 6.2	< 17.2	15	16
MR18-XRF476/SS121	11/14/2009	--	5	< 17.3	< 5.9	< 8.7
MR18-XRF477	11/14/2009	--	< 6.5	< 14.8	24	< 7.4
MR18-XRF478	11/14/2009	--	< 4.2	< 17.2	< 6.0	< 8.3
MR18-XRF488	11/14/2009	--	< 7.8	< 19.1	29	24
MR18-XRF489	11/14/2009	--	< 4.6	< 16.2	< 6.3	< 8.6
MR18-XRF493	11/14/2009	--	< 6.3	< 17.7	16	24
MR18-XRF494/SS125	11/14/2009	--	< 4.8	< 16.4	< 6.7	13
MR18-XRF495	11/14/2009	--	< 4.9	< 16.7	< 6.6	< 9.0
MR18-XRF499/SS127	11/14/2009	< 194.3	< 4.3	< 16.6	< 5.7	< 8.2
MR18-XRF500	11/14/2009	--	9	< 25.0	< 9.1	24
MR18-XRF501	11/14/2009	--	< 5.8	< 18.7	< 8.1	23
MR18-XRF503	11/14/2009	--	< 11.1	< 15.4	135	14

Notes:

mg/kg - Milligrams per kilogram

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Checked by: Renee Clore

TABLE 4-2

Surface Soil Analytical Results
 Site UXO-12/UXO-18 Preliminary Assessment/Site Inspection
 MCB CamLej, North Carolina

Chemical Name		Arsenic	Copper	Lead	Zinc
Camp Lejeune Background SS 2X Mean		0.626	4.83	12.3	10.8
Adjusted Industrial Soil RSLs		1.6	4100	800	31000
Adjusted Residential Soil RSLs		0.39	310	400	2400
NC SSLs		5.8	700	270	1200
Sample ID	Sample Date	Total Metals (mg/kg)			
MR18-SS01-09D	11/9/09	<u>2.98</u>	2.45	26.8 J-	8.13
MR18-SS02-09D	11/9/09	<u>3.08</u>	0.949	14 J-	5.42
MR18-SS02D-09D	11/9/09	<u>2.54</u>	1.35	14.4 J-	6.82
MR18-SS03-09D	11/9/09	<u>2.21</u>	0.805	11.4 J-	3.8
MR18-SS04-09D	11/9/09	<u>1.29</u>	1.75	12.3 J-	2.84
MR18-SS05-09D	11/9/09	<u>1.19</u>	0.471 J	9.9 J-	2.51
MR18-SS06-09D	11/9/09	0.461	0.613 U	5.83 J-	1.77
MR18-SS07-09D	11/10/09	<u>1.56</u>	1.55	14.6 J-	6.18
MR18-SS08-09D	11/10/09	<u>1.2</u>	0.904	11.3 J-	7.82
MR18-SS09-09D	11/10/09	<u>0.885</u>	4.65	10.1 J-	8.04
MR18-SS10-09D	11/9/09	<u>1.01</u>	0.394 J	4.39 J-	5.19
MR18-SS11-09D	11/10/09	<u>0.674</u>	0.324 J	7.36 J-	1.88
MR18-SS11D-09D	11/10/09	<u>0.697</u>	0.314 J	9.56 J-	1.76
MR18-SS12-09D	11/10/09	<u>1.26</u>	6.72	29.1 J-	6.33
MR18-SS13-09D	11/10/09	<u>1.9</u>	20.6	86.1 J-	8.2
MR18-SS14-09D	11/10/09	<u>1.09</u>	0.888	16.1 J-	3.24
MR18-SS15-09D	11/10/09	<u>0.712</u>	0.618 J	10.2 J-	1.49
MR18-SS16-09D	11/10/09	0.278 U	3.53	2.82 J-	1.22
MR18-SS17-09D	11/10/09	<u>1.28</u>	0.899	17.3 J-	2.65
MR18-SS18-10A	2/23/10	<u>1.19</u>	1.87	16.4	5.62
MR18-SS19-10A	2/23/10	<u>0.841</u>	2.34	37.3	3.23
MR18-SS20-09D	11/10/09	<u>0.762</u>	0.5 J	8.16 J-	2.81
MR18-SS21-09D	11/10/09	<u>0.948</u>	0.64 U	4.28 J-	1.53
MR18-SS22-09D	11/10/09	<u>1.31</u>	0.702 U	6.71 J-	1.58
MR18-SS23-09D	11/10/09	<u>1.74</u>	1.58	10.2 J-	1.35 J
MR18-SS23D-09D	11/10/09	<u>1.73</u>	2.52	12.9 J-	1.98
MR18-SS24-09D	11/10/09	<u>5.44</u>	0.904 U	13.4 J-	6.1
MR18-SS25-09D	11/10/09	<u>1.33</u>	0.599 J	10.5 J-	5.58
MR18-SS26-10A	2/23/10	<u>0.857</u>	0.372 J	5.58	1.37 J
MR18-SS27-10A	2/23/10	0.269 J	0.421 J	5.89	2.02
MR18-SS28-10A	2/23/10	0.277 J	0.691	6.98	3.8
MR18-SS29-10A	2/23/10	<u>1.64</u>	0.554 J	13.5	2.48
MR18-SS29D-10A	2/23/10	<u>1.41</u>	0.433 J	8.91	2.4
MR18-SS30-10A	2/23/10	<u>1.5</u>	0.503 J	11.1	9.08
MR18-SS31-10A	2/23/10	0.39	0.864	11.2	4.35
MR18-SS32-10A	2/23/10	<u>1.26</u>	1.85	19.4	2.34
MR18-SS33-10A	2/23/10	<u>1.29</u>	0.83 J	10.5 J-	3.7
MR18-SS34-10A	2/23/10	<u>0.643</u>	0.734 J	23 J-	4.38
MR18-SS35-10A	2/23/10	<u>0.489</u>	0.703 U	3.56 J-	1.17 J
MR18-SS36-10A	2/23/10	<u>1.64</u>	0.78 U	13.2 J-	4.29
MR18-SS37-10A	2/23/10	<u>1.54</u>	0.662 J	10.6 J-	7.01
MR18-SS38-10A	2/23/10	<u>1.69</u>	0.804 U	10.1 J-	3.47
MR18-SS39-10A	2/23/10	<u>1.36</u>	0.825	9.01 J-	2.54
MR18-SS40-10A	2/23/10	<u>0.401</u>	0.614 J	3.2 J-	0.908 J
MR18-SS40D-10A	2/23/10	<u>0.454</u>	0.764	3.18 J-	0.867 J
MR18-SS41-10A	2/23/10	<u>0.563</u>	0.625 U	3.68 J-	1.7
MR18-SS42-10A	2/23/10	<u>0.874</u>	0.679 U	4.78 J-	2.68
MR18-SS43-10A	2/23/10	<u>0.733</u>	0.695 U	8.14 J-	3.66
MR18-SS44-10A	2/23/10	<u>0.848</u>	0.402 J	6.14 J-	2.62

TABLE 4-2

Surface Soil Analytical Results
 Site UXO-12/UXO-18 Preliminary Assessment/Site Inspection
 MCB CamLej, North Carolina

Chemical Name	Arsenic	Copper	Lead	Zinc	
Camp Lejeune Background SS 2X Mean	0.626	4.83	12.3	10.8	
Adjusted Industrial Soil RSLs	1.6	4100	800	31000	
Adjusted Residential Soil RSLs	0.39	310	400	2400	
NC SSLs	5.8	700	270	1200	
Sample ID	Sample Date	Total Metals (mg/kg)			
MR18-SS45-10A	2/23/10	<u>1.66</u>	0.668 U	4.65	1.19 J
MR18-SS46-10A	2/23/10	<u>1.18</u>	0.781 J	13.2 J-	4.89
MR18-SS47-10A	2/23/10	<u>1.07</u>	0.677 U	5.05	2.39
MR18-SS48-10A	2/23/10	<u>2.05</u>	0.794 J	17.2 J-	6.33
MR18-SS49-10A	2/23/10	<u>1.26</u>	6.52	10.4 J-	8.76
MR18-SS50-10A	2/23/10	<u>0.721</u>	0.472 J	8.49 J-	2.32
MR18-SS50D-10A	2/23/10	<u>0.664</u>	0.691 U	6.08 J-	1.62
MR18-SS51-10A	2/23/10	<u>0.524</u>	0.62 U	3.33 J-	1.45
MR18-SS52-10A	2/24/10	<u>0.938</u>	0.728 J	9.94	2.22
MR18-SS53-10A	2/24/10	<u>1.2</u>	0.802 J	13.6	2.66
MR18-SS54-10A	2/24/10	<u>0.77</u>	0.907	7.39	4.36
MR18-SS55-10A	2/24/10	<u>1.69</u>	0.731 J	15.4	5.12
MR18-SS56-10A	2/24/10	<u>1.06</u>	0.695 J	9.96	3.03
MR18-SS57-10A	2/24/10	<u>0.728</u>	0.771 U	8.03	1.89
MR18-SS58-10A	2/24/10	<u>0.939</u>	0.521 J	9.09	2.21
MR18-SS59-10A	2/24/10	<u>3.09</u>	0.843 U	13.1	3.05
MR18-SS60-10A	2/24/10	<u>1.77</u>	1.13	11.9	5.39
MR18-SS60D-10A	2/24/10	<u>1.62</u>	0.795 J	12.3	4.61
MR18-SS61-10A	2/24/10	<u>1.08</u>	0.422 J	9.59	2.93
MR18-SS62-10A	2/24/10	<u>0.823</u>	0.544 J	7.44	2.32
MR18-SS63-10A	2/24/10	<u>1.42</u>	1.54	16.2	3.28
MR18-SS64-10A	2/24/10	<u>0.677</u>	0.502 J	6.19	1.75
MR18-SS65-10A	2/24/10	<u>0.588</u>	2.72	8.49	10.9
MR18-SS66-10A	2/24/10	<u>0.532</u>	0.848	7.61	4.02
MR18-SS67-10A	2/24/10	<u>0.694</u>	0.716 U	9.22	2.88
MR18-SS68-10A	2/24/10	<u>1.21</u>	0.513 J	7.87	2.55
MR18-SS69-10A	2/24/10	0.353 U	0.588 U	0.967	0.532 J
MR18-SS70-10A	2/24/10	<u>0.749</u>	0.627 J	7.34	2.76
MR18-SS70D-10A	2/24/10	<u>0.741</u>	0.466 J	7.36	1.81
MR18-SS71-10A	2/25/10	<u>0.507 J</u>	1.68	6.53	10.6
MR18-SS72-10A	2/24/10	<u>0.941</u>	2.6	8.08	5.16
MR18-SS73-10A	2/24/10	0.289 J	1.08	4.23	3.07
MR18-SS74-10A	2/24/10	<u>1.14</u>	0.533 J	16.9	5.18
MR18-SS75-10A	2/24/10	<u>1.34</u>	0.798 J	11.5	2.54
MR18-SS76-10A	2/24/10	<u>0.737</u>	0.686 U	3.63	2.09
MR18-SS77-10A	2/24/10	<u>0.951</u>	0.779 J	10.2	2.23
MR18-SS78-10A	2/24/10	<u>0.848</u>	0.598 J	7.71	2.17
MR18-SS79-10A	2/24/10	<u>0.398</u>	0.326 J	3.92	1.26 J
MR18-SS80-10A	2/24/10	<u>0.847</u>	5.97	7.6	4.38
MR18-SS81-10A	2/25/10	<u>0.707</u>	0.645 U	5.03	1.61
MR18-SS82-10A	2/25/10	<u>0.912</u>	1.22	11.1	4.33
MR18-SS83-10A	2/25/10	<u>0.494</u>	0.595 U	3.65	1.23
MR18-SS84-10A	2/25/10	<u>0.442</u>	0.736 U	7.1	0.749 J
MR18-SS85-10A	2/25/10	<u>0.954</u>	0.562 J	9.31	2.44
MR18-SS86-10A	2/25/10	<u>1.47</u>	3.07	14.5	20.8
MR18-SS87-10A	2/25/10	<u>0.727</u>	1.71	8.57	6.28
MR18-SS88-10A	2/24/10	<u>1.23</u>	4.17	17.4	13.1
MR18-SS89-10A	2/25/10	<u>1.09</u>	0.945	14.2	3.05
MR18-SS90-10A	2/25/10	<u>0.524</u>	0.359 J	4.38	1.2 J
MR18-SS90D-10A	2/25/10	<u>0.469</u>	0.355 J	5.35	1.3
MR18-SS91-10A	2/25/10	<u>0.452</u>	0.425 J	3.16	1.02 J

TABLE 4-2

Surface Soil Analytical Results
 Site UXO-12/UXO-18 Preliminary Assessment/Site Inspection
 MCB CamLej, North Carolina

Chemical Name	Arsenic	Copper	Lead	Zinc
Camp Lejeune Background SS 2X Mean	0.626	4.83	12.3	10.8
Adjusted Industrial Soil RSLs	1.6	4100	800	31000
Adjusted Residential Soil RSLs	0.39	310	400	2400
NC SSLs	5.8	700	270	1200
Sample ID	Sample Date	Total Metals (mg/kg)		
MR18-SS92-10A	2/25/10	<u>0.653</u>	2.23	3.99
MR18-SS93-10A	2/25/10	<u>0.454</u>	0.608 U	2.83
MR18-SS94-10A	2/25/10	<u>1.11</u>	64.4	14.8
MR18-SS95-10A	2/25/10	<u>0.803</u>	10.4	8.66
MR18-SS96-09D	11/13/09	<u>0.726</u>	1.32	15.9
MR18-SS97-09D	11/13/09	<u>1.43</u>	1.52	11.9
MR18-SS98-10A	2/25/10	0.353 J	0.671 U	2.21
MR18-SS99-10A	2/25/10	<u>0.61</u>	0.942 U	4.23
MR18-SS100-10A	2/25/10	<u>0.806</u>	0.852 U	5.15
MR18-SS100D-10A	2/25/10	<u>0.85</u>	0.876 U	4.98
MR18-SS101-10A	2/25/10	<u>0.857</u>	4.2	10.3
MR18-SS102-10A	2/25/10	<u>0.492</u>	0.708 J	4.16
MR18-SS103-10A	2/25/10	<u>0.651</u>	0.757 J	5.34
MR18-SS104-10A	2/25/10	<u>1.1</u>	21.7	10.1
MR18-SS105-09D	11/13/09	<u>0.557</u>	0.941	3.74
MR18-SS105D-09D	11/13/09	<u>0.464</u>	0.859	3.93
MR18-SS106-10A	2/24/10	<u>0.76</u>	1.06	4.12
MR18-SS107-10A	2/25/10	<u>0.965</u>	1.52	11.3
MR18-SS108-10A	2/25/10	0.327 J	0.803 U	2.87
MR18-SS109-10A	2/25/10	<u>1.05</u>	2.63	7.91
MR18-SS110-09D	11/13/09	<u>1.34</u>	0.676 U	2.65
MR18-SS111-10A	2/25/10	<u>0.633</u>	0.927	5.12
MR18-SS112-10A	2/25/10	<u>1.42</u>	1.26	13.3
MR18-SS113-09D	11/13/09	0.352	2.29	7.1
MR18-SS114-09D	11/13/09	0.33	1.12	6.9
MR18-SS115-10A	2/25/10	<u>0.609</u>	0.432 J	4.85
MR18-SS116-10A	2/25/10	<u>0.41 J</u>	0.79 U	3.33
MR18-SS117-10A	2/25/10	<u>0.832</u>	0.857 U	3.66
MR18-SS118-10A	2/25/10	<u>0.427</u>	0.692 U	3.07
MR18-SS119-10A	2/25/10	<u>0.555 J</u>	1.48 U	5.43
MR18-SS120-10A	2/25/10	<u>0.48 U</u>	1.09	2.17
MR18-SS120D-10A	2/25/10	<u>0.51 U</u>	1.88	2.61
MR18-SS121-09D	11/13/09	<u>1.17</u>	0.539 J	3.08
MR18-SS122-10A	2/25/10	<u>0.591</u>	0.554 J	2.99
MR18-SS123-10A	2/25/10	<u>0.654 J</u>	0.729 J	5.47
MR18-SS124-10A	2/25/10	0.258 J	0.758 U	1.9
MR18-SS125-09D	11/13/09	<u>0.557</u>	4.36	8.39
MR18-SS125D-09D	11/13/09	<u>0.533</u>	3.72	7.63
MR18-SS126-10A	2/24/10	<u>0.547</u>	2.89	4.82
MR18-SS127-09D	11/13/09	<u>0.711</u>	0.987	4.78
MR18-SS128-10A	2/24/10	<u>0.49</u>	0.639 J	7.32

Notes:

- J - Analyte present. Value may or may not be accurate or precise
- J- - Analyte present, value may be biased low, actual value may be higher
- mg/kg - Milligrams per kilogram
- NC SSLs - North Carolina Soil Screening Levels
- RSLs - Risk-based Screening Levels
- U - The material was analyzed for, but not detected
- Shading indicates exceedance of two times the mean base background concentration for surface soil
- Bold box indicates exceedance of NC SSLs**

Bold text indicates exceedance of Adjusted Industrial Soil RSLs

Underline indicates exceedance of Adjusted Residential Soil RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

Generated by: Jeremy Diner

Checked by: Renee Clore

TABLE 4-3
Sediment Analytical Results
Site UXO-12/UXO-18 Preliminary Assessment/Site Inspection
MCB CamLej, North Carolina

Chemical Name	Antimony	Arsenic	Copper	Lead	Zinc	
Adjusted Industrial Soil RSLs	41	1.6	4,100	800	31,000	
Adjusted Residential Soil RSLs	3.1	0.39	310	400	2,300	
Sample ID	Sample Date	Total Metals (mg/kg)				
MR18-SD01-09D	2/23/10	0.969 UJ	0.387 U	0.738	3.07	13.3
MR18-SD01D-09D	2/23/10	0.939 UJ	0.375 U	0.597 J	4.12	10.1
MR18-SD02-09D	2/23/10	1.01 UJ	<u>0.98</u>	1.37	9.72	14.9
MR18-SD03-09D	2/23/10	0.9 UJ	<u>0.575</u>	0.6 U	3.98	1.61
MR18-SD04-09D	2/23/10	0.701 J	3.48	52.9	182	12.8
MR18-SD05-09D	2/23/10	1.18 UJ	2.19	12.8	36.2	63.4
MR18-SD06-09D	2/23/10	1.18 UJ	<u>1.21</u>	0.404 J	5.74	2.62
MR18-SD07-09D	2/23/10	2.94 UJ	2.12	6.26	13.6	18.1
MR18-SD08-09D	2/23/10	2.8 UJ	3.07	8.79	21.7	36.4
MR18-SD09-09D	2/23/10	1.58 UJ	<u>1</u>	1.86	11.5	4.94
MR18-SD10-09D	2/23/10	3.33 UJ	1.98	3.99	19.2	6.87

Notes:

J - Analyte present. Value may or may not be accurate or precise

mg/kg - Milligrams per kilogram

RSLs - Risk-based Screening Levels

U - The material was analyzed for, but not detected

Bold text indicates exceedance of Adjusted Industrial Soil RSLs

Underline indicates exceedance of Adjusted Residential Soil RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

Generated by: Jeremy Diner

Checked by: Renee Clore

TABLE 4-4

Surface Water Analytical Results

Site UXO-12/UXO-18 Preliminary Investigation/Site Inspection

MCB CamLej, North Carolina

Chemical Name		Arsenic	Copper	Lead	Zinc	Arsenic	Copper	Lead	Zinc
NRWQC		0.018	1,300	--	7,400	0.018	1,300	--	7,400
NC 2B		10	--	--	--	10	--	--	--
Sample ID	Sample Date	Total Metals (µg/L)				Dissolved Metals (µg/L)			
MR18-SW01-09D	2/23/10	0.849 J	2.09 J	1.06	15.4	0.985 J	2.15 J	0.61 J	14
MR18-SW02-09D	2/23/10	0.761 J	1.91 J	0.976	13.4	0.958 J	1.89 J	0.526 J	12.6
MR18-SW03-09D	2/23/10	1.5 U	2.5 U	0.75 U	9.42	1.5 U	2.5 U	0.75 U	10.8
MR18-SW03D-09D	2/23/10	0.977 J	2.5 U	0.648 J	9.04	1.5 U	4.93	0.75 U	10.4
MR18-SW04-09D	2/23/10	1.06 J	2.52	1.52	9.75	1.18 J	1.82 J	1.05	10.2
MR18-SW05-09D	2/23/10	0.986 J	5.58	5.4	37.4	1.5 U	3.95	2.08	37.7
MR18-SW06-09D	2/23/10	1.5 U	2.5 U	0.439 J	4.08 J	1.5 U	2.5 U	0.75 U	4.94 J
MR18-SW07-09D	2/23/10	1.5 U	2.5 U	0.75 U	7.73	1.5 U	2.5 U	0.75 U	7.61
MR18-SW08-09D	2/23/10	1.5 U	2.5 U	0.75 U	8.99	0.953 J	2.5 U	0.75 U	10.2
MR18-SW09-09D	2/23/10	1.5 U	2.5 U	0.75 U	5.8	1.5 U	2.5 U	0.75 U	7.65
MR18-SW10-09D	2/23/10	0.866 J	2.5 U	0.75 U	7.14	1.01 J	2.5 U	0.75 U	8.33

Notes:

J - Analyte present. Value may or may not be accurate or precise

NC 2B - North Carolina 2B Surface Water Standards

NRWQC - National Recommended Water Quality Criteria

U - The material was analyzed for, but not detected

µg/L - Micrograms per liter

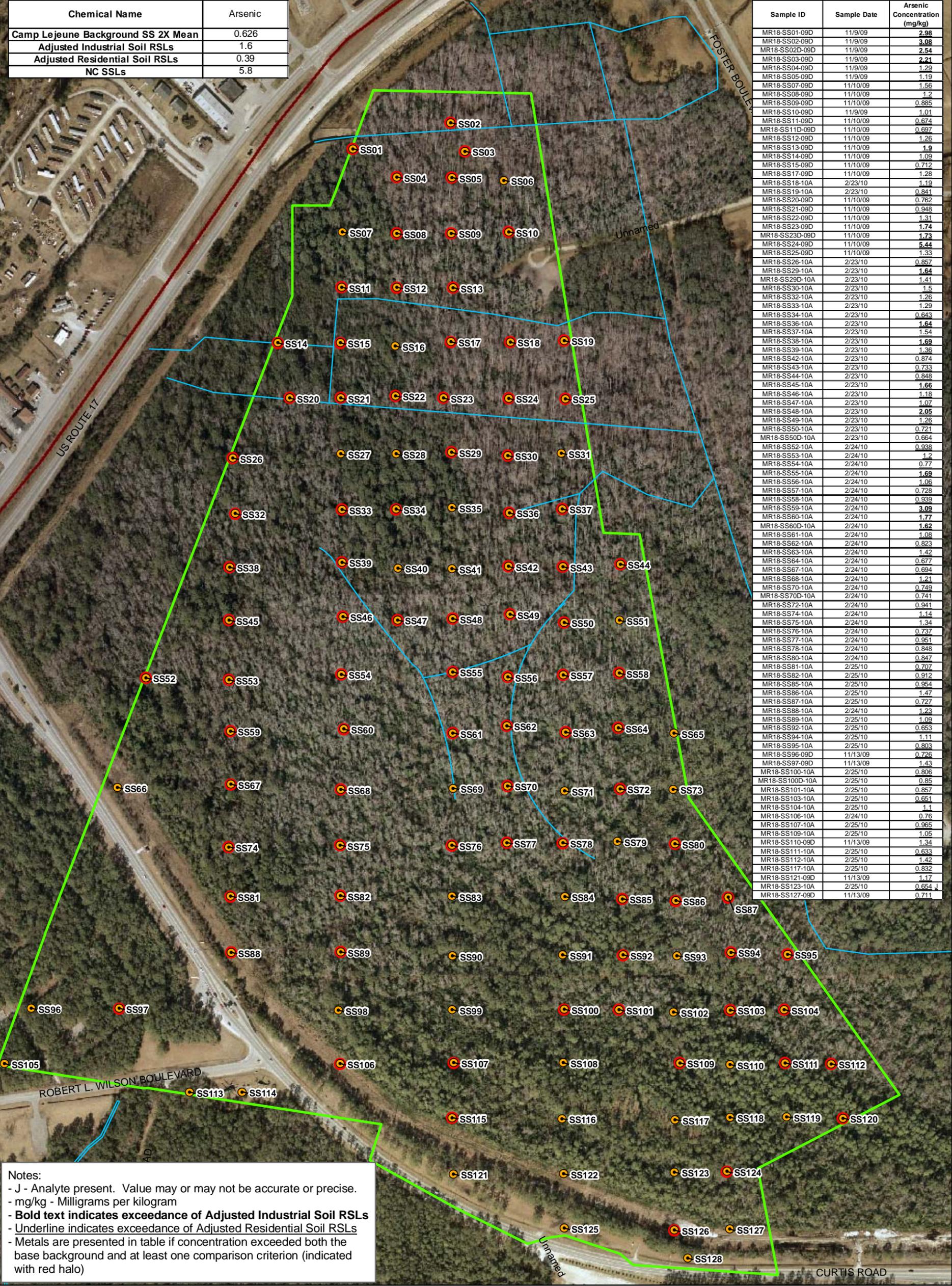
Bold text indicates exceedance of NRWQCUnderline indicates exceedance of NC 2B Standards

Generated by: Jeremy Diner

Checked by: Renee Clore

Chemical Name	Arsenic
Camp Lejeune Background SS 2X Mean	0.626
Adjusted Industrial Soil RSLs	1.6
Adjusted Residential Soil RSLs	0.39
NC SSLs	5.8

Sample ID	Sample Date	Arsenic Concentration (mg/kg)
MR18-SS01-09D	11/9/09	2.98
MR18-SS02-09D	11/9/09	3.08
MR18-SS02D-09D	11/9/09	2.54
MR18-SS03-09D	11/9/09	2.21
MR18-SS04-09D	11/9/09	1.29
MR18-SS05-09D	11/9/09	1.19
MR18-SS07-09D	11/10/09	1.56
MR18-SS08-09D	11/10/09	1.2
MR18-SS09-09D	11/10/09	0.885
MR18-SS10-09D	11/9/09	1.01
MR18-SS11-09D	11/10/09	0.674
MR18-SS11D-09D	11/10/09	0.697
MR18-SS12-09D	11/10/09	1.26
MR18-SS13-09D	11/10/09	1.9
MR18-SS14-09D	11/10/09	1.09
MR18-SS15-09D	11/10/09	0.712
MR18-SS17-09D	11/10/09	1.28
MR18-SS18-10A	2/23/10	1.19
MR18-SS19-10A	2/23/10	0.841
MR18-SS20-09D	11/10/09	0.762
MR18-SS21-09D	11/10/09	0.948
MR18-SS22-09D	11/10/09	1.31
MR18-SS23-09D	11/10/09	1.74
MR18-SS23D-09D	11/10/09	1.73
MR18-SS24-09D	11/10/09	5.44
MR18-SS25-09D	11/10/09	1.33
MR18-SS26-10A	2/23/10	0.857
MR18-SS29-10A	2/23/10	1.64
MR18-SS29D-10A	2/23/10	1.41
MR18-SS30-10A	2/23/10	1.5
MR18-SS32-10A	2/23/10	1.26
MR18-SS33-10A	2/23/10	1.29
MR18-SS34-10A	2/23/10	0.643
MR18-SS36-10A	2/23/10	1.64
MR18-SS37-10A	2/23/10	1.54
MR18-SS38-10A	2/23/10	1.69
MR18-SS39-10A	2/23/10	1.36
MR18-SS42-10A	2/23/10	0.874
MR18-SS43-10A	2/23/10	0.733
MR18-SS44-10A	2/23/10	0.848
MR18-SS45-10A	2/23/10	1.66
MR18-SS46-10A	2/23/10	1.18
MR18-SS47-10A	2/23/10	1.07
MR18-SS48-10A	2/23/10	2.05
MR18-SS49-10A	2/23/10	1.26
MR18-SS50-10A	2/23/10	0.721
MR18-SS50D-10A	2/23/10	0.664
MR18-SS52-10A	2/24/10	0.938
MR18-SS53-10A	2/24/10	1.2
MR18-SS54-10A	2/24/10	0.77
MR18-SS55-10A	2/24/10	1.69
MR18-SS56-10A	2/24/10	1.06
MR18-SS57-10A	2/24/10	0.728
MR18-SS58-10A	2/24/10	0.939
MR18-SS59-10A	2/24/10	3.09
MR18-SS60-10A	2/24/10	1.77
MR18-SS60D-10A	2/24/10	1.62
MR18-SS61-10A	2/24/10	1.08
MR18-SS62-10A	2/24/10	0.823
MR18-SS63-10A	2/24/10	1.42
MR18-SS64-10A	2/24/10	0.677
MR18-SS67-10A	2/24/10	0.694
MR18-SS68-10A	2/24/10	1.21
MR18-SS70-10A	2/24/10	0.749
MR18-SS70D-10A	2/24/10	0.741
MR18-SS72-10A	2/24/10	0.941
MR18-SS74-10A	2/24/10	1.14
MR18-SS75-10A	2/24/10	1.34
MR18-SS76-10A	2/24/10	0.737
MR18-SS77-10A	2/24/10	0.951
MR18-SS78-10A	2/24/10	0.848
MR18-SS80-10A	2/24/10	0.847
MR18-SS81-10A	2/25/10	0.707
MR18-SS82-10A	2/25/10	0.912
MR18-SS85-10A	2/25/10	0.954
MR18-SS86-10A	2/25/10	1.47
MR18-SS87-10A	2/25/10	0.727
MR18-SS88-10A	2/24/10	1.23
MR18-SS89-10A	2/25/10	1.09
MR18-SS92-10A	2/25/10	0.653
MR18-SS94-10A	2/25/10	1.11
MR18-SS95-10A	2/25/10	0.803
MR18-SS96-09D	11/13/09	0.726
MR18-SS97-09D	11/13/09	1.43
MR18-SS100-10A	2/25/10	0.806
MR18-SS100D-10A	2/25/10	0.85
MR18-SS101-10A	2/25/10	0.857
MR18-SS103-10A	2/25/10	0.651
MR18-SS104-10A	2/25/10	1.1
MR18-SS106-10A	2/24/10	0.76
MR18-SS107-10A	2/25/10	0.965
MR18-SS109-10A	2/25/10	1.05
MR18-SS110-09D	11/13/09	1.34
MR18-SS111-10A	2/25/10	0.633
MR18-SS112-10A	2/25/10	1.42
MR18-SS117-10A	2/25/10	0.832
MR18-SS121-09D	11/13/09	1.17
MR18-SS123-10A	2/25/10	0.654
MR18-SS127-09D	11/13/09	0.711



Notes:
 - J - Analyte present. Value may or may not be accurate or precise.
 - mg/kg - Milligrams per kilogram
 - **Bold text indicates exceedance of Adjusted Industrial Soil RSLs**
 - Underline indicates exceedance of Adjusted Residential Soil RSLs
 - Metals are presented in table if concentration exceeded both the base background and at least one comparison criterion (indicated with red halo)

- Legend**
- Surface Soil Sample Location Exceeding Screening Criteria
 - Surface Soil Sample Location
 - Surface Water
 - Site UXO-12/UXO-18 Boundary
 - Installation Boundary

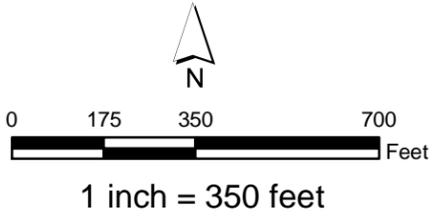
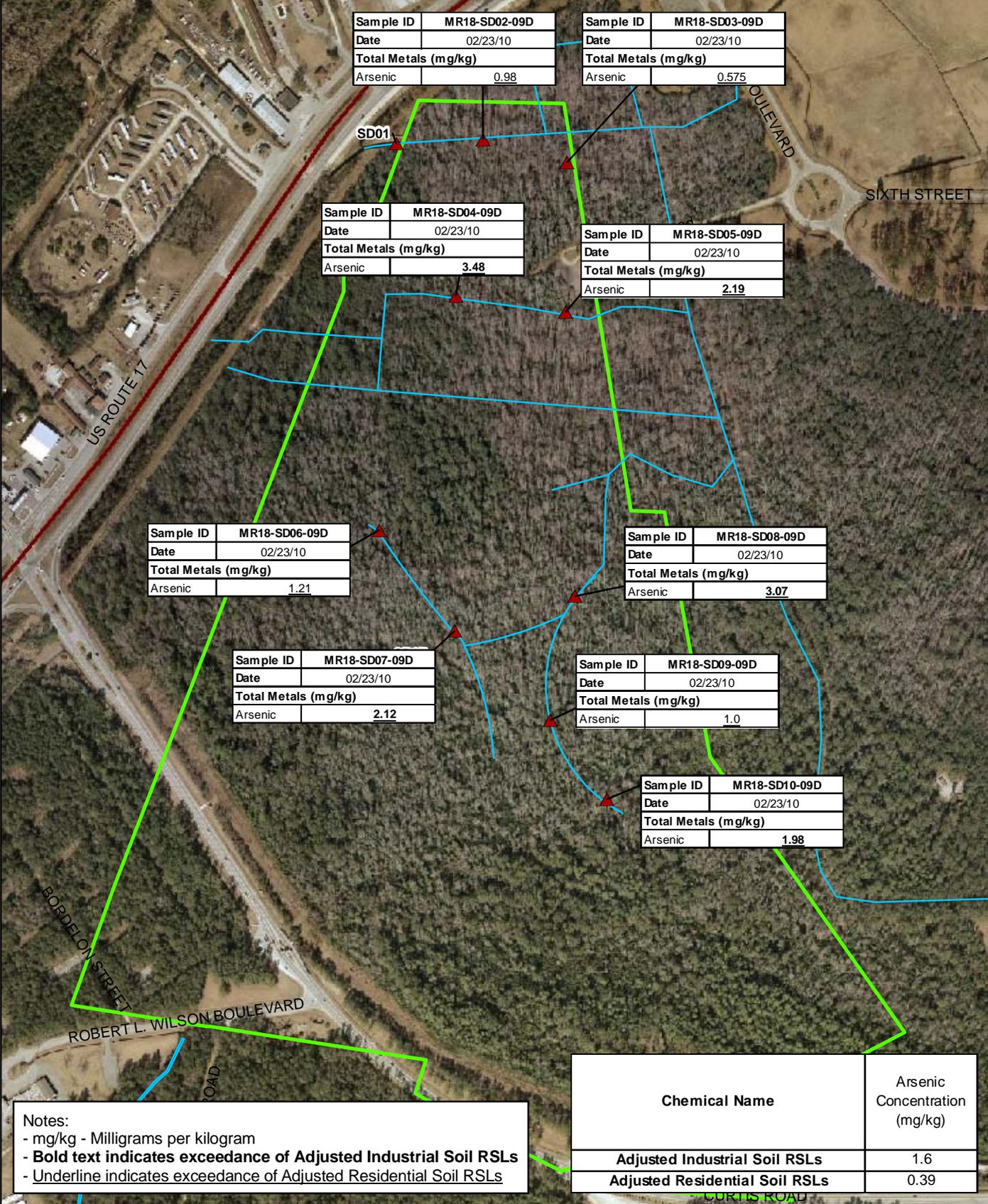


Figure 4-1
 Surface Soil Exceedances
 Site UXO-12/UXO-18
 Preliminary Assessment/Site Inspection
 MCB CamLej
 North Carolina





- Legend**
- ▲ Sediment Sample Location
 - Surface Water
 - Site UXO-12/UXO-18 Boundary
 - Installation Boundary

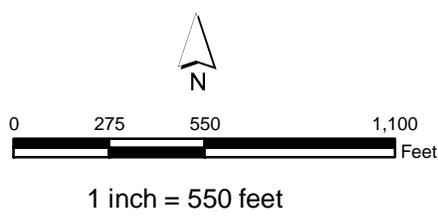


Figure 4-2
 Sediment Exceedances
 Site UXO-12/UXO-18
 Preliminary Assessment/Site Inspection
 MCB CamLej
 North Carolina

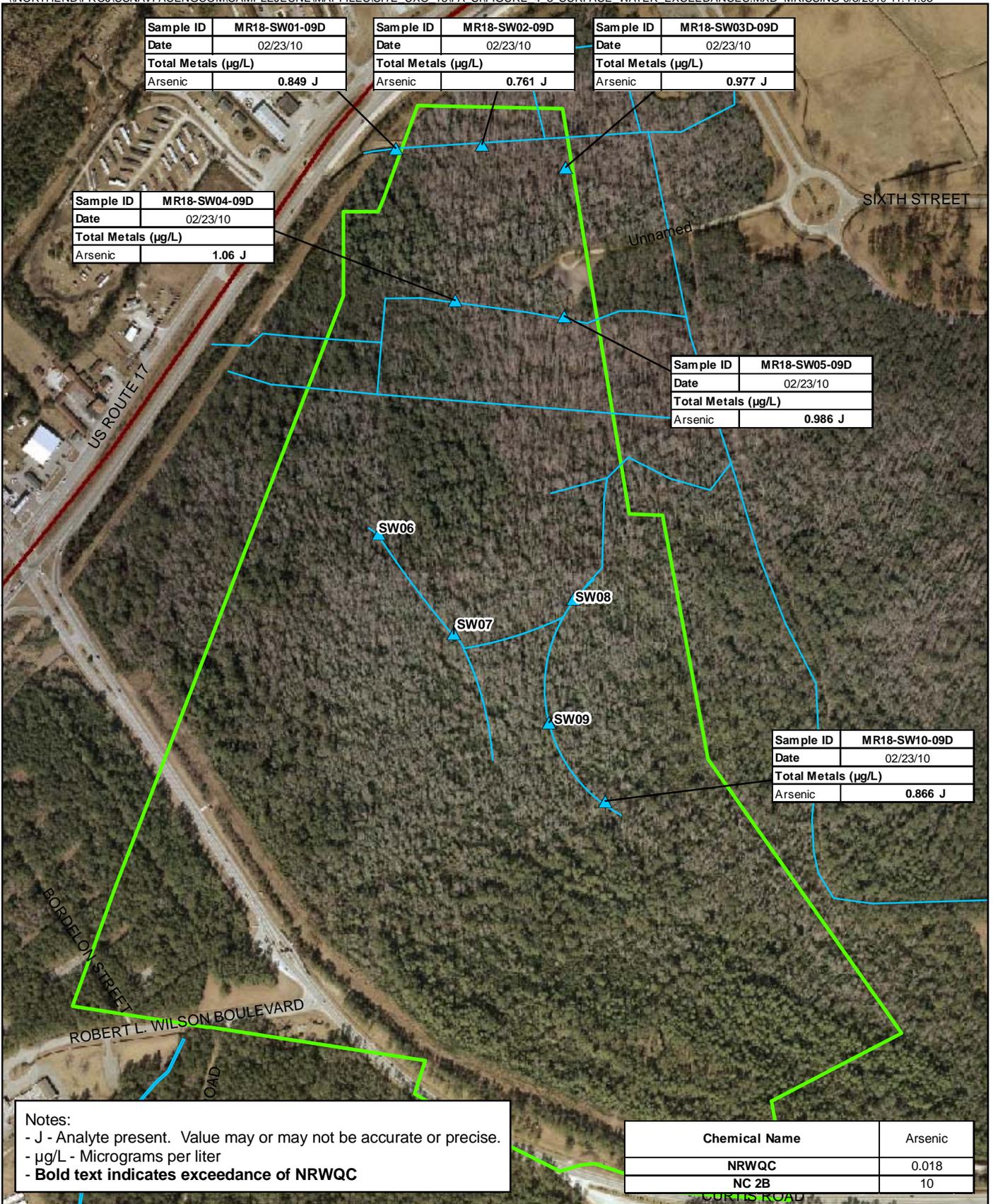


Figure 4-3
 Surface Water Exceedances
 Site UXO-12/UXO-18
 Preliminary Assessment/Site Inspection
 MCB CamLej
 North Carolina



Human Health Risk Screening

A human health risk screening (HHRS) was performed to assess the potential for human health risks associated with exposure to site media (surface soil, surface water, and sediment). The results of the HHRS provide a preliminary indication of potential risks from constituents of potential concern (COPCs) and are used to help evaluate whether future unrestricted (i.e., residential) use of the site is acceptable based on human health risks or if the site requires further evaluation (e.g., a baseline risk assessment, additional data collection and evaluation).

The data included in the risk evaluation were validated in accordance with the *Munitions Response Program Master Project Plan* (CH2M HILL 2008a). The validated data were then evaluated to determine the reliability of the data for use in the HHRS. A review of the data identified the following criteria for data usability:

- Estimated values flagged with a J (or J-) qualifier were treated as detected concentrations
- For duplicate samples, the maximum concentration between the two samples was used as the sample concentration

The data evaluated in the risk screening are discussed in more detail in **Section 4.1**.

5.1 Human Health Conceptual Site Model

The human health conceptual site model (CSM) presents an overview of site conditions, potential contaminant migration pathways, and exposure pathways to potential receptors. The human health CSM for surface soil, surface water, and sediment is presented on **Figure 5-1**. **Section 2** presents the site history and setting.

Potential current receptors include visitors, trespassers, military personnel that use the site for troop training, and maintenance workers. The current receptors may come in contact with surface soil, surface water, and sediment. Exposure routes may include incidental ingestion of and dermal contact with the surface soil, surface water, and sediment, as well as inhalation of particulate emissions from the surface soil. Based on the site history, volatile organic compounds (VOCs) were not used at Site UXO-12/UXO-18; therefore, inhalation of VOC emissions from site media is not a potentially complete exposure route.

Future site use is not expected to change significantly from current site use; therefore, potential future receptors include current receptors, and construction workers who perform any future construction projects at the site as well as possible industrial/Base workers. Additionally, although unlikely, future residents are included as a worst-case scenario to evaluate unrestricted future site use. Exposure routes for future exposure to the surface soil are the same as those for current surface soil, incidental ingestion of and dermal contact with the soil, and inhalation of particulate emissions from the soil. The construction worker could also be exposed to surface water and sediment, through incidental ingestion and dermal contact.

5.2 Human Health Risk-Based Screening and Risk Ratio Evaluation Methodology

The HHRS was conducted in three steps using a risk ratio technique (Navy, 2000). If COPCs were identified after Step 1, the COPCs were evaluated in Step 2. If COPCs were identified after Step 2, the COPCs were evaluated in Step 3. The three-step screening process is described below:

5.2.1 Step 1

The maximum detected analyte concentrations for each medium were compared to USEPA RSLs (USEPA, 2010) and other HHRS levels (if appropriate). The soil data were also compared to twice the mean Base background concentrations (Baker, 2001). No background values were available for surface water or sediment. RSLs based on noncarcinogenic effects were divided by 10 to account for exposure to multiple constituents (i.e., were adjusted to a hazard quotient [HQ] of 0.1, from the HQ of 1.0 used on the RSL table). RSLs based on carcinogenic endpoints were used as presented in the RSL table and are based on a carcinogenic risk of 1×10^{-6} .

The surface soil and sediment data were compared to residential soil RSLs and industrial soil RSLs. Residential soil RSLs are more conservative (i.e., lower) than industrial soil RSLs and are therefore protective of all potential receptors (e.g., residents, industrial workers, construction workers). NC SSLs are also shown on the Step 1 screening tables for comparison.

The surface water data were compared to the North Carolina surface water standards for human health and water supply (if available), or NRWQC for human health (water and organisms criteria). Lead concentrations in surface water were also compared to the federal action level for drinking water of 15 $\mu\text{g}/\text{L}$ (USEPA, 2002).

If the maximum detected concentration in soil, surface water, or sediment exceeded the appropriate screening value and background concentration, the screening level risk evaluation proceeded to Step 2.

In addition to comparing the detected concentrations to the screening levels, the detection limits for non-detected analytes were compared to the screening levels. Non-detected analytes with detection limits exceeding the screening level were not identified as COPCs to carry forward to Step 2, but were discussed to evaluate the potential for underestimating the total risks.

5.2.2 Step 2

For analytes identified as COPCs in Step 1, a corresponding risk level was calculated using the following equation:

$$\text{corresponding risk level} = \frac{\text{concentration} \times \text{acceptable risk level}}{\text{RSL}}$$

The concentration is the maximum detected concentration (the same concentration that was used in Step 1). The acceptable risk level is 1 for noncarcinogens and 10^{-6} for carcinogens. RSLs for noncarcinogenic effects were not adjusted by 10 as was done in Step 1, they are used as presented in the RSL table.

All of the corresponding risk levels for each analyte within a medium were summed to calculate the cumulative corresponding hazard index (HI) (for noncarcinogens) and cumulative corresponding carcinogenic risk (for carcinogens). A cumulative corresponding HI was also calculated for each target organ/effect. If the cumulative corresponding HI for a target organ/effect is greater than 0.5, or the cumulative corresponding carcinogenic risk is greater than 5×10^{-5} , the analytes contributing to these values are retained as COPCs and carried forward to Step 3.

5.2.3 Step 3

A corresponding risk level was calculated as discussed above for Step 2; however, the 95 percent upper confidence limit (UCL) was used in place of the maximum detected concentration, if more than five samples were available for that medium, to obtain a more site-specific risk ratio. If the cumulative corresponding HI by target organ/effect is greater than 0.5, or the cumulative corresponding carcinogenic risk is greater than 5×10^{-5} , then constituents contributing to these values are considered COPCs.

ProUCL Version 4.00.04 (USEPA, 2009b) was used to test the data distribution and calculate 95 percent UCL used for the Step 3 risk ratio calculations.

5.3 Human Health Risk Screening Results

The human health risk-based screening (comparison to risk-based criteria and background levels, Step 1) and risk ratio evaluation (Steps 2 and 3) were performed for surface soil, surface water, and sediment. Based on historic site use, samples were analyzed for selected metals only (antimony, arsenic, copper, lead, and zinc).

5.3.1 Surface Soil Risk Screening

Tables E.1 and E.1a, **Appendix E**, present the risk-based screening and risk ratio evaluation for surface soil. As shown on Table E.1 in **Appendix E**, arsenic was the only constituent in surface soil that exceeded the risk-based screening level and background concentration and was identified as a COPC in Step 1. Based on Step 2 of the screening process (Table E.1a, **Appendix E**), arsenic was eliminated as a COPC. Although the site is large (about 176 acres) and combining all of the surface soil data into one exposure unit may not be appropriate, both steps of the screening were performed using the maximum detected concentration, representing the highest potential exposure at the site. Therefore, exposure to surface soil would not pose any unacceptable risks, and further evaluation of surface soil based on human health risks is not necessary.

5.3.2 Surface Water

Table E.2, **Appendix E** presents the risk-based screening for surface water. As shown on Table E.2, **Appendix E**, there were no analytes detected in surface water at concentrations exceeding the screening levels. Therefore, exposure to surface water would not result in any

unacceptable human health risks, and no further evaluation of surface water is required based on potential human exposure.

5.3.3 Sediment

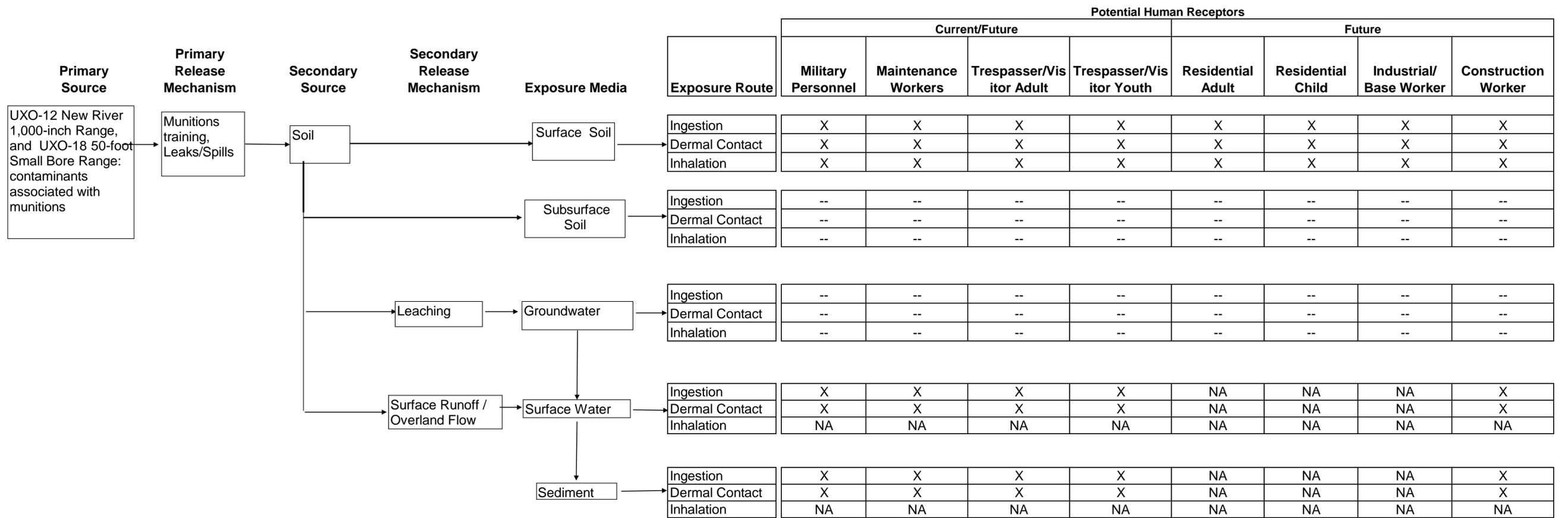
Tables E.3 and E.3a, **Appendix E**, present the risk-based screening and risk ratio evaluation for sediment. As shown on Table E.3, **Appendix E**, arsenic exceeded the first step of the screening and was identified as a COPC for evaluation in Step 2. Based on Step 2 (risk ratio using maximum detected concentration, Table E.3a, **Appendix E**), arsenic was eliminated as a COPC. Therefore, exposure to sediment would not result in any unacceptable human health risks, and no further evaluation of sediment is required based on potential human exposure.

5.3.4 Non-detected analytes

Antimony was the only non-detected analyte in surface soil and surface water, however the detection limit was below screening value. There were no non-detected constituents in sediment. Based on this evaluation, there are not expected to be any non-detected analytes present at the site that would result in unacceptable risks, or changes to the results of the HHRS evaluation.

5.4 Human Health Risk Screening Summary

The HHRS at Site UXO-12/UXO-18 indicated that exposure to the target analytes (selected metals) in surface soil, surface water, and sediment would not result in any COPCs, or any potentially unacceptable risks to human health; therefore, based on the evaluation of the target analytes, unrestricted future site use would be acceptable.



NA - Not Applicable or pathway is incomplete
 X - Potentially complete exposure pathways
 -- = Exposure media is present, however samples not collected from this media since low surface soil contamination found. Therefore, pathway not evaluated in risk assessment.

Generated by: Martha White
 Checked by: Renee Clore

FIGURE 5-1
 Conceptual Site Model for Human Health Risk Screening
 Site UXO-12/UXO-18 Preliminary Assessment/Site Inspection
 MCB CamLej
 North Carolina

Ecological Risk Screening

6.1 Introduction

An ecological risk screening (ERS) was conducted for Site UXO-12/UXO-18. Surface soil, sediment, and surface water analytical results were screened against benchmarks intended to be protective of ecological receptors. The sediment and surface water data considered in the screen were collected in 2010, while surface soil data were collected in 2009 and 2010.

6.2 Site Ecological Setting and Available Data

Site UXO-12/UXO-18 is predominately wooded land located east of U.S. Highway 17 and north of Curtis Road. A small portion of the site also lies south of Curtis Road. Surface soil samples were collected from various locations throughout the site. Several small drainages and wetland areas occur in the northern and central areas of the site and discharge into Southwest Creek. Surface water and sediment samples were collected from these drainage areas. Surface water at this site is considered freshwater.

A total of 128 surface soil samples were collected (plus 13 duplicates) from 0-1 foot bgs , and 10 co-located surface water and sediment samples (plus one duplicate) were collected within the drainages onsite. All samples were analyzed for antimony, arsenic, copper, lead, and zinc. Dissolved concentrations of these analytes were also available for surface water samples.

6.3 Ecological Risk Screening Methodology

For each medium (surface soil, sediment, and surface water), the maximum and arithmetic mean concentrations are presented along with representative ecological screening values (ESVs) intended to be protective of ecological receptors. HQs were calculated by dividing these statistics by the ESVs. It should be noted that ESVs for inorganics in water are generally based on dissolved concentrations and comparing them to total metals concentrations is conservative and may over-represent risk.

For locations with multiple data points (i.e., a parent and duplicate sample were available), data were reduced to the value of the greatest detected concentration or highest detection limit if there was no detection. One half of the detection limit was used for nondetects as the representative concentration when determining mean values.

For soil, the USEPA Ecological Soil Screening Levels (EcoSSL) (USEPA, 2009c) were preferentially selected over USEPA Region 4 values (USEPA, 2001). When no EcoSSL was available for a constituent, the USEPA Region 4 value was selected.

A selection hierarchy was also applied to surface water. The NRWQC were preferentially selected over the USEPA Region 4 value (USEPA, 2001). However, when no NRWQC was available for a constituent, the USEPA Region 4 value was selected as the ESV for that

constituent. Freshwater screening values were selected for the surface water analysis. For sediment, USEPA Region 4 values were used.

As part of the ERS, surface soil background concentrations were compared to site-specific media concentrations. Additional lines of evidence in the evaluation include the frequency of detection, frequency of exceedance, magnitude of exceedance, and identification of potential laboratory contaminants.

6.4 Ecological Risk Screening Results

This section addresses constituents that were detected and had available ESVs based on the selection hierarchy discussed above. Non-detected constituents are not expected to pose a risk to ecological receptors. Table F-1 in **Appendix F** presents the surface soil screening, Table F-2 in **Appendix F** presents the sediment screening, and Table F-3 in **Appendix F** presents the surface water screening.

6.4.1 Surface Soil

Copper and lead were the only target analytes detected with concentrations in excess of ESVs (Table F-1, **Appendix F**). Copper had a low frequency of exceedance (1/128 samples; less than 1 percent) and the mean HQ was less than one. Lead concentrations exceeded the MCB CamLej background range (0.45 to 38.5 mg/kg) in only 1 of 28 samples, suggesting that lead concentrations over the majority of the site are consistent with background. Additionally, the mean HQ for lead was less than one. Consequently, both constituents are not expected to pose a risk to ecological receptors.

6.4.2 Sediment

Copper and lead were the only target analytes detected at concentrations in excess of ESVs (Table F-2, **Appendix F**). Copper had a low magnitude of exceedance (HQ = 2.83), low frequency of exceedance (only 1 out of 10 samples exceeded the ESV), and the mean HQ was less than one, indicating that a risk to ecological receptors is unlikely. Lead concentrations exceeded the ESV in two samples (SD04 and SD05) collected from within the same drainage. These samples were collected adjacent to surface soil sample MR18-SS13 which contained the maximum lead concentration (86.1 mg/kg). This area is well characterized and while lead concentrations in sediments were slightly elevated, the spatial extent was limited and risks to ecological receptors are not expected to be significant. Furthermore, the mean concentration of lead in sediment only slightly exceeded the ESV (HQ = 1.02). It is also important to consider that lead concentrations in the onsite surface soil had a low frequency and magnitude of exceedance and appeared to be generally consistent with background. Lead concentrations would be expected to be slightly higher in sediment from runoff accumulation over time.

6.4.3 Surface Water

None of the detected constituents had concentrations in excess of ESVs (Table F-3, **Appendix F**).

6.5 Ecological Risk Screening Summary

Based on the available data, no significant risks to populations of ecological receptors were identified.

Conclusions and Recommendations

This section presents the conclusions and recommendations from the Site UXO-12/UXO-18 PA/SI.

7.1 Conclusions

Lead is generally the primary metals constituent observed at elevated concentrations at small arms range sites. At UXO-12/UXO-18, concentrations of copper, lead, and zinc exceeded twice the mean Base background concentration, where applicable, at some surface soil, sediment, and surface water sample locations but did not exceed regulatory screening criteria. Arsenic was the only target analyte detected in surface soil, sediment, and surface water at concentrations exceeding regulatory screening criteria and Base background concentrations. However, arsenic exceedances were of a similar order of magnitude throughout the site with no areas of elevated metals concentrations that would be consistent with the spatial distribution of metals impacts anticipated for former small arms range activity. Additionally, elevated lead concentrations would be expected to coincide with elevated arsenic concentrations on small arms range impacted sites, which was not observed at this site.

Based on the results of the surface soil sampling effort, subsurface soil and groundwater sampling were determined to be unnecessary considering that surface soil results did not exceed the NC SSLs; indicating that leaching of metals constituents to subsurface soil and groundwater was unlikely.

A HHRS including a risk ratio evaluation was performed based on surface soil, sediment, and surface water results. Results of the HHRS indicate that there are no unacceptable risks identified for current or likely future receptors exposed to site media.

An ERS was performed based on surface soil, sediment, and surface water results. Results of the ERS indicate that there are no unacceptable risks identified for ecological receptors exposed to site media.

7.2 Recommendations

The environmental investigation was conducted to evaluate the presence of MC contamination and to evaluate potential risks to human health and ecological receptors within the Site UXO-12/UXO-18 investigation area. The HHRS and the ERS conducted for the PA/SI concluded that surface soil, sediment, and surface water are not anticipated to pose any unacceptable risk to human health or ecological receptors; therefore, no further evaluation at Site UXO-12/UXO-18 is recommended and the sites are recommended for closure and removal from the MMRP.

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Appendix A
Archival Records Search Report

Final

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

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

Contract Task Order 040

March 2011

Prepared for

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Naval Facilities Engineering Command
Mid-Atlantic**

Under the

**NAVFAC CLEAN 1000 Program
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Prepared by



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Charlotte, North Carolina

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- 2 Historical Aerial Photographs

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- 1-2 UXO-12/UXO-18 Range Area Map
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- 2-13 UXO-12/UXO-18 (Plates 3, 4) Overlay Map - 1942-1946

Acronyms and Abbreviations

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

SECTION 1

Introduction, Purpose, and Scope

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

The results of the environmental investigation will determine if any impacts to soil and groundwater have occurred at the UXO-12/UXO-18 investigation area due to past range activities. To support site investigation effort, this archival records search report has been prepared to provide a narrative of the historical activities at the UXO-12/UXO-18 investigation area that may have resulted in environmental contamination with munitions of explosive concern (MEC).

The Archival Records Search Report is an investigative review of existing information about the site and its surrounding area, with an emphasis on obtaining information from personnel and historical resources that might indicate a potentially hazardous release to the environment. **Figure 1-2** shows the site boundary in relation to the surrounding areas where previous environmental investigations have been completed.

The scope of this report includes:

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

A complete listing of resources identified and investigated for this report is provided in **Attachment 1**. **Attachment 1** also includes details concerning the reviews of the historical information from the Alfred M. Gray Research Center at MCB Quantico, National Archives and Records Administration (NARA) map and text files, and MCB Camp Lejeune files. **Attachment 2** contains historical aerial photographs from 1946 to 1951 obtained during the research activities (MCB Quantico, 1946; 1948; 1951).



Legend

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

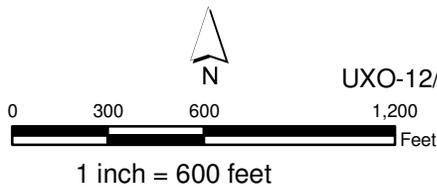


Figure 1-1
Site Map
UXO-12/UXO-18 Archival Records Search Report
MCB Camp Lejeune
North Carolina





Legend

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

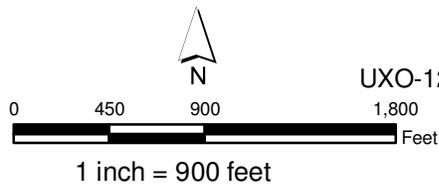


Figure 1-2
 UXO-12/UXO-18 Area Map
 UXO-12/UXO-18 Archival Records Search Report
 MCB Camp Lejeune
 North Carolina



Site Information

2.1 Facility Information

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

2.2 Ownership History

2.2.1 Camp Lejeune Ownership History

The history of the land now occupied by Camp Lejeune is documented primarily through land records and maps. Following the start of World War II (WW II), the War Department began purchasing tracts of land in 1941 from local residents to meet the need for an East Coast amphibious training facility. Prior to occupation by the Marine Corps, the land had been occupied by white and African-American communities and farms since the Colonial era. The land contained plantation houses, cabins, farm buildings, tobacco barns, stores, and various cemeteries (Global Security, 2008).

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

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

2.3 Site Description

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

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

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

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

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

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

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

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

2.4 Operational History

2.4.1 Review of Historical Aerial Photographs and Site Maps

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2.4.5 Current Site Conditions

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

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

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

2.5 Previous Investigations

2.5.1 Solid Waste Management Units

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

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

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

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

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

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

2.5.2 Site 35, Former Camp Geiger Fuel Farm

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

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

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

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

2.5.4 Site 40

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

2.5.5 Site UXO-05

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

SECTION 3

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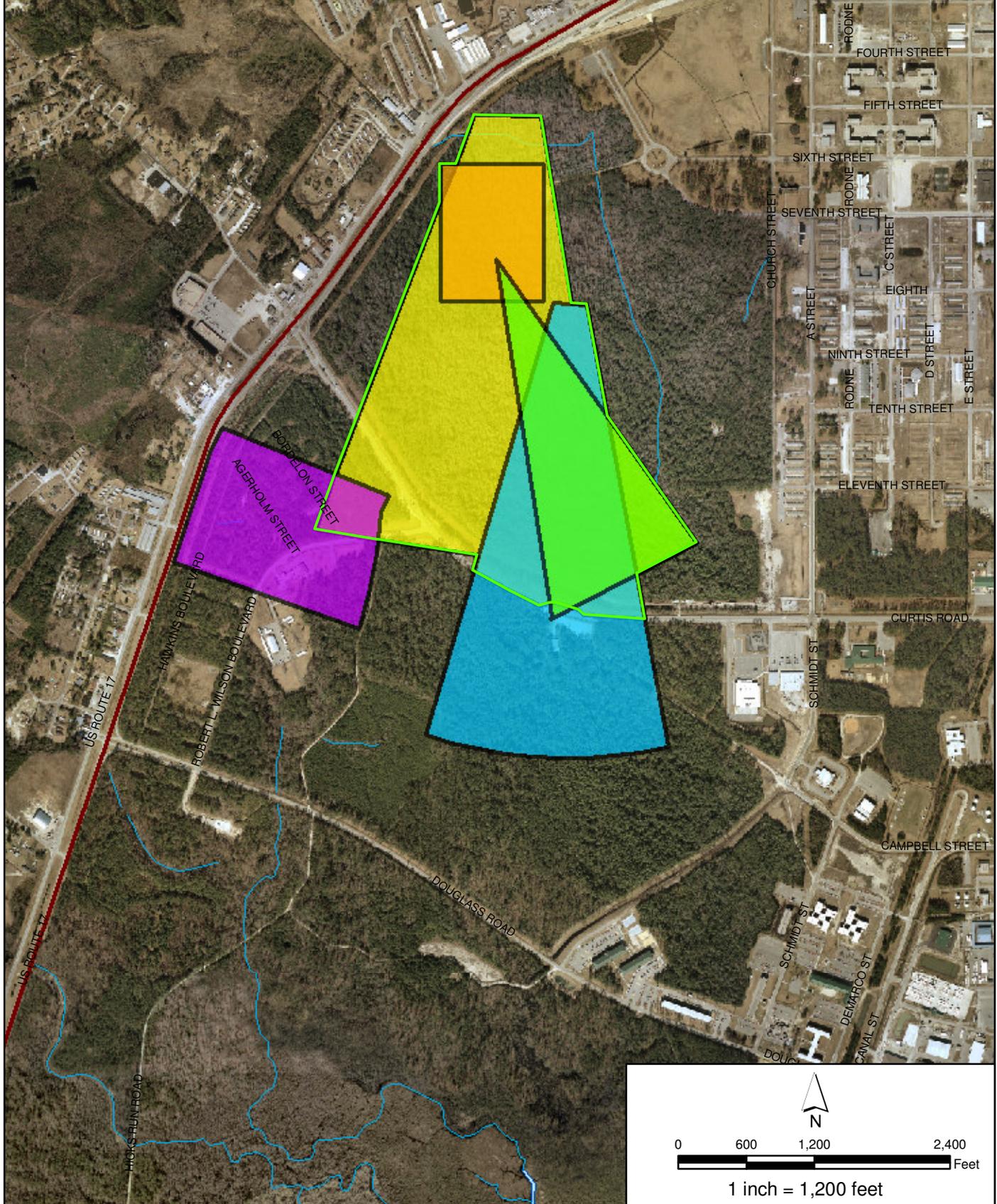
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Legend

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

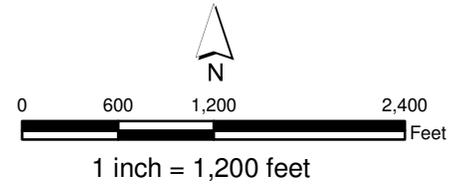


Figure 2-2
 Historical Range Fan Boundaries
 UXO-12/UXO-18 Archival Records Search Report
 MCB Camp Lejeune
 North Carolina



50 Foot
Small Arms
Range

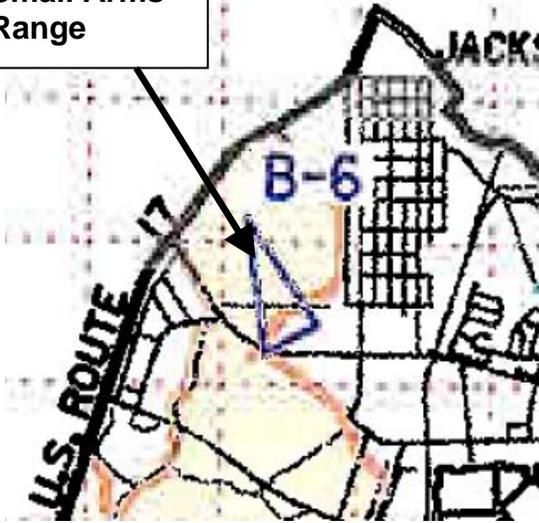


Plate 5 (1951)

1000 Inch
Range

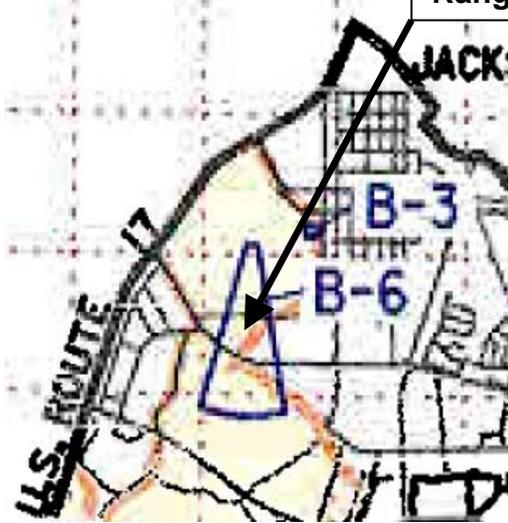


Plate 6 (1953)

50 Foot
Small Arms
Range

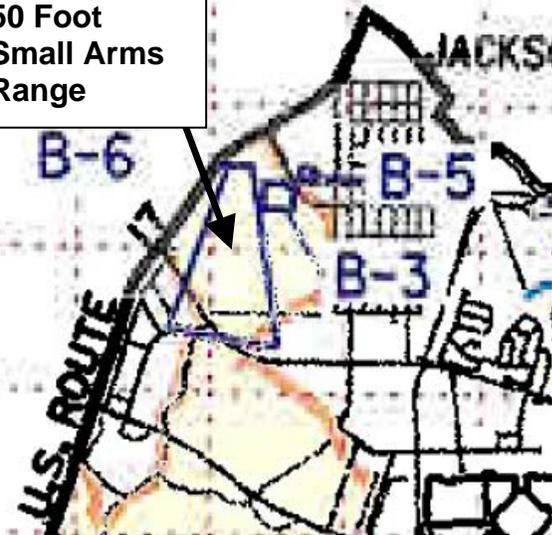
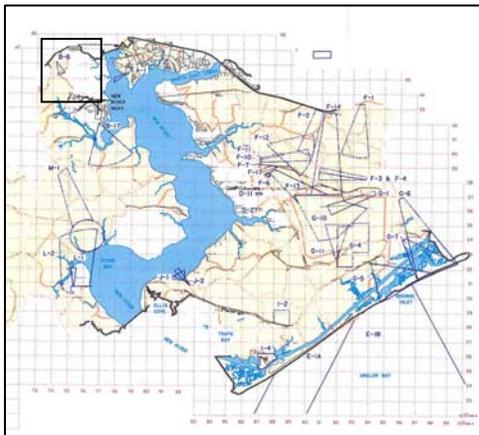


Plate 8 (1954)

50 Foot Small
Arms Range



Plate 10 (1958)



0 1000 2000



Approximate scale in
Meters

N

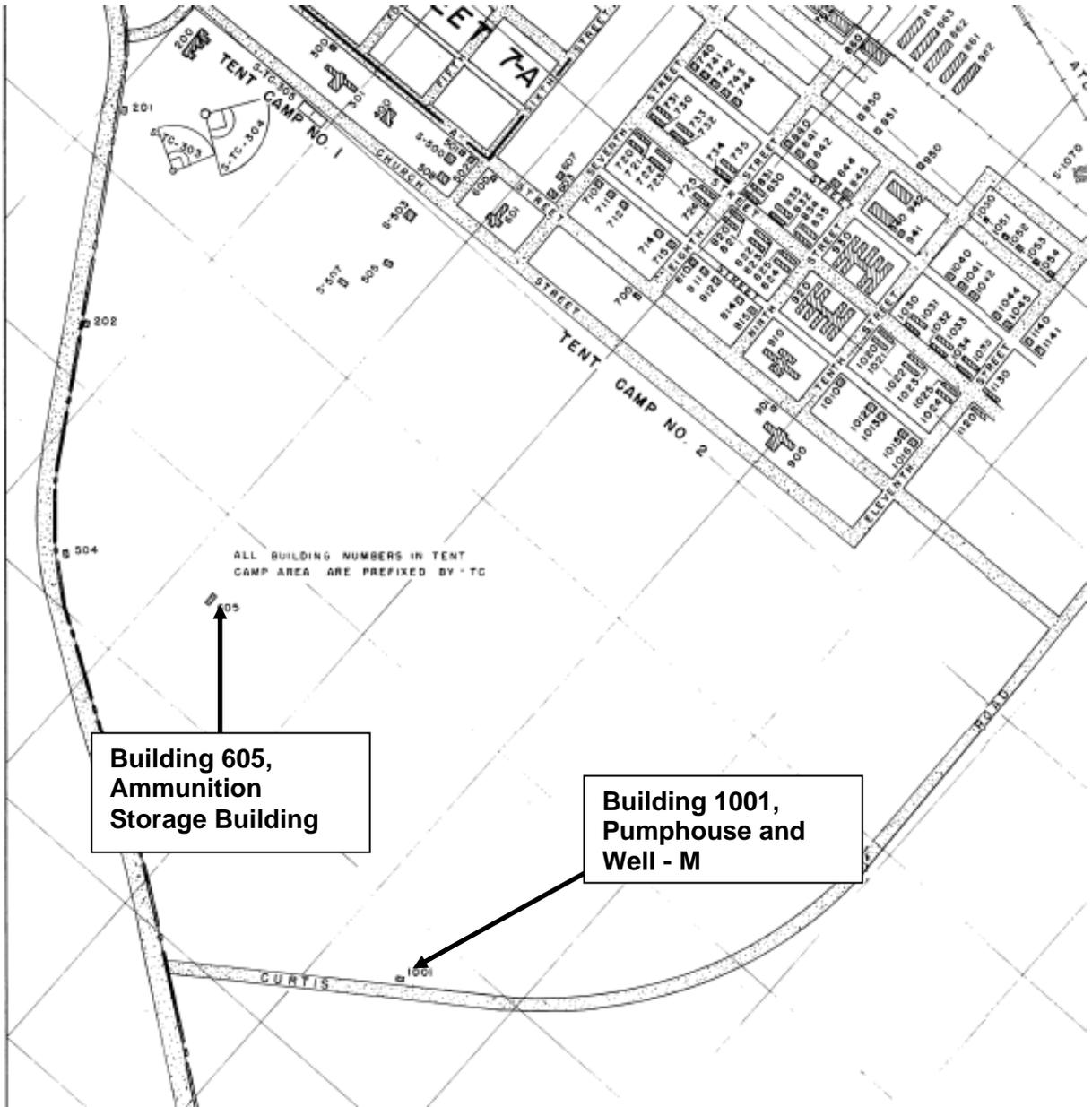


Figure 2-3
UXO-12/UXO-18 (Plates 5,6,8,10) Overlay Map – 1951,
1953, 1954, 1958
UXO-12/UXO-18 Archival Records Research Report
MCB Camp Lejeune
North Carolina

Source: USACE, 2000



CH2MHILL



0 1000 2000



Approximate Scale in Feet

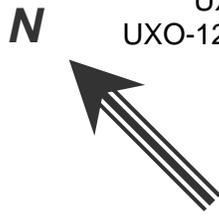
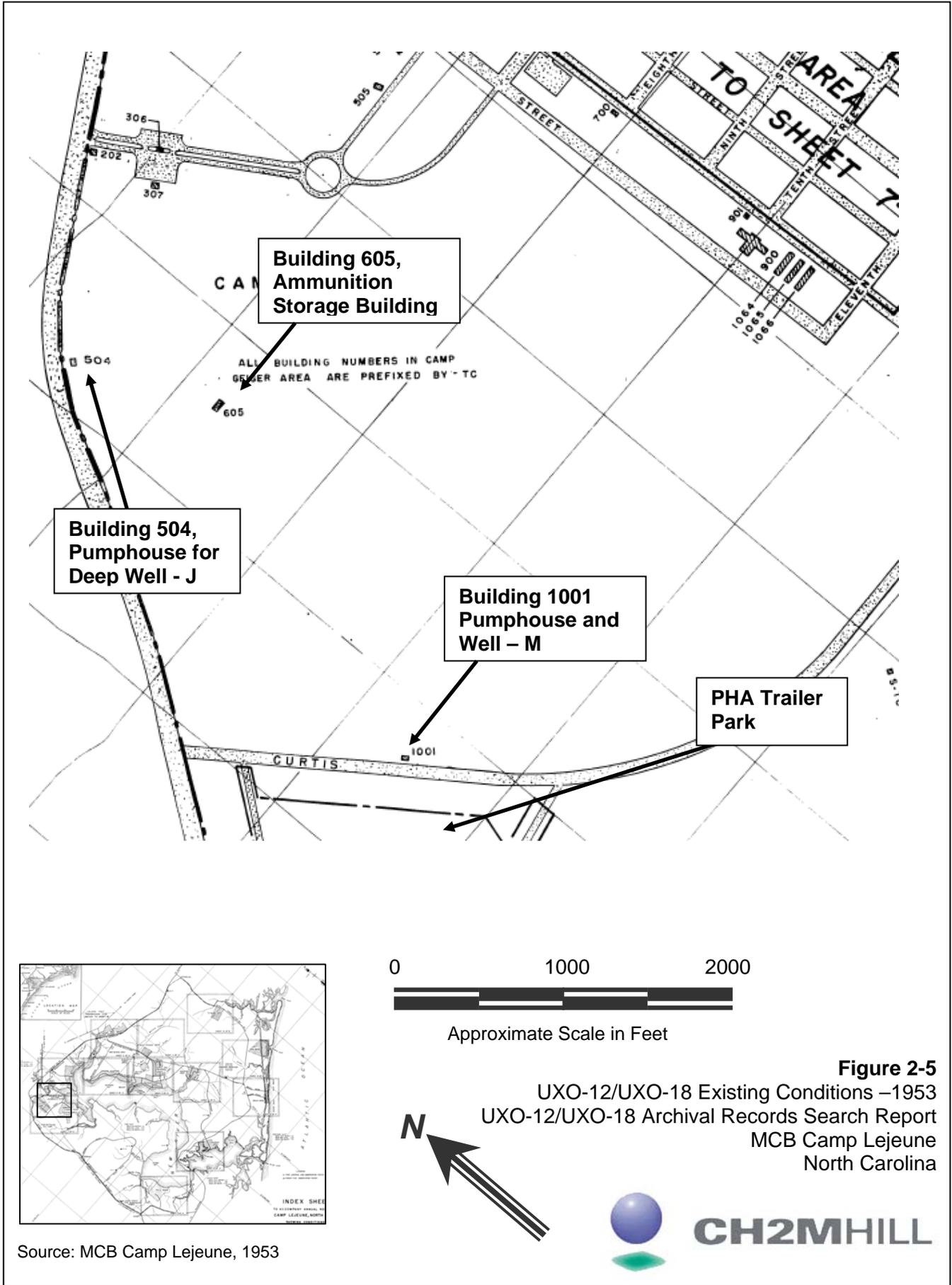
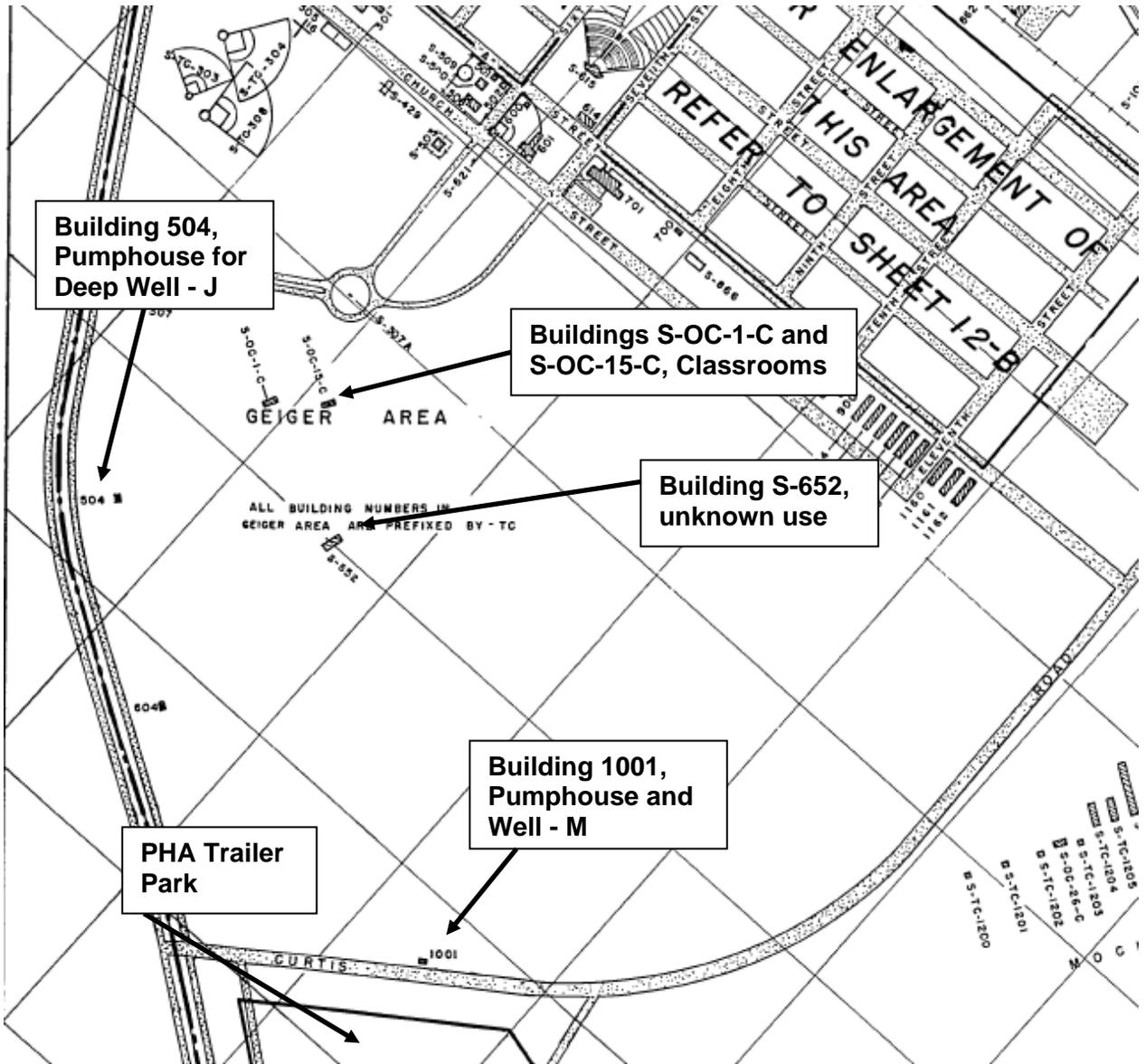


Figure 2-4
 UXO-12/UXO-18 Existing Conditions – 1949
 UXO-12/UXO-18 Archival Records Search Report
 MCB Camp Lejeune
 North Carolina



Source: MCB Camp Lejeune, 1949





Approximate Scale in Feet

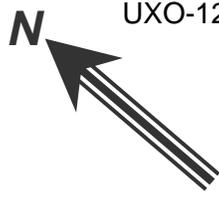
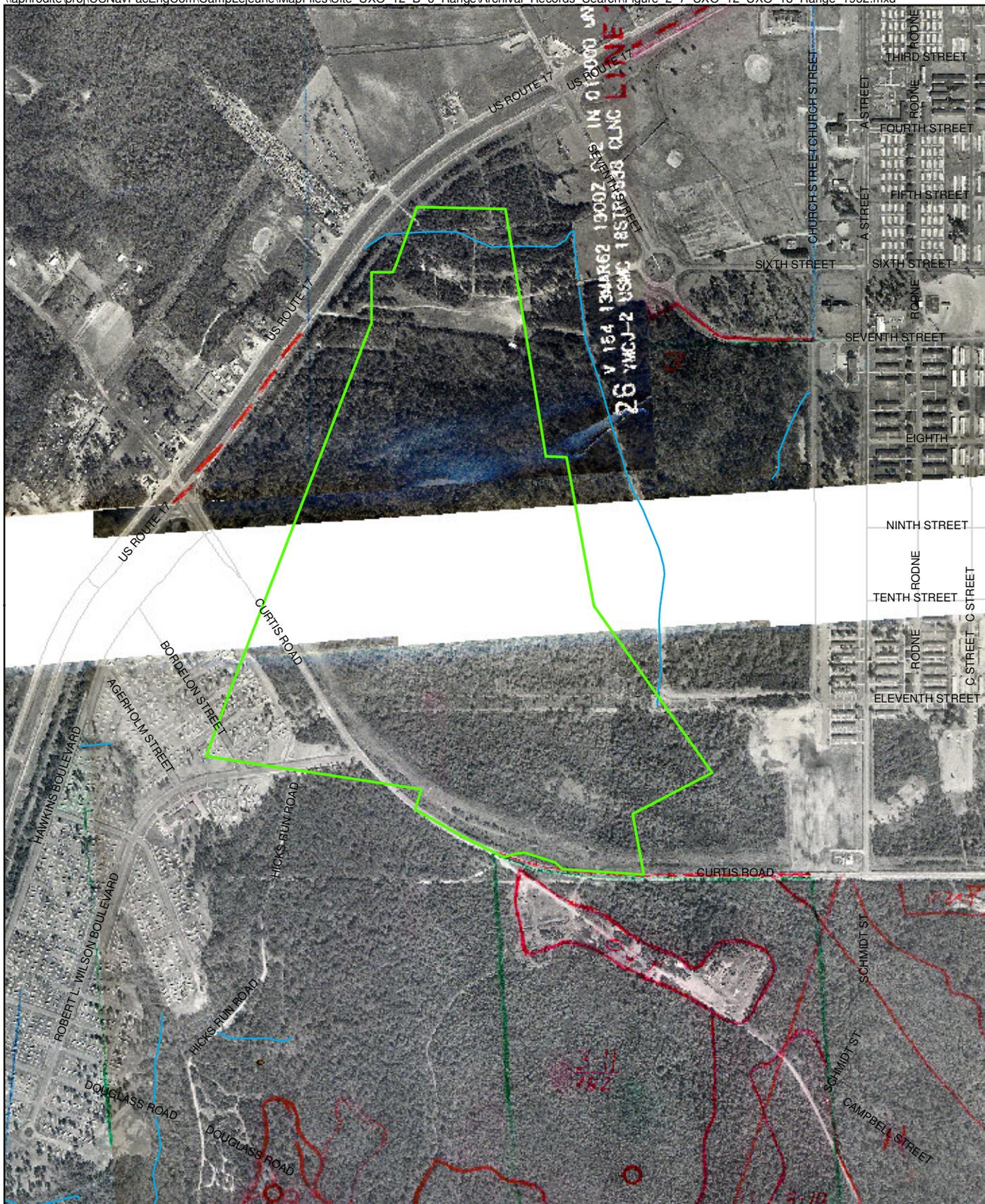


Figure 2-6
 UXO-12/UXO-18 Existing Conditions –1963
 UXO-12/UXO-18 Archival Records Search Report
 MCB Camp Lejeune
 North Carolina

Source: MCB Camp Lejeune, 1963





Legend

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

Note:

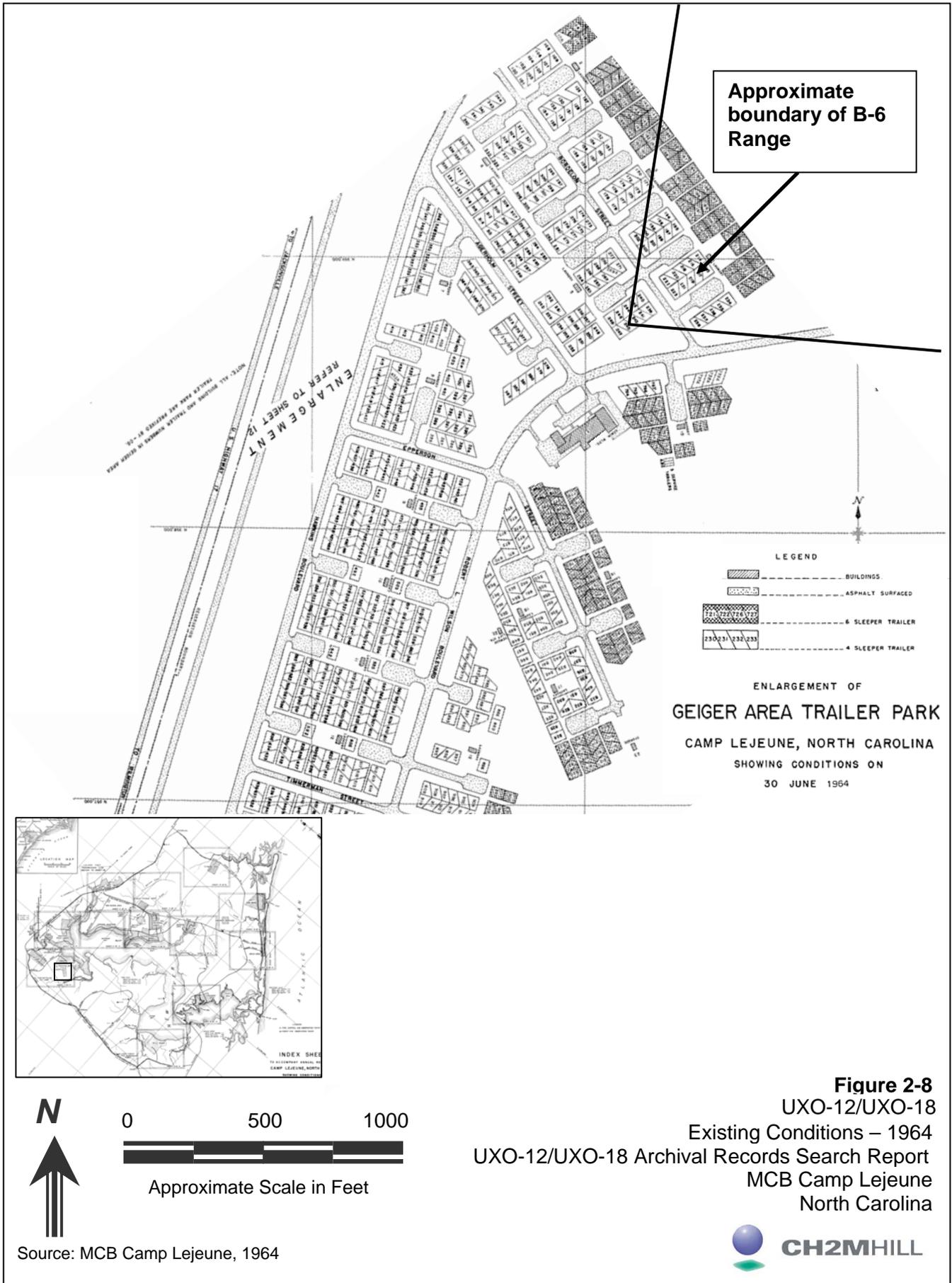
Historic 1962 imagery is unavailable on the white area in the above map.



1 inch = 900 feet

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





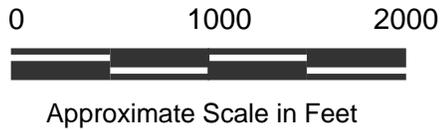
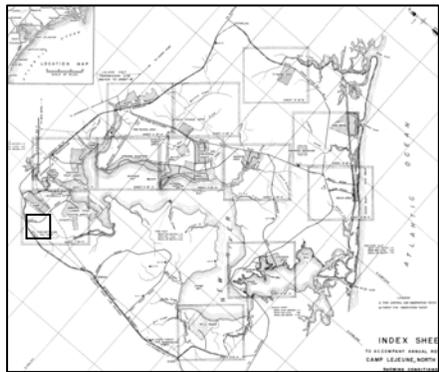
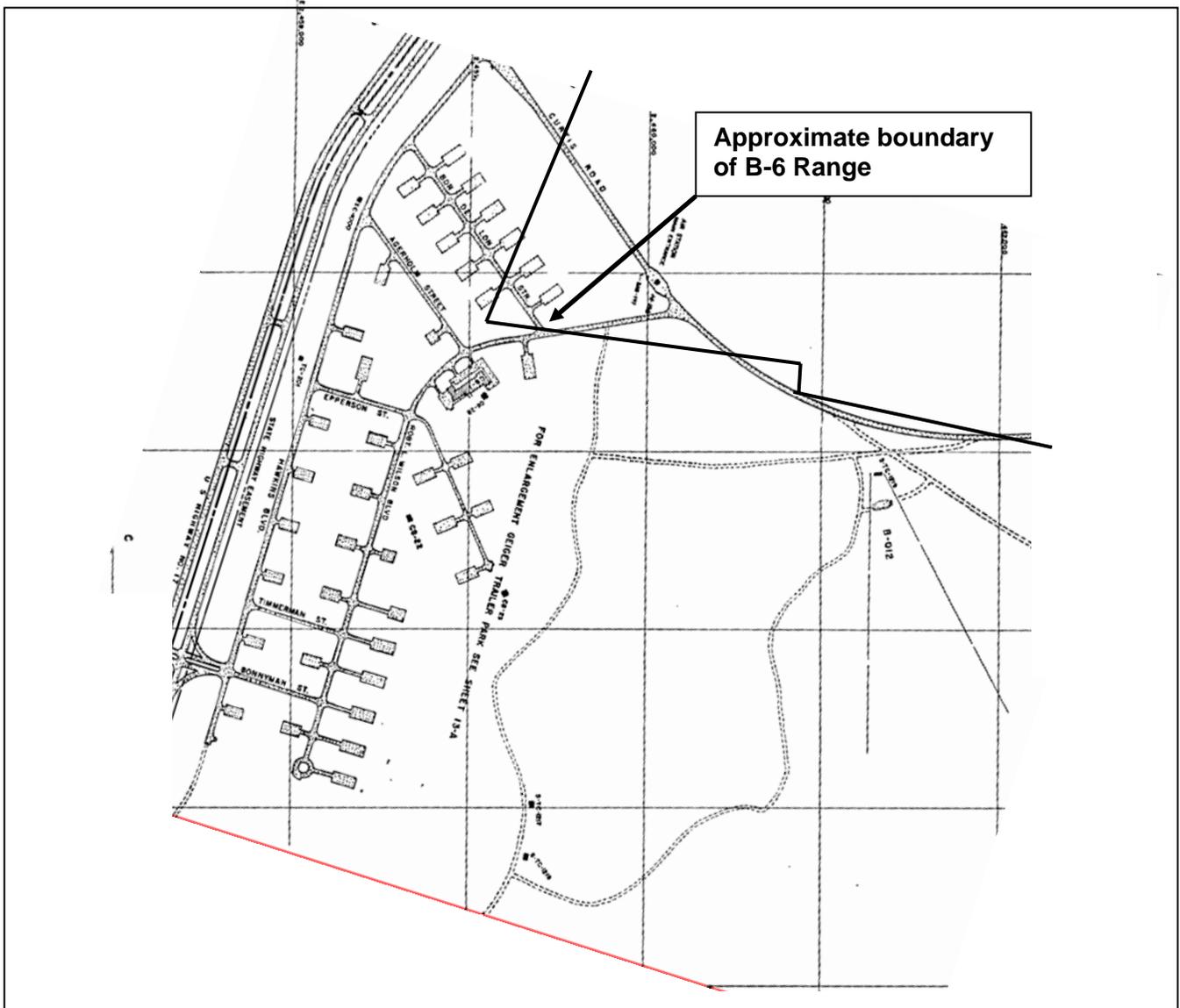


Figure 2-9
 UXO-12/UXO-18 Existing Conditions –1979
 UXO-12/UXO-18 Archival Records Search Report
 MCB Camp Lejeune
 North Carolina

Source: MCB Camp Lejeune, 1979





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

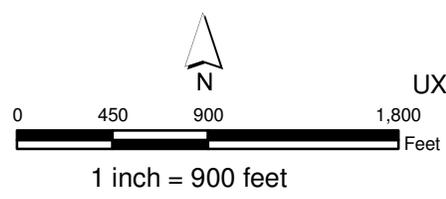
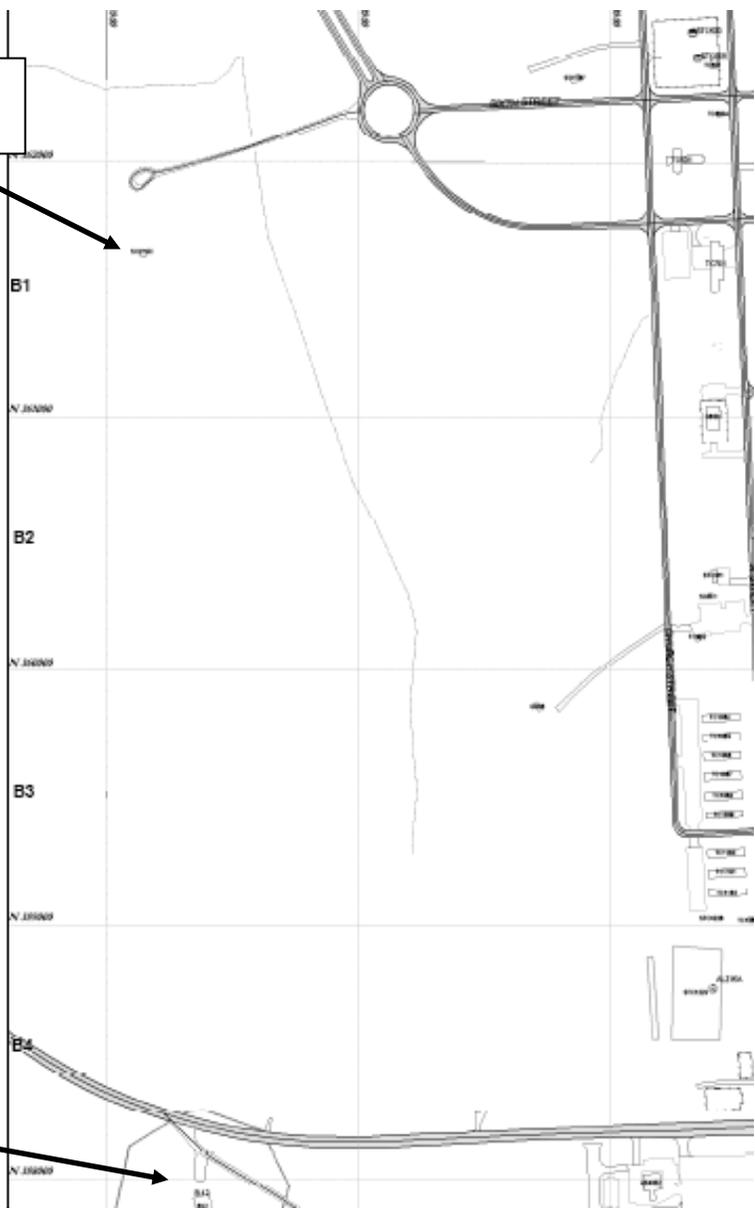


Figure 2-11
Historical Aerial - 1989
UXO-12/UXO-18 Archival Records Search Report
MCB Camp Lejeune
North Carolina



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



**B-12 Baffled
Pistol Range**



Source: MCB Camp Lejeune, 2005



Approximate Scale in Feet



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



Miniature Anti-Tank Range (UXO-05)

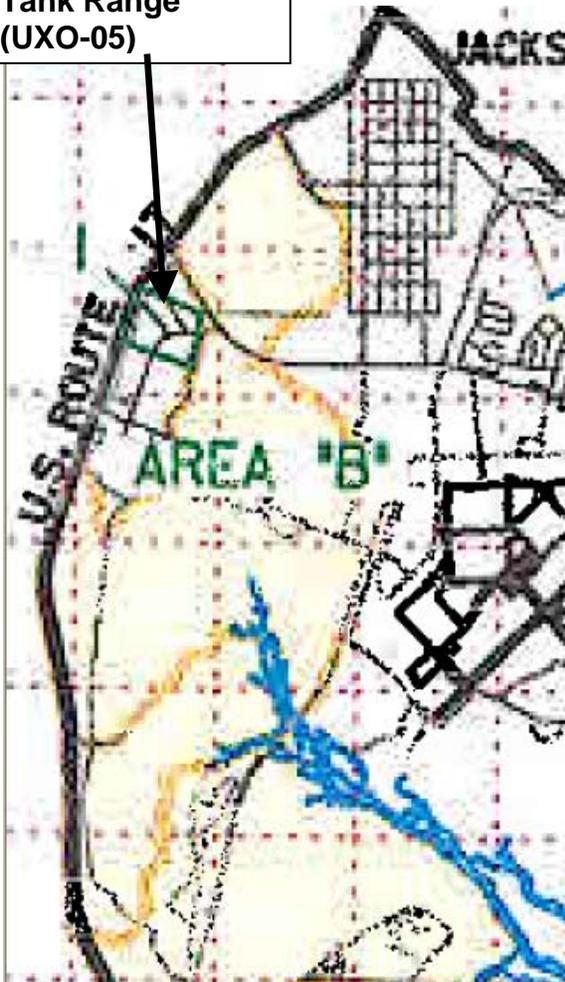


Plate 3 (1942)

1000 Inch Range (UXO-12)

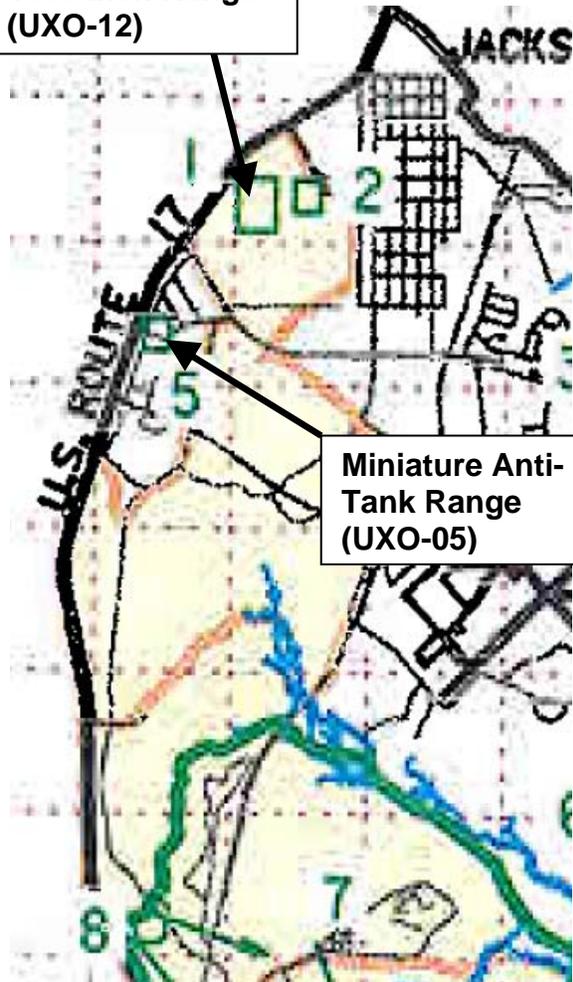
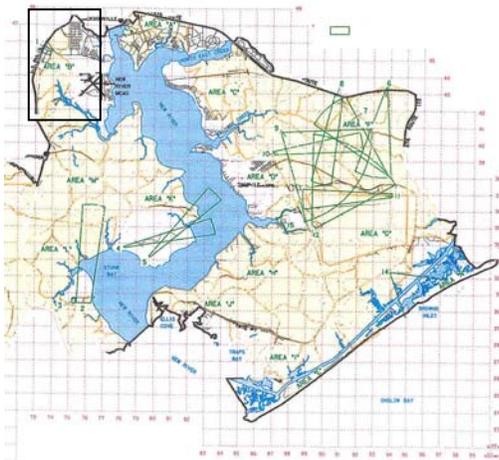


Plate 4 (1946)

0 1500 3000



Approximate scale in Meters



Source: USACE, 2000



CH2MHILL

Figure 2-13
UXO-12/UXO-18 (Plates 3, 4) Overlay Map – 1942-1946
UXO-12/UXO-18 Archival Records Search Report
MCB Camp Lejeune
North Carolina

Attachment 1
Resource Review Summary

Resource Review Summary

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

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

Marine Corps Library Review

Text Division

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

Site Visit: November 12, 2008

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

No pertinent documents were obtained from the file review; however, maps showing the subject site were reviewed and copied.

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

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

National Archives and Records Administration Review

Text Division

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

Site visit on November 14, 2008

Reviewed 5 boxes of files associated with the Marine Corps, 1939-1950

- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 1275/70-800 (10/45-1/47) to 1275/70-727 (1/44-12/47), Box 218.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 1275/70-800 (10/44-1/45) to 1275/70-800 (7/45-9/45), Box 219.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2295-10 Brooklyn to 2285-10 Camp Lejeune, Box 1570.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2295-10 Camp Lejeune to 2285-10 Camp Lejeune, Box 1571.
- Record Group 127 (USMC), Office of the Commandant, General Correspondence, January 1939-June 1950, 2295-10 Camp Lejeune to 2285-10 Camp Lejeune, Box 1572.

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

List of Documents Obtained from National Archives

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

MCB Camp Lejeune Base Site Visit and Records Review

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

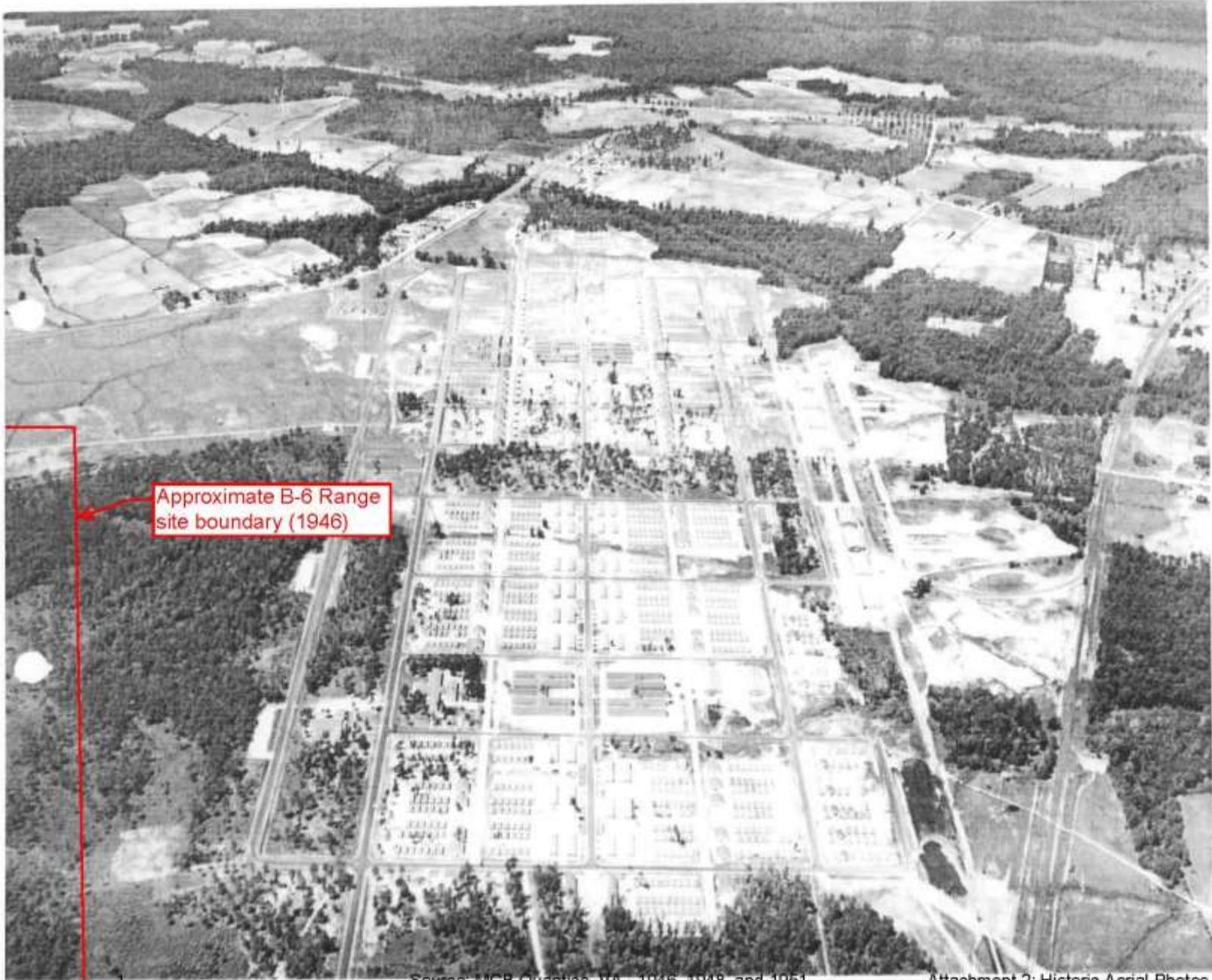
Interviews were conducted with Bob Lowder/Environmental Manager, Anna Watts/Technical Records, Carl Baker/Technical Records, and Duane Richardson/EOD Base Range Safety Officer (910-451-1240) on October 1, 2008.

List of Documents Obtained from Camp Lejeune

Base Library

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

Attachment 2
Historical Aerial Photographs

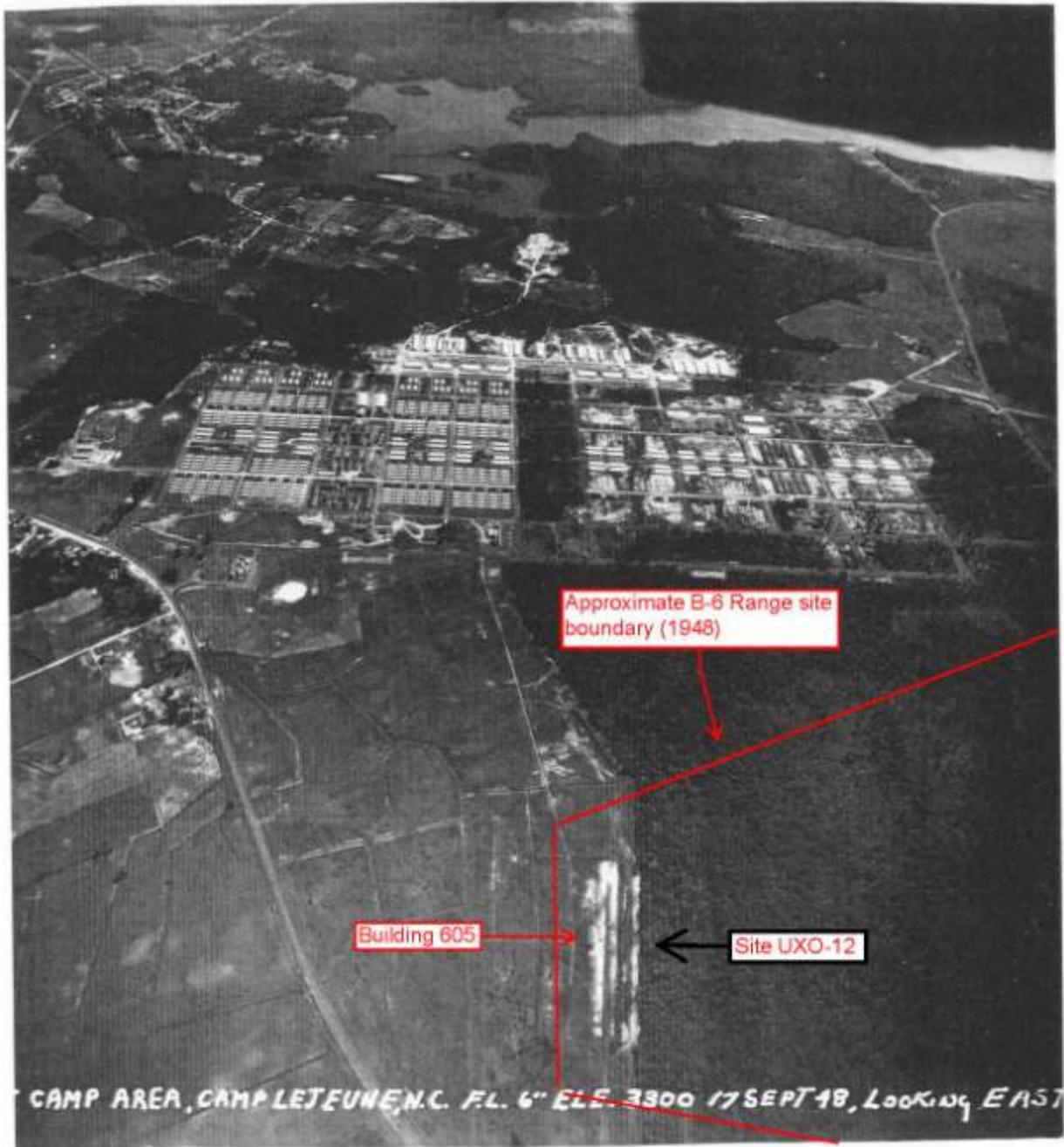


Approximate B-6 Range site boundary (1946)

Source: MCB Quantico, VA, 1946, 1948, and 1951.

Attachment 2: Historic Aerial Photos





TENT



Appendix B
Munitions Response Site Identification and
Notification Report

**MUNITIONS RESPONSE SITE
IDENTIFICATION AND NOTIFICATION REPORT**

Instructions: Project managers shall complete all blocks in this report and enclose it in a letter or memo, fax it, or attach it to a digitally signed e-mail, and send to either:

NOSSA (N53) 4234 Steve's Way, Ste 121 Indian Head, MD 20640-5058 Fax: 301-744-6749 (DSN 354) E-mail: inhdnossa-ess@navy.mil	COMMARSYSCOM (PM AMMO) 2200 Lester Street Quantico, VA 22134-5010 Fax: 703-432-3160 (DSN 378) E-mail: explosivessafety@usmc.mil
---	---

Site name/number,
Activity, City,
State and ZIP code:

Site UXO-18 Former
New River 50 ft. Small
Bore Range (also
known as the B-6 50-ft.
Small Arms Range),
MCB Camp Lejeune,
North Carolina

Date
submitted:

November 6, 2009

Project manager:
Contact information

Bryan Beck
NAVFAC Atlantic
Phone 757-322-4734
brian.k.beck@navy.mil

EOD/UXO
contractor:
Contact
information

MCB Camp Lejeune
EOD

Site history:
Briefly describe
past site use with
respect to MEC or
MPPEH

The UXO-18 New River 50 ft. Small Bore Range historically has been known by several names, including the B-6, 50-Foot Small Arms Range, B-6, 50-Foot .22 Caliber Range, and the B-6, 1000-Inch Range (MG and .22 Caliber). According to the United States Army Corps of Engineers *Final Range Identification and Preliminary Range Assessment, Marine Corps Base Camp Lejeune (2001)*, personnel fired .22 caliber rifle and pistol rounds as well as .32, .38, and .45 caliber pistol rounds at this range. Additionally, two other small arms sites (UXO-05 and UXO-12) overlap the UXO-18 investigation area.

The *Final Range Identification and Preliminary Range Assessment* concluded that MEC was not known or suspected to be present as only small arms were reportedly used at UXO-18.

Work task/project
being performed and
MEC or MPPEH
encountered:
Quantity, type/
nomenclature, and
condition

A determination was made by MARCORSYSCOM (USMC, December 22, 2008) that an ESS was not necessary to conduct work at Site UXO-18. Land surveying and mechanical vegetation clearing activities were being performed at UXO-18 on October 21, 2009. During these activities, site personnel identified two suspected MPPEH items. The items were subsequently identified as an expended M29 3.5" practice rocket and an expended Signal, Illum, Ground.

Summary of actions
taken to date and
planned actions:

MCB Camp Lejeune Range Control was notified by CH2M HILL personnel. Camp Lejeune EOD responded to the project site and removed the items for disposal. The EOD incident report documenting this event is attached (MCB Camp Lejeune EOD, October 21, 2009).

Additional notifications were made to Mr. Bob Lowder (Camp Lejeune EMD), Mr. Bryan Beck (NAVFAC), and Mr. James Taylor (MARCORSYSCOM).

No additional MEC-related responses are planned. Work at the site will continue as planned; site activities include environmental sampling, including soil, sediment, surface water, and groundwater sample collection.

Note: MARCORSYSCOM concurrence that an ESS is not required must be obtained prior to resuming operations.

INCIDENT REPORT

Date of Incident: 21 Oct 09

Time of Incident: 1538

Name of Person Reporting Incident: Rachel Zajac

Contact Number of Person Reporting Incident: 919-946-8650

Location of Incident: NRAS UXO area #18, Behind EOD bldg

Nature of Incident: 3 ½ inch rocket found

Personnel Involved:

	RANK	L NAME	LAST 4 SSN	UNIT
1.	CIV	Rajac Rachel		Environmental Consulting, CH 2M-HILL

Remarks: 1538: Rachel Rajac with Environmental Consulting, CH 2M-HILL contacted BB and stated they found a 3 ½ inch rocket on NRAS at UXO area-18.

1540: BB contacts EOD and gave GySgt Blum Rachel Rajacs phone number and instructed GySgt Blum to call her. GySgt will contact BB after he investigates situation.

POC for Additional Info/Follow Up: GySgt Blum, EOD, 449-0558

Time/Name Notified Range Control Chain of Command:

1. Blackburn Supervisor: 1542, No further action required
2. Operations Officer:
3. Director Range Control:
4. Deputy Director Range Control:
5. Director AC/S G-3:
6. Deputy Director AC/S G-3:
7. Base Range Safety Officer:
8. Base Command Duty Officer:

Follow Up: 1620: GySgt Blum reports that EOD picked up a 3.5 inch Practice Rocket (pop-up flare). He stated that it would be transported to EOD site 2 and destroyed tomorrow.

RCDO: B.S. Brenneman

Appendix C
Data Validation Summary Reports

Project: Small Bore Range, MCLB Camp Lejeune (CTO-040)
Laboratory: Empirical Laboratories, LLC
Sample Delivery Group: 1002203
Fraction: Inorganic
Matrix: Aqueous
Report Date: 4/21/2010

This analytical quality assurance report is based upon a review of analytical data generated for surface water samples. One matrix spike/matrix spike duplicate sample, one field duplicate samples, two equipment blanks, and one field blank were submitted for this Sample Delivery Group. The sample locations, laboratory identification numbers, sample collection date, sample matrix, and analyses performed are presented in Table 1.

The samples were analyzed for total and dissolved metals. The sample analyses were performed in accordance with the procedures outlined in the method referenced at the end of this report.

All sample analyses have undergone an analytical quality assurance review to ensure adherence to the required protocols. Results have been validated or qualified according to general guidance provided in the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review", OSWER 9240.1-45 EPA 540-R-04-004, October 2004 and "Data Validation Standard Operating Procedures for Contract Laboratory Program Routine Analytical Services", USEPA Region IV, Revision 2.1, July 1999.

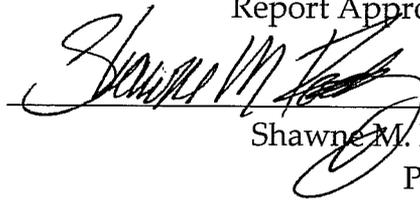
These documents specify procedures for validating data generated for CLP analyses. Therefore, the quality control requirements specified in the methods and associated acceptance criteria were also used to evaluate the non-CLP data. The parameters presented on the following page were evaluated.

-
- X • Data Completeness
 - X • Chain of Custody Documentation
 - X • Holding Times
 - X • Initial and Continuing Calibrations
 - X • ICP Interference Check Sample Results
 - X • Laboratory and Field Blank Analysis Results
 - X • Matrix Spike Recoveries and Reproducibility
 - X • Laboratory Duplicate Analysis Results
 - X • ICP Serial Dilution Results
 - X • Field Duplicate Analysis Results
 - X • Laboratory Control Sample Results
 - GFAA Post-Digestion Spike Recovery/Duplicate Burn Precision
 - X • Qualitative Identification
 - X • Quantitation/Reporting Limits
-

X - Denotes parameter evaluated.

It is recommended that the data only be used according to the qualifiers presented, and discussed in this report. All other data should be considered qualitatively and quantitatively valid as reported by the laboratory, based on the items evaluated.

Report Approved By:



Shawne M. Rodgers
President

4/21/2010

Date

1.0 DATA COMPLETENESS

The case narrative needed to be revised to explain the detection limit values presented on the Method Detection Limit (MDL) summary form. The laboratory was contacted and provided the revised case narrative.

2.0 CHAIN OF CUSTODY DOCUMENTATION

The chain of custody (COC) documentation was complete.

3.0 HOLDING TIMES

All criteria were met. No qualifiers were applied.

4.0 INITIAL AND CONTINUING CALIBRATIONS

All criteria were met. No qualifiers were applied.

5.0 ICP INTERFERENCE CHECK SAMPLE RESULTS

All criteria were met. No qualifiers were applied.

6.0 LABORATORY AND FIELD BLANK ANALYSIS RESULTS

All criteria were met. No qualifiers were applied.

7.0 MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERIES AND REPRODUCIBILITY

All criteria were met. No qualifiers were applied.

8.0 LABORATORY DUPLICATE RESULTS

All criteria were met. No qualifiers were applied.

9.0 ICP SERIAL DILUTION RESULTS

All criteria were met. No qualifiers were applied.

10.0 FIELD DUPLICATE RESULTS

Duplicate samples MR18-SW03-10A and MR18-SW03D-10A were submitted to the laboratory evaluate sampling and analytical precision for those analytes determined to be present. Results for these duplicate samples are presented in Tables 2 and 3. There are no USEPA-established acceptance criteria for field duplicate samples. EDQ uses internal an acceptance criterion of 25 percent for values greater than five times the reporting limit (RL) (or \pm the RL for results less than five times the RL).

11.0 LABORATORY CONTROL SAMPLE RESULTS

All criteria were met. No qualifiers were applied.

12.0 GFAA POST-DIGESTION SPIKE/DUPLICATE BURN

This parameter is not applicable to the analyses completed.

13.0 **QUALITATIVE IDENTIFICATION**

All criteria were met. No qualifiers were applied.

14.0 **QUANTITATION/REPORTING LIMITS**

As required by USEPA protocol, all analytes, which were qualitatively identified at concentrations below their respective RLs, have been marked with "J" qualifiers to indicate that they are quantitative estimates.

METHODOLOGY REFERENCES

Analysis	Reference
Metals	Method 6010B, "Test Methods for Evaluating Solid Wastes", SW-846, third edition, Promulgated Updates II, IIA, and III, June 1997

**Table 1 Samples For Data Validation Review
CTO-040 Camp Lejeune
Jacksonville, North Carolina
Empirical Laboratories Sample Delivery Group 1002203**

SAMPLE I.D.	LABORATORY I.D.	DATE COLLECTED	MATRIX	ANALYSES PERFORMED	
				METAL	FMETAL
MR18-SW03-10A	1002203-01	02/23/2010 08:35	Surface Water	X	
MR18-SW03-10A	1002203-02	02/23/2010 08:35	Surface Water		X
MR18-SW03D-10A	1002203-03	02/23/2010 08:40	Surface Water	X	
MR18-SW03D-10A	1002203-04	02/23/2010 08:40	Surface Water		X
MR18-SW01-10A	1002203-05	02/23/2010 09:55	Surface Water	X	
MR18-SW01-10A	1002203-06	02/23/2010 09:55	Surface Water		X
MR18-SW02-10A	1002203-07	02/23/2010 09:25	Surface Water	X	
MR18-SW02-10A	1002203-08	02/23/2010 09:25	Surface Water		X
MR18-SW06-10A	1002203-09	02/23/2010 09:15	Surface Water	X	
MR18-SW06-10A	1002203-10	02/23/2010 09:15	Surface Water		X
MR18-SW05-10A	1002203-11	02/23/2010 10:50	Surface Water	X	
MR18-SW05-10A	1002203-12	02/23/2010 10:50	Surface Water		X
MR18-SW09-10A	1002203-13	02/23/2010 10:20	Surface Water	X	
MR18-SW09-10A	1002203-14	02/23/2010 10:20	Surface Water		X
MR18-SW10-10A	1002203-15	02/23/2010 10:55	Surface Water	X	
MR18-SW10-10A	1002203-16	02/23/2010 10:55	Surface Water		X
MR18-SW04-10A	1002203-17	02/23/2010 11:20	Surface Water	X	
MR18-SW04-10A	1002203-18	02/23/2010 11:20	Surface Water		X
MR18-SW07-10A	1002203-19	02/23/2010 09:55	Surface Water	X	
MR18-SW07-10A	1002203-20	02/23/2010 09:55	Surface Water		X
MR18-FB022310	1002203-21	02/23/2010 11:30	Field Blank	X	
MR18-FB022310	1002203-22	02/23/2010 11:30	Field Blank		X
MR18-EBS022310	1002203-23	02/23/2010 13:30	Equipment Blank	X	
MR18-SW08-10A	1002203-24	02/23/2010 13:40	Surface Water	X	
MR18-SW08-10A	1002203-25	02/23/2010 13:40	Surface Water		X
MR18-EBW022310	1002203-26	02/23/2010 14:30	Equipment Blank	X	
MR18-EBW022310	1002203-27	02/23/2010 14:30	Equipment Blank		X

Table 2 Field Duplicate Sample Results for Inorganic Analyses
Surface Water Duplicate Samples MR18-SW03-10A and MR18-SW03D-10A

Analyte	Sample Result (µg/L)	Field Duplicate Result (µg/L)	RPD	ACTION
	MR18-SW03-10A	MR18-SW03D-10A		
Arsenic	ND	0.977	J	NC
Lead	ND	0.648	J	NC
Zinc	9.42	9.04		4

**Table 3 Field Duplicate Sample Results for Dissolved Inorganic Analyses
Surface Water Duplicate Samples MR18-SW03-10A and MR18-SW03D-10A**

Analyte	Sample Result (µg/L)	Field Duplicate Result (µg/L)	RPD	ACTION
	MR18-SW03-10A	MR18-SW03D-10A		
Copper (dissolved)	ND	4.93	NC	
Zinc (dissolved)	10.8	10.4	4	

Project: Small Bore Range, MCLB Camp Lejeune (CTO-040)
Laboratory: Empirical Laboratories, LLC
Sample Delivery Group: 1002219
Fraction: Inorganic
Matrix: Solid
Report Date: 4/20/2010

This analytical quality assurance report is based upon a review of analytical data generated for soil samples. Three matrix spike/matrix spike duplicate samples, five field duplicate samples, and one field blank were submitted for this Sample Delivery Group. The sample locations, laboratory identification numbers, sample collection date, sample matrix, and analyses performed are presented in Table 1.

The samples were analyzed for metals. The sample analyses were performed in accordance with the procedures outlined in the method referenced at the end of this report.

All sample analyses have undergone an analytical quality assurance review to ensure adherence to the required protocols. Results have been validated or qualified according to general guidance provided in the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review", OSWER 9240.1-45 EPA 540-R-04-004, October 2004 and "Data Validation Standard Operating Procedures for Contract Laboratory Program Routine Analytical Services", USEPA Region IV, Revision 2.1, July 1999.

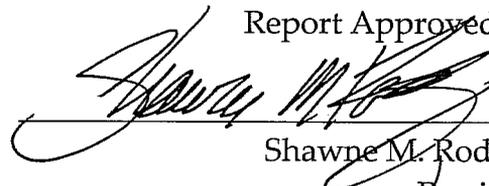
These documents specify procedures for validating data generated for CLP analyses. Therefore, the quality control requirements specified in the methods and associated acceptance criteria were also used to evaluate the non-CLP data. The parameters presented on the following page were evaluated.

-
- X • Data Completeness
 - X • Chain of Custody Documentation
 - X • Holding Times
 - X • Initial and Continuing Calibrations
 - X • ICP Interference Check Sample Results
 - X • Laboratory and Field Blank Analysis Results
 - X • Matrix Spike Recoveries and Reproducibility
 - X • Laboratory Duplicate Analysis Results
 - X • ICP Serial Dilution Results
 - X • Field Duplicate Analysis Results
 - X • Laboratory Control Sample Results
 - GFAA Post-Digestion Spike Recovery/Duplicate Burn Precision
 - X • Qualitative Identification
 - X • Quantitation/Reporting Limits
-

X - Denotes parameter evaluated.

It is recommended that the data only be used according to the qualifiers presented, and discussed in this report. All other data should be considered qualitatively and quantitatively valid as reported by the laboratory, based on the items evaluated.

Report Approved By:



Shawne M. Rodgers
President



Date

1.0 DATA COMPLETENESS

The case narrative needed to be revised to explain the detection limit values presented on the Method Detection Limit (MDL) summary form. The laboratory was contacted and provided the revised case narrative.

2.0 CHAIN OF CUSTODY DOCUMENTATION

The chain of custody (COC) documentation was complete.

3.0 HOLDING TIMES

All criteria were met. No qualifiers were applied.

4.0 INITIAL AND CONTINUING CALIBRATIONS

The positive results reported for lead for samples MR18-SS36-10A, MR18-SS34-10A, MR18-SS35-10A, MR18-SS33-10A, MR18-SS37-10A, MR18-SS42-10A, MR18-SS44-10A, MR18-SS38-10A, MR18-SS39-10A, MR18-SS43-10A, MR18-SS41-10A, MR18-SS40-10A, MR18-SS40D-10A, MR18-SS51-10A, MR18-SS49-10A, MR18-SS46-10A, MR18-SS48-10A, MR18-SS50-10A, and MR18-SS50D-10A are biased low quantitative estimates, and may be higher than reported. A low recovery for this analyte was obtained for the associated continuing calibration verification standard analysis. The positive results for lead for these samples have been marked "J-" to indicate that they are biased low quantitative estimates.

5.0 ICP INTERFERENCE CHECK SAMPLE RESULTS

All criteria were met. No qualifiers were applied.

6.0 *LABORATORY AND FIELD BLANK ANALYSIS RESULTS*

The positive results reported for zinc for samples MR18-SS35-10A, MR18-SS40-10A, and MR18-SS40D-10A are considered to be nondetect due to the presence of this analyte in the associated preparation blank presented in Table 2. This analyte was detected in the associated preparation blank at a level less than the reporting limit, indicating the possibility of a false positive at this level. The results for these samples are less than the reporting limit. Replacing the sample result with the reporting limit and marking it "U" has indicated this.

The positive results reported for zinc for samples MR18-SS51-10A and MR18-SS50D-10A are considered to be nondetect due to the presence of this analyte in the associated preparation blank presented in Table 2. This analyte was detected in the associated preparation blank at a level less than the reporting limit, indicating the possibility of a false positive at this level. The results for zinc for these samples are greater than the reporting limit. The sample results have been marked "U" to indicate this.

7.0 *MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERIES AND REPRODUCIBILITY*

Positive results and Reporting limits (RLs) for antimony for all samples, should be considered biased low quantitative estimates and may be higher than reported. The associated matrix spike recovery was below the acceptance limit for this analyte. The low recovery indicates the presence of interferences for antimony for samples of similar matrix. The positive results have been marked "J" to indicate that they are biased low quantitative estimates. RLs have been marked "UJ".

8.0 *LABORATORY DUPLICATE RESULTS*

All criteria were met. No qualifiers were applied.

9.0 ICP SERIAL DILUTION RESULTS

All criteria were met. No qualifiers were applied.

10.0 FIELD DUPLICATE RESULTS

Duplicate sample pairs MR18-SD01-10A and MR18-SD01D-10A, MR18-SS29-10A and MR18-SS29D-10A, MR18-SS40-10A and MR18-SS40D-10A, MR18-SS50-10A and MR18-SS50D-10A, and MR18-SS70-10A and MR18-SS70D-10A were submitted to the laboratory evaluate sampling and analytical precision for those analytes determined to be present. Results for these duplicate samples are presented in Tables 3, 4, 5, 6, and 7, respectively. There are no USEPA-established acceptance criteria for field duplicate samples. EDQ uses internal an acceptance criterion of 40 percent for values greater than five times the RL (or \pm twice the RL for results less than five times the RL).

11.0 LABORATORY CONTROL SAMPLE RESULTS

All criteria were met. No qualifiers were applied.

12.0 GFAA POST-DIGESTION SPIKE/DUPLICATE BURN

This parameter is not applicable to the analyses completed.

13.0 QUALITATIVE IDENTIFICATION

All criteria were met. No qualifiers were applied.

14.0

QUANTITATION/REPORTING LIMITS

As required by USEPA protocol, all analytes, which were qualitatively identified at concentrations below their respective RLs, have been marked with "J" qualifiers to indicate that they are quantitative estimates.

METHODOLOGY REFERENCES

Analysis	Reference
Metals	Method 6010B, "Test Methods for Evaluating Solid Wastes", SW-846, third edition, Promulgated Updates II, IIA, and III, June 1997

**Table 1 Samples For Data Validation Review
CTO-040 Camp Lejeune
Jacksonville, North Carolina
Empirical Laboratories Sample Delivery Group 1002219**

SAMPLE I.D.	LABORATORY I.D	DATE COLLECTED	MATRIX	ANALYSES PERFORMED
				METAL
MR18-SD03-10A	1002219-01	2/23/2010	Soil	X
MR18-SD01-10A	1002219-02	2/23/2010	Soil	X
MR18-SD02-10A	1002219-03	2/23/2010	Soil	X
MR18-SS29-10A	1002219-04	2/23/2010	Soil	X
MR18-SS31-10A	1002219-05	2/23/2010	Soil	X
MR18-SS30-10A	1002219-06	2/23/2010	Soil	X
MR18-SS29D-10A	1002219-07	2/23/2010	Soil	X
MR18-SS18-10A	1002219-08	2/23/2010	Soil	X
MR18-SS19-10A	1002219-09	2/23/2010	Soil	X
MR18-SD07-10A	1002219-10	2/23/2010	Soil	X
MR18-SD06-10A	1002219-11	2/23/2010	Soil	X
MR18-SD05-10A	1002219-12	2/23/2010	Soil	X
MR18-SD09-10A	1002219-13	2/23/2010	Soil	X
MR18-SD10-10A	1002219-14	2/23/2010	Soil	X
MR18-SD04-10A	1002219-15	2/23/2010	Soil	X
MR18-SS28-10A	1002219-16	2/23/2010	Soil	X
MR18-SS32-10A	1002219-17	2/23/2010	Soil	X
MR18-SS26-10A	1002219-18	2/23/2010	Soil	X
MR18-SS27-10A	1002219-19	2/23/2010	Soil	X
MR18-SD08-10A	1002219-20	2/23/2010	Soil	X
MR18-SS36-10A	1002219-21	2/23/2010	Soil	X
MR18-SS34-10A	1002219-22	2/23/2010	Soil	X
MR18-SS35-10A	1002219-23	2/23/2010	Soil	X
MR18-SS33-10A	1002219-24	2/23/2010	Soil	X
MR18-SS37-10A	1002219-25	2/23/2010	Soil	X
MR18-SS42-10A	1002219-26	2/23/2010	Soil	X
MR18-SS44-10A	1002219-27	2/23/2010	Soil	X
MR18-SS38-10A	1002219-28	2/23/2010	Soil	X
MR18-SS39-10A	1002219-29	2/23/2010	Soil	X
MR18-SS43-10A	1002219-30	2/23/2010	Soil	X
MR18-SS41-10A	1002219-31	2/23/2010	Soil	X
MR18-SS40-10A	1002219-32	2/23/2010	Soil	X
MR18-SS40D-10A	1002219-33	2/23/2010	Soil	X
MR18-SS51-10A	1002219-34	2/23/2010	Soil	X
MR18-SS49-10A	1002219-35	2/23/2010	Soil	X
MR18-SS46-10A	1002219-36	2/23/2010	Soil	X
MR18-SS48-10A	1002219-37	2/23/2010	Soil	X
MR18-SS50-10A	1002219-38	2/23/2010	Soil	X
MR18-SS50D-10A	1002219-39	2/23/2010	Soil	X
MR18-SS45-10A	1002219-40	2/23/2010	Soil	X

**Table 1 Samples For Data Validation Review
CTO-040 Camp Lejeune
Jacksonville, North Carolina
Empirical Laboratories Sample Delivery Group 1002219**

SAMPLE I.D.	LABORATORY I.D.	DATE COLLECTED	MATRIX	ANALYSES PERFORMED
				METAL
MR18-SS47-10A	1002219-41	2/23/2010	Soil	X
MR18-EB022410	1002219-42	2/24/2010	Equipment Blank	X
MR18-SS126-10A	1002219-43	2/24/2010	Soil	X
MR18-SS66-10A	1002219-44	2/24/2010	Soil	X
MR18-SS67-10A	1002219-45	2/24/2010	Soil	X
MR18-SS70-10A	1002219-46	2/24/2010	Soil	X
MR18-SS70D-10A	1002219-47	2/24/2010	Soil	X
MR18-SS69-10A	1002219-48	2/24/2010	Soil	X
MR18-SS68-10A	1002219-49	2/24/2010	Soil	X
MR18-SS56-10A	1002219-50	2/24/2010	Soil	X
MR18-SS54-10A	1002219-51	2/24/2010	Soil	X
MR18-SS55-10A	1002219-52	2/24/2010	Soil	X
MR18-SS53-10A	1002219-53	2/24/2010	Soil	X
MR18-SS52-10A	1002219-54	2/24/2010	Soil	X
MR18-SD01D-10A	1002219-55	2/24/2010	Soil	X

METAL Total Metals: Antimony, Arsenic, Copper, Lead, and Zinc

Table 2

Blank Results for Inorganic Analyses

<u>BLANK</u>	<u>ANALYTE</u>	<u>CONCENTRATION</u> <u>/UNITS</u>	<u>ASSOC. SAMPLES</u>
0C04002-BLK1	Zinc	0.262 mg/Kg	MR18-SS36-10A, MR18-SS34-10A, MR18-SS35-10A, MR18-SS33-10A, MR18-SS37-10A, MR18-SS42-10A, MR18-SS44-10A, MR18-SS38-10A, MR18-SS39-10A, MR18-SS43-10A, MR18-SS41-10A, MR18-SS40-10A, MR18-SS40D-10A, MR18-SS51-10A, MR18-SS49-10A, MR18-SS46-10A, MR18-SS48-10A, MR18-SS50-10A, and MR18-SS50D-10A

Table 3 **Field Duplicate Sample Results for Inorganic Analyses**
Sediment Duplicate Samples MR18-SD01-10A and MR18-SD01D-10A

Analyte	Sample Result (mg/Kg)	Field Duplicate Result (mg/Kg)	RPD	ACTION
	MR18-SD01-10A	MR18-SD01D-10A		
Copper	0.738	0.597	J	21
Lead	3.07	4.12		29
Zinc	13.3	10.1		27

Table 4 **Field Duplicate Sample Results for Inorganic Analyses**
Soil Duplicate Samples MR18-SS29-10A and MR18-SS29D-10A

Analyte	Sample Result (mg/Kg)		Field Duplicate Result (mg/Kg)		RPD	ACTION
	MR18-SS29-10A		MR18-SS29D-10A			
Arsenic	1.64		1.41		15	
Copper	0.554	J	0.433	J	25	
Lead	13.5		8.91		41	
Zinc	2.48		2.4		3	

**Table 5 Field Duplicate Sample Results for Inorganic Analyses
Soil Duplicate Samples MR18-SS40-10A and MR18-SS40D-10A**

Analyte	Sample Result (mg/Kg)		Field Duplicate Result (mg/Kg)	RPD	ACTION
	MR18-SS40-10A		MR18-SS40D-10A		
Arsenic	0.401		0.454	12	
Copper	0.614	J	0.764	22	
Lead	3.2	J-	3.18	J-	1

**Table 6 Field Duplicate Sample Results for Inorganic Analyses
Soil Duplicate Samples MR18-SS50-10A and MR18-SS50D-10A**

Analyte	Sample Result (mg/Kg)		Field Duplicate Result (mg/Kg)		RPD	ACTION
	MR18-SS50-10A		MR18-SS50D-10A			
Arsenic	0.721		0.664		8	
Copper	0.472	J	ND		NC	
Lead	8.49	J-	6.08	J-	33	
Zinc	2.32		1.62		36	

**Table 7 Field Duplicate Sample Results for Inorganic Analyses
Soil Duplicate Samples MR18-SS70-10A and MR18-SS70D-10A**

Analyte	Sample Result (mg/Kg)		Field Duplicate Result (mg/Kg)		RPD	ACTION
	MR18-SS70-10A		MR18-SS70D-10A			
Arsenic	0.749		0.741		1	
Copper	0.627	J	0.466	J	29	
Lead	7.34		7.36		0	
Zinc	2.76		1.81		42	

Project: Small Bore Range, MCLB Camp Lejeune (CTO-040)
Laboratory: Empirical Laboratories, LLC
Sample Delivery Group: 1002229
Fraction: Inorganic
Matrix: Solid
Report Date: 4/18/2010

This analytical quality assurance report is based upon a review of analytical data generated for soil samples. Three matrix spike/matrix spike duplicate samples, four field duplicate samples, and one field blank were submitted for this Sample Delivery Group. The sample locations, laboratory identification numbers, sample collection date, sample matrix, and analyses performed are presented in Table 1.

The samples were analyzed for metals. The sample analyses were performed in accordance with the procedures outlined in the method referenced at the end of this report.

All sample analyses have undergone an analytical quality assurance review to ensure adherence to the required protocols. Results have been validated or qualified according to general guidance provided in the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review", OSWER 9240.1-45 EPA 540-R-04-004, October 2004 and "Data Validation Standard Operating Procedures for Contract Laboratory Program Routine Analytical Services", USEPA Region IV, Revision 2.1, July 1999.

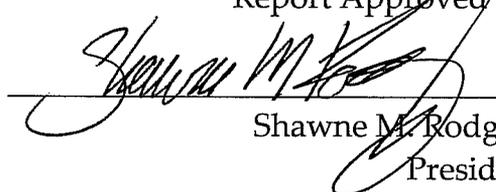
These documents specify procedures for validating data generated for CLP analyses. Therefore, the quality control requirements specified in the methods and associated acceptance criteria were also used to evaluate the non-CLP data. The parameters presented on the following page were evaluated.

-
- X • Data Completeness
 - X • Chain of Custody Documentation
 - X • Holding Times
 - X • Initial and Continuing Calibrations
 - X • ICP Interference Check Sample Results
 - X • Laboratory and Field Blank Analysis Results
 - X • Matrix Spike Recoveries and Reproducibility
 - X • Laboratory Duplicate Analysis Results
 - X • ICP Serial Dilution Results
 - X • Field Duplicate Analysis Results
 - X • Laboratory Control Sample Results
 - GFAA Post-Digestion Spike Recovery/Duplicate Burn Precision
 - X • Qualitative Identification
 - X • Quantitation/Reporting Limits
-

X - Denotes parameter evaluated.

It is recommended that the data only be used according to the qualifiers presented, and discussed in this report. All other data should be considered qualitatively and quantitatively valid as reported by the laboratory, based on the items evaluated.

Report Approved By:



Shawne M. Rodgers
President

4/18/2010

Date

1.0 DATA COMPLETENESS

The case narrative needed to be revised to explain the detection limit values presented on the Method Detection Limit (MDL) summary form. The laboratory was contacted and provided the revised case narrative.

2.0 CHAIN OF CUSTODY DOCUMENTATION

The chain of custody (COC) documentation was complete.

3.0 HOLDING TIMES

All criteria were met. No qualifiers were applied.

4.0 INITIAL AND CONTINUING CALIBRATIONS

All criteria were met. No qualifiers were applied.

5.0 ICP INTERFERENCE CHECK SAMPLE RESULTS

All criteria were met. No qualifiers were applied.

6.0 LABORATORY AND FIELD BLANK ANALYSIS RESULTS

All criteria were met. No qualifiers were applied.

7.0 ***MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERIES AND REPRODUCIBILITY***

Reporting limits (RLs) for antimony for all samples, except MR18-SS106-10A, should be considered biased low quantitative estimates and may be higher than reported. The associated matrix spike recovery was below the acceptance limit for this analyte. The low recovery indicates the presence of interferences for antimony for samples of similar matrix. The RLs have been marked "UJ" to indicate that they are biased low quantitative estimates.

The laboratory did not select a site sample to perform matrix spike/ matrix spike duplicate analyses for the metals analyses associated with sample MR18-SS106-10A. Therefore, sample MR18-SS106-10A could not be evaluated based on this parameter. This should be noted when assessing the sample data.

8.0 ***LABORATORY DUPLICATE RESULTS***

All criteria were met. No qualifiers were applied.

The laboratory did not select a site sample to perform matrix spike/ matrix spike duplicate analyses for the metals analyses associated with sample MR18-SS106-10A. Therefore, sample MR18-SS106-10A could not be evaluated based on this parameter. This should be noted when assessing the sample data.

9.0 ***ICP SERIAL DILUTION RESULTS***

All criteria were met. No qualifiers were applied.

The laboratory did not select a site sample to perform serial dilution analyses for the metals analyses associated with sample MR18-SS106-10A.

Therefore, sample MR18-SS106-10A could not be evaluated based on this parameter. This should be noted when assessing the sample data.

10.0 *FIELD DUPLICATE RESULTS*

Duplicate sample pairs MR18-SS120-10A and MR18-SS120D-10A, MR18-SS100-10A and MR18-SS100D-10A, MR18-SS90-10A and MR18-SS90D-10A, and MR18-SS60-10A and MR18-SS60D-10A were submitted to the laboratory evaluate sampling and analytical precision for those analytes determined to be present. Results for these duplicate samples are presented in Tables 2, 3, 4, and 5, respectively. There are no USEPA-established acceptance criteria for field duplicate samples. EDQ uses internal an acceptance criterion of 40 percent for values greater than five times the RL (or \pm twice the RL for results less than five times the RL).

11.0 *LABORATORY CONTROL SAMPLE RESULTS*

All criteria were met. No qualifiers were applied.

12.0 *GFAA POST-DIGESTION SPIKE/DUPLICATE BURN*

This parameter is not applicable to the analyses completed.

13.0 *QUALITATIVE IDENTIFICATION*

All criteria were met. No qualifiers were applied.

14.0 *QUANTITATION/REPORTING LIMITS*

As required by USEPA protocol, all analytes, which were qualitatively identified at concentrations below their respective RLs, have been marked with "J" qualifiers to indicate that they are quantitative estimates.

METHODOLOGY REFERENCES

Analysis	Reference
Metals	Method 6010B, "Test Methods for Evaluating Solid Wastes", SW-846, third edition, Promulgated Updates II, IIA, and III, June 1997

**Table 1 Samples For Data Validation Review
CTO-040 Camp Lejeune
Jacksonville, North Carolina
Empirical Laboratories Sample Delivery Group 1002229**

SAMPLE I.D.	LABORATORY I.D	DATE COLLECTED	MATRIX	ANALYSES PERFORMED
				METAL
MR18-SS122-10A	1002229-01	2/25/2010	Soil	X
MR18-SS107-10A	1002229-02	2/25/2010	Soil	X
MR18-SS115-10A	1002229-03	2/25/2010	Soil	X
MR18-SS116-10A	1002229-04	2/25/2010	Soil	X
MR18-SS99-10A	1002229-05	2/25/2010	Soil	X
MR18-SS108-10A	1002229-06	2/25/2010	Soil	X
MR18-SS118-10A	1002229-07	2/25/2010	Soil	X
MR18-SS124-10A	1002229-08	2/25/2010	Soil	X
MR18-SS120-10A	1002229-09	2/25/2010	Soil	X
MR18-SS119-10A	1002229-10	2/25/2010	Soil	X
MR18-SS123-10A	1002229-11	2/25/2010	Soil	X
MR18-SS120D-10A	1002229-12	2/25/2010	Soil	X
MR18-SS85-10A	1002229-13	2/25/2010	Soil	X
MR18-SS91-10A	1002229-14	2/25/2010	Soil	X
MR18-SS84-10A	1002229-15	2/25/2010	Soil	X
MR18-SS101-10A	1002229-16	2/25/2010	Soil	X
MR18-SS92-10A	1002229-17	2/25/2010	Soil	X
MR18-SS102-10A	1002229-18	2/25/2010	Soil	X
MR18-SS87-10A	1002229-19	2/25/2010	Soil	X
MR18-SS94-10A	1002229-20	2/25/2010	Soil	X
MR18-SS93-10A	1002229-21	2/25/2010	Soil	X
MR18-SS103-10A	1002229-22	2/25/2010	Soil	X
MR18-SS86-10A	1002229-23	2/25/2010	Soil	X
MR18-SS100-10A	1002229-24	2/25/2010	Soil	X
MR18-SS100D-10A	1002229-25	2/25/2010	Soil	X
MR18-SS112-10A	1002229-26	2/25/2010	Soil	X
MR18-SS104-10A	1002229-27	2/25/2010	Soil	X
MR18-SS111-10A	1002229-28	2/25/2010	Soil	X
MR18-SS95-10A	1002229-29	2/25/2010	Soil	X
MR18-SS98-10A	1002229-30	2/25/2010	Soil	X
MR18-SS90-10A	1002229-31	2/25/2010	Soil	X
MR18-SS90D-10A	1002229-32	2/25/2010	Soil	X
MR18-SS81-10A	1002229-33	2/25/2010	Soil	X
MR18-SS83-10A	1002229-34	2/25/2010	Soil	X
MR18-SS89-10A	1002229-35	2/25/2010	Soil	X
MR18-SS82-10A	1002229-36	2/25/2010	Soil	X
MR18-EB022510	1002229-37	2/25/2010	Equipment Blank	X
MR18-SS117-10A	1002229-38	2/25/2010	Soil	X
MR18-SS109-10A	1002229-39	2/25/2010	Soil	X
MR18-SS71-10A	1002229-40	2/25/2010	Soil	X

**Table 1 Samples For Data Validation Review
CTO-040 Camp Lejeune
Jacksonville, North Carolina
Empirical Laboratories Sample Delivery Group 1002229**

SAMPLE I.D.	LABORATORY I.D	DATE COLLECTED	MATRIX	ANALYSES PERFORMED
				METAL
MR18-SS128-10A	1002229-41	2/24/2010	Soil	X
MR18-SS75-10A	1002229-42	2/24/2010	Soil	X
MR18-SS74-10A	1002229-43	2/24/2010	Soil	X
MR18-SS78-10A	1002229-44	2/24/2010	Soil	X
MR18-SS77-10A	1002229-45	2/24/2010	Soil	X
MR18-SS76-10A	1002229-46	2/24/2010	Soil	X
MR18-SS63-10A	1002229-47	2/24/2010	Soil	X
MR18-SS80-10A	1002229-48	2/24/2010	Soil	X
MR18-SS79-10A	1002229-49	2/24/2010	Soil	X
MR18-SS65-10A	1002229-50	2/24/2010	Soil	X
MR18-SS58-10A	1002229-51	2/24/2010	Soil	X
MR18-SS73-10A	1002229-52	2/24/2010	Soil	X
MR18-SS64-10A	1002229-53	2/24/2010	Soil	X
MR18-SS57-10A	1002229-54	2/24/2010	Soil	X
MR18-SS72-10A	1002229-55	2/24/2010	Soil	X
MR18-SS60D-10A	1002229-56	2/24/2010	Soil	X
MR18-SS61-10A	1002229-57	2/24/2010	Soil	X
MR18-SS60-10A	1002229-58	2/24/2010	Soil	X
MR18-SS59-10A	1002229-59	2/24/2010	Soil	X
MR18-SS62-10A	1002229-60	2/24/2010	Soil	X
MR18-SS88-10A	1002229-61	2/24/2010	Soil	X
MR18-SS106-10A	1002229-62	2/24/2010	Soil	X

METAL Total Metals: Antimony, Arsenic, Copper, Lead, and Zinc

**Table 2 Field Duplicate Sample Results for Inorganic Analyses
Soil Duplicate Samples MR18-SS120-10A and MR18-SS120D-10A**

Analyte	Sample Result (mg/Kg)	Field Duplicate Result (mg/Kg)	RPD	ACTION
	MR18-SS120-10A	MR18-SS120D-10A		
Copper	1.09	1.88	53	
Lead	2.17	2.61	18	
Zinc	0.892	J 1.22	J 31	

Table 3 Field Duplicate Sample Results for Inorganic Analyses
 Soil Duplicate Samples MR18-SS100-10A and MR18-SS100D-10A

Analyte	Sample Result (mg/Kg)		Field Duplicate Result (mg/Kg)		RPD	ACTION
	MR18-SS100-10A		MR18-SS100D-10A			
Arsenic	0.806		0.850		5	
Lead	5.15		4.98		3	
Zinc	1.14	J	1.08	J	5	

**Table 4 Field Duplicate Sample Results for Inorganic Analyses
Soil Duplicate Samples MR18-SS90-10A and MR18-SS90D-10A**

Analyte	Sample Result (mg/Kg)		Field Duplicate Result (mg/Kg)		RPD	ACTION
	MR18-SS90-10A		MR18-SS90D-10A			
Arsenic	0.524		0.469		11	
Copper	0.359	J	0.355	J	1	
Lead	4.38		5.35		20	
Zinc	1.2	J	1.3		8	

**Table 5 Field Duplicate Sample Results for Inorganic Analyses
Soil Duplicate Samples MR18-SS60-10A and MR18-SS60D-10A**

Analyte	Sample Result (mg/Kg)	Field Duplicate Result (mg/Kg)	RPD	ACTION
	MR18-SS60-10A	MR18-SS60D-10A		
Arsenic	1.77	1.62		9
Copper	1.13	0.795	J	35
Lead	11.9	12.3		3
Zinc	5.39	4.61		16

Project: Small Bore Range, MCLB Camp Lejeune (CTO-040)
Laboratory: Empirical Laboratories, LLC
Sample Delivery Group: UX018_001
Fraction: Inorganic
Matrix: Solid
Report Date: 1/17/2010

This analytical quality assurance report is based upon a review of analytical data generated for soil samples. The sample locations, laboratory identification numbers, sample collection date, sample matrix, and analyses performed are presented in Table 1.

The samples were analyzed for metals. The sample analyses were performed in accordance with the procedures outlined in the method referenced at the end of this report.

All sample analyses have undergone an analytical quality assurance review to ensure adherence to the required protocols. Results have been validated or qualified according to general guidance provided in the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review", OSWER 9240.1-45 EPA 540-R-04-004, October 2004 and "Data Validation Standard Operating Procedures for Contract Laboratory Program Routine Analytical Services", USEPA Region IV, Revision 2.1, July 1999.

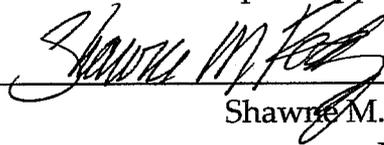
These documents specify procedures for validating data generated for CLP analyses. Therefore, the quality control requirements specified in the methods and associated acceptance criteria were also used to evaluate the non-CLP data. The parameters presented on the following page were evaluated.

-
- X • Data Completeness
 - X • Chain of Custody Documentation
 - X • Holding Times
 - X • Initial and Continuing Calibrations
 - X • ICP Interference Check Sample Results
 - X • Laboratory and Field Blank Analysis Results
 - X • Matrix Spike Recoveries and Reproducibility
 - X • Laboratory Duplicate Analysis Results
 - X • ICP Serial Dilution Results
 - X • Field Duplicate Analysis Results
 - X • Laboratory Control Sample Results
 - GFAA Post-Digestion Spike Recovery/Duplicate Burn Precision
 - X • Qualitative Identification
 - X • Quantitation/Reporting Limits
-

X - Denotes parameter evaluated.

It is recommended that the data only be used according to the qualifiers presented, and discussed in this report. All other data should be considered qualitatively and quantitatively valid as reported by the laboratory, based on the items evaluated.

Report Approved By:



Shawne M. Rodgers
President



Date

1.0 DATA COMPLETENESS

Sample MR18-SS02D-09D was incorrectly identified as sample MR18-SS02-09D in the data package. The laboratory was contacted and provided hand-corrected forms.

The raw data for sample MR18-EB111009 was missing from the data package. The laboratory was contacted and provided the missing raw data.

2.0 CHAIN OF CUSTODY DOCUMENTATION

The chain of custody (COC) documentation was complete.

3.0 HOLDING TIMES

All criteria were met. No qualifiers were applied.

4.0 INITIAL AND CONTINUING CALIBRATIONS

All criteria were met. No qualifiers were applied.

5.0 ICP INTERFERENCE CHECK SAMPLE RESULTS

All criteria were met. No qualifiers were applied.

6.0 LABORATORY AND FIELD BLANK ANALYSIS RESULTS

All criteria were met. No qualifiers were applied.

7.0 ***MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERIES AND REPRODUCIBILITY***

Positive results and reporting limits (RLs) for antimony and lead for all samples should be considered biased low quantitative estimates and may be higher than reported. The associated matrix spike recoveries were below the acceptance limit for these analytes. The low recoveries indicate the presence of interferences for antimony and lead for samples of similar matrix. The positive results have been marked "J-" to indicate that they are biased low quantitative estimates. RLs are marked "UJ".

8.0 ***LABORATORY DUPLICATE RESULTS***

All criteria were met. No qualifiers were applied.

9.0 ***ICP SERIAL DILUTION RESULTS***

All criteria were met. No qualifiers were applied.

10.0 ***FIELD DUPLICATE RESULTS***

Duplicate sample pairs MR18-SS11-09D and MR18-SS11D-09D, MR18-SS23-09D and MR18-SS23D-09D, and MR18-SS02-09D and MR18-SS02-09D-D were submitted to the laboratory evaluate sampling and analytical precision for those analytes determined to be present. Results for these duplicate samples are presented in Tables 3 through 5. There are no USEPA-established acceptance criteria for field duplicate samples. EDQ uses internal an acceptance criterion of 40 percent for values greater than five times the RL (or \pm twice the RL for results less than five times the RL).

11.0 ***LABORATORY CONTROL SAMPLE RESULTS***

All criteria were met. No qualifiers were applied.

12.0 GFAA POST-DIGESTION SPIKE/DUPLICATE BURN

This parameter is not applicable to the analyses completed.

13.0 QUALITATIVE IDENTIFICATION

All criteria were met. No qualifiers were applied.

14.0 QUANTITATION/REPORTING LIMITS

As required by USEPA protocol, all analytes, which were qualitatively identified at concentrations below their respective RLs, have been marked with "J" qualifiers to indicate that they are quantitative estimates.

METHODOLOGY REFERENCES

Analysis	Reference
Metals (Except Mercury)	Method 6010B, "Test Methods for Evaluating Solid Wastes", SW-846, third edition, Promulgated Updates II, IIA, and III, June 1997

**Table 1 Samples For Data Validation Review
 Small Bore Range, MCLB Camp Lejeune (CTO-040)
 Soil Samples Collected November 2009
 Empirical Laboratories, LLC Sample Delivery Group UX018_001**

SAMPLE I.D.	LABORATORY I.D	DATE COLLECTED	MATRIX	ANALYSES PERFORMED
				SMET
MR18-SS11-09D	0911103-01	11/10/2009	Soil	X
MR18-SS11D-09D	0911103-02	11/10/2009	Soil	X
MR18-SS14-09D	0911103-03	11/10/2009	Soil	X
MR18-SS15-09D	0911103-04	11/10/2009	Soil	X
MR18-SS16-09D	0911103-05	11/10/2009	Soil	X
MR18-SS17-09D	0911103-06	11/10/2009	Soil	X
MR18-SS24-09D	0911103-07	11/10/2009	Soil	X
MR18-SS25-09D	0911103-08	11/10/2009	Soil	X
MR18-SS12-09D	0911103-09	11/10/2009	Soil	X
MR18-SS13-09D	0911103-10	11/10/2009	Soil	X
MR18-SS20-09D	0911103-11	11/10/2009	Soil	X
MR18-SS21-09D	0911103-12	11/10/2009	Soil	X
MR18-SS22-09D	0911103-13	11/10/2009	Soil	X
MR18-SS23D-09D	0911103-14	11/10/2009	Soil	X
MR18-SS23-09D	0911103-15	11/10/2009	Soil	X
MR18-SS07-09D	0911103-16	11/10/2009	Soil	X
MR18-SS08-09D	0911103-17	11/10/2009	Soil	X
MR18-SS09-09D	0911103-18	11/10/2009	Soil	X
MR18-SS01-09D	0911103-19	11/9/2009	Soil	X
MR18-SS02D-09D	0911103-20	11/9/2009	Soil	X
MR18-SS02-09D	0911103-21	11/9/2009	Soil	X
MR18-SS03-09D	0911103-22	11/9/2009	Soil	X
MR18-SS04-09D	0911103-23	11/9/2009	Soil	X
MR18-SS05-09D	0911103-24	11/9/2009	Soil	X
MR18-SS06-09D	0911103-25	11/9/2009	Soil	X
MR18-SS10-09D	0911103-26	11/9/2009	Soil	X
MR18-EB111009	0911103-27	11/10/2009	Equipment Blank	X
MR18-EB110909	0911103-28	11/9/2009	Equipment Blank	X
MR18-FB110909	0911103-29	11/9/2009	Field Blank	X

**Table 3 Field Duplicate Sample Results for Inorganic Analyses
Soil Duplicate Samples MR18-SS11-09D and MR18-SS11D-09D**

Analyte	Sample Result (mg/Kg)		Field Duplicate Result (mg/Kg)		RPD	ACTION
	MR18-SS11-09D		MR18-SS11D-09D			
Arsenic	0.674		0.697		3	
Copper	0.324	J	0.314	J	3	
Lead	7.36	J-	9.56	J-	26	
Zinc	1.88		1.76		7	

Table 4 **Field Duplicate Sample Results for Inorganic Analyses**
Soil Duplicate Samples MR18-SS23-09D and MR18-SS23D-09D

Analyte	Sample Result (mg/Kg)		Field Duplicate Result (mg/Kg)		RPD	ACTION
	MR18-SS23-09D		MR18-SS23D-09D			
Arsenic	1.74		1.73		1	
Copper	1.58		2.52		46	Less than 5 X RL
Lead	10.2	J-	12.9	J-	23	
Zinc	1.35	J	1.98		38	

Table 5 **Field Duplicate Sample Results for Inorganic Analyses**
Soil Duplicate Samples MR18-SS02-09D and MR18-SS02-09D-D

Analyte	Sample Result (mg/Kg)		Field Duplicate Result (mg/Kg)		RPD	ACTION
	MR18-SS02-09D		MR18-SS02-09D-D			
Arsenic	3.08		2.54		19	
Copper	0.949		1.35		35	
Lead	14	J-	14.4	J-	3	
Zinc	5.42		6.82		23	

Project: Small Bore Range, MCLB Camp Lejeune (CTO-040)
Laboratory: Empirical Laboratories, LLC
Sample Delivery Group: UX018_002
Fraction: Inorganic
Matrix: Solid
Report Date: 1/17/2010

This analytical quality assurance report is based upon a review of analytical data generated for soil samples. The sample locations, laboratory identification numbers, sample collection date, sample matrix, and analyses performed are presented in Table 1.

The samples were analyzed for metals. The sample analyses were performed in accordance with the procedures outlined in the method referenced at the end of this report.

All sample analyses have undergone an analytical quality assurance review to ensure adherence to the required protocols. Results have been validated or qualified according to general guidance provided in the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review", OSWER 9240.1-45 EPA 540-R-04-004, October 2004 and "Data Validation Standard Operating Procedures for Contract Laboratory Program Routine Analytical Services", USEPA Region IV, Revision 2.1, July 1999.

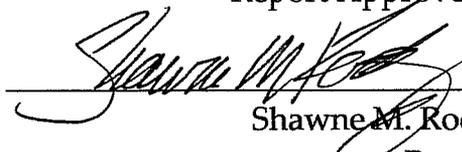
These documents specify procedures for validating data generated for CLP analyses. Therefore, the quality control requirements specified in the methods and associated acceptance criteria were also used to evaluate the non-CLP data. The parameters presented on the following page were evaluated.

-
- X • Data Completeness
 - X • Chain of Custody Documentation
 - X • Holding Times
 - X • Initial and Continuing Calibrations
 - X • ICP Interference Check Sample Results
 - X • Laboratory and Field Blank Analysis Results
 - X • Matrix Spike Recoveries and Reproducibility
 - X • Laboratory Duplicate Analysis Results
 - X • ICP Serial Dilution Results
 - X • Field Duplicate Analysis Results
 - X • Laboratory Control Sample Results
 - GFAA Post-Digestion Spike Recovery/Duplicate Burn Precision
 - X • Qualitative Identification
 - X • Quantitation/Reporting Limits
-

X - Denotes parameter evaluated.

It is recommended that the data only be used according to the qualifiers presented, and discussed in this report. All other data should be considered qualitatively and quantitatively valid as reported by the laboratory, based on the items evaluated.

Report Approved By:



Shawne M. Rodgers
President



Date

1.0 DATA COMPLETENESS

The data package was complete

2.0 CHAIN OF CUSTODY DOCUMENTATION

The chain of custody (COC) documentation was complete.

3.0 HOLDING TIMES

All criteria were met. No qualifiers were applied.

4.0 INITIAL AND CONTINUING CALIBRATIONS

All criteria were met. No qualifiers were applied.

5.0 ICP INTERFERENCE CHECK SAMPLE RESULTS

All criteria were met. No qualifiers were applied.

6.0 LABORATORY AND FIELD BLANK ANALYSIS RESULTS

All criteria were met. No qualifiers were applied.

7.0 MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERIES AND REPRODUCIBILITY

Positive results and reporting limits (RLs) for antimony for all samples should be considered biased low quantitative estimates and may be higher than reported. The associated matrix spike recovery was below the acceptance limit for this analyte. The low recovery indicates the presence

of interferences for antimony for samples of similar matrix. The positive results have been marked "J-" to indicate that they are biased low quantitative estimates. RLs are marked "UJ".

8.0 LABORATORY DUPLICATE RESULTS

All criteria were met. No qualifiers were applied.

9.0 ICP SERIAL DILUTION RESULTS

All criteria were met. No qualifiers were applied.

10.0 FIELD DUPLICATE RESULTS

Duplicate sample pairs MR18-SS125-09D and MR18-SS125D-09D and MR18-SS105-09D and MR18-SS105D-09D were submitted to the laboratory evaluate sampling and analytical precision for those analytes determined to be present. Results for these duplicate samples are presented in Tables 3 and 4. There are no USEPA-established acceptance criteria for field duplicate samples. EDQ uses internal an acceptance criterion of 40 percent for values greater than five times the RL (or \pm twice the RL for results less than five times the RL).

11.0 LABORATORY CONTROL SAMPLE RESULTS

All criteria were met. No qualifiers were applied.

12.0 GFAA POST-DIGESTION SPIKE/DUPLICATE BURN

This parameter is not applicable to the analyses completed.

13.0 QUALITATIVE IDENTIFICATION

All criteria were met. No qualifiers were applied.

QUANTITATION/REPORTING LIMITS

As required by USEPA protocol, all analytes, which were qualitatively identified at concentrations below their respective RLs, have been marked with "J" qualifiers to indicate that they are quantitative estimates.

METHODOLOGY REFERENCES

Analysis	Reference
Metals (Except Mercury)	Method 6010B, "Test Methods for Evaluating Solid Wastes", SW-846, third edition, Promulgated Updates II, IIA, and III, June 1997

**Table 1 Samples For Data Validation Review
 Small Bore Range, MCLB Camp Lejeune (CTO-040)
 Soil Samples Collected November 2009
 Empirical Laboratories, LLC Sample Delivery Group UX018_002**

SAMPLE I.D.	LABORATORY I.D	DATE COLLECTED	MATRIX	ALYSES PERFORM
				SMET
Sample_Name	Lab_Sample_ID	Date_Collected	Total Of SDG	6010B
MR18-SS110-09D	0911155-01	11/13/2009	Soil	X
MR18-SS121-09D	0911155-02	11/13/2009	Soil	X
MR18-SS125-09D	0911155-03	11/13/2009	Soil	X
MR18-SS125D-09D	0911155-04	11/13/2009	Soil	X
MR18-SS127-09D	0911155-05	11/13/2009	Soil	X
MR18-SS114-09D	0911155-06	11/13/2009	Soil	X
MR18-SS113-09D	0911155-07	11/13/2009	Soil	X
MR18-SS97-09D	0911155-08	11/13/2009	Soil	X
MR18-SS105-09D	0911155-09	11/13/2009	Soil	X
MR18-SS105D-09D	0911155-10	11/13/2009	Soil	X
MR18-SS96-09D	0911155-11	11/13/2009	Soil	X

**Table 3 Field Duplicate Sample Results for Inorganic Analyses
Soil Duplicate Samples MR18-SS125-09D and MR18-SS125D-09D**

Analyte	Sample Result (mg/Kg)	Field Duplicate Result (mg/Kg)	RPD	ACTION
	MR18-SS125-09D	MR18-SS125D-09D		
Arsenic	0.557	0.533	4	
Copper	4.36	3.72	16	
Lead	8.39	7.63	9	
Zinc	5.2	5.18	0	

Table 4 **Field Duplicate Sample Results for Inorganic Analyses**
Soil Duplicate Samples MR18-SS105-09D and MR18-SS105D-09D

Analyte	Sample Result (mg/Kg)	Field Duplicate Result (mg/Kg)	RPD	ACTION
	MR18-SS105-09D	MR18-SS105D-09D		
Arsenic	0.557	0.464	18	
Copper	0.941	0.859	9	
Lead	3.74	3.93	5	
Zinc	8.25	6.84	19	

Data Validation Qualifier Code Glossary

- J** - The positive result reported for this analyte is a quantitative estimate.
- J+** - The positive result reported for this analyte is a quantitative estimate, but may be biased high.
- J-** - The positive result reported for this analyte is a quantitative estimate, but may be biased low.
- U** - This analyte was not detected in the sample. The numeric value represents the sample quantitation/detection limit.
- UJ** - This analyte was not detected in the sample. The actual quantitation/detection limit may be higher than reported.
- N** - This analyte has been "tentatively" identified. The numeric value represents its approximate concentration.
- Y** - This analyte coelutes with another target compound on the two chromatographic columns used for analysis.
- R** - The result for this analyte is unreliable. Additional data is needed to confirm or disprove the presence of this compound/analyte in the sample.

Other Codes:

- ND** - There were no positive results for this analytical fraction.
- NA** - This parameter is not applicable to this sample.
- NR** - This analysis parameter was not required for this sample.

Appendix D
Raw Analytical Data

CTO-40
Camp Lejeune - UXO-18
Validated Sediment Raw Analytical Results
February 2010

Station ID	MR18-SD/SW01		MR18-SD/SW02	MR18-SD/SW03	MR18-SD/SW04	MR18-SD/SW05	MR18-SD/SW06	MR18-SD/SW07	MR18-SD/SW08	MR18-SD/SW09	MR18-SD/SW10
Sample ID	MR18-SD01-10A	MR18-SD01D-10A	MR18-SD02-10A	MR18-SD03-10A	MR18-SD04-10A	MR18-SD05-10A	MR18-SD06-10A	MR18-SD07-10A	MR18-SD08-10A	MR18-SD09-10A	MR18-SD10-10A
Sample Date	02/23/10	02/23/10	02/23/10	02/23/10	02/23/10	02/23/10	02/23/10	02/23/10	02/23/10	02/23/10	02/23/10
Chemical Name											
Total Metals (mg/kg)											
Antimony	0.969 UJ	0.939 UJ	1.01 UJ	0.9 UJ	0.701 J	1.18 UJ	1.18 UJ	2.94 UJ	2.8 UJ	1.58 UJ	3.33 UJ
Arsenic	0.387 U	0.375 U	0.98	0.575	3.48	2.19	1.21	2.12	3.07	1	1.98
Copper	0.738	0.597 J	1.37	0.6 U	52.9	12.8	0.404 J	6.26	8.79	1.86	3.99
Lead	3.07	4.12	9.72	3.98	182	36.2	5.74	13.6	21.7	11.5	19.2
Zinc	13.3	10.1	14.9	1.61	12.8	63.4	2.62	18.1	36.4	4.94	6.87

Notes:

Shading indicates detections

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

mg/kg - Milligrams per kilogram

CTO-40
Camp Lejeune - UXO-18
Validated Surface Soil Raw Analytical Results
November 2009

Sample ID	MR18-SS01-09D	MR18-SS02-09D	MR18-SS02D-09D	MR18-SS03-09D	MR18-SS04-09D	MR18-SS05-09D	MR18-SS06-09D	MR18-SS07-09D	MR18-SS08-09D	MR18-SS09-09D	MR18-SS10-09D	MR18-SS11-09D	MR18-SS12-09D
Sample Date	11/9/09	11/9/09	11/9/09	11/9/09	11/9/09	11/9/09	11/9/09	11/10/09	11/10/09	11/10/09	11/9/09	11/10/09	11/10/09
Chemical Name													
Total Metals (MG/KG)													
Antimony	1.27 UJ	1.04 UJ	1.08 UJ	1.04 UJ	0.863 UJ	0.909 UJ	0.919 UJ	1.05 UJ	0.998 UJ	0.877 UJ	0.977 UJ	0.901 UJ	0.917 UJ
Arsenic	2.98	3.08	2.54	2.21	1.29	1.19	0.461	1.56	1.2	0.885	1.01	0.674	1.26
Copper	2.45	0.949	1.35	0.805	1.75	0.471 J	0.613 U	1.55	0.904	4.65	0.394 J	0.324 J	6.72
Lead	26.8 J-	14 J-	14.4 J-	11.4 J-	12.3 J-	9.9 J-	5.83 J-	14.6 J-	11.3 J-	10.1 J-	4.39 J-	7.36 J-	29.1 J-
Zinc	8.13	5.42	6.82	3.8	2.84	2.51	1.77	6.18	7.82	8.04	5.19	1.88	6.33

Notes:

J- - Analyte present. Value may be biased low. Value may be higher

J - Analyte present. Value may or may not be accurate or precise

MG/KG - Milligrams per kilogram

NS - Not sampled

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

CTO-40
Camp Lejeune - UXO-18
Validated Surface Soil Raw Analytical Results
November 2009

Sample ID	MR18-SS13-09D	MR18-SS14-09D	MR18-SS15-09D	MR18-SS16-09D	MR18-SS17-09D	MR18-SS20-09D	MR18-SS21-09D	MR18-SS22-09D	MR18-SS23-09D	MR18-SS23D-09D	MR18-SS24-09D	MR18-SS25-09D	MR18-SS96-09D
Sample Date	11/10/09	11/10/09	11/10/09	11/10/09	11/10/09	11/10/09	11/10/09	11/10/09	11/10/09	11/10/09	11/10/09	11/10/09	11/13/09
Chemical Name													
Total Metals (MG/KG)													
Antimony	1.15 UJ	1.03 UJ	0.964 UJ	0.835 UJ	0.93 UJ	1.05 UJ	0.96 UJ	1.05 UJ	1.02 UJ	1.07 UJ	1.36 UJ	1.1 UJ	0.882 UJ
Arsenic	1.9	1.09	0.712	0.278 U	1.28	0.762	0.948	1.31	1.74	1.73	5.44	1.33	0.726
Copper	20.6	0.888	0.618 J	3.53	0.899	0.5 J	0.64 U	0.702 U	1.58	2.52	0.904 U	0.599 J	1.32
Lead	86.1 J-	16.1 J-	10.2 J-	2.82 J-	17.3 J-	8.16 J-	4.28 J-	6.71 J-	10.2 J-	12.9 J-	13.4 J-	10.5 J-	15.9
Zinc	8.2	3.24	1.49	1.22	2.65	2.81	1.53	1.58	1.35 J	1.98	6.1	5.58	6.24

Notes:

J - Analyte present. Value may be biased low. Value may be higher
 J - Analyte present. Value may or may not be accurate or precise
 MG/KG - Milligrams per kilogram
 NS - Not sampled
 U - The material was analyzed for, but not detected
 UJ - Analyte not detected, quantitation limit may be inaccurate

CTO-40
Camp Lejeune - UXO-18
Validated Surface Soil Raw Analytical Results
November 2009

Sample ID	MR18-SS97-09D	MR18-SS105-09D	MR18-SS105D-09D	MR18-SS110-09D	MR18-SS113-09D	MR18-SS114-09D	MR18-SS11D-09D	MR18-SS121-09D	MR18-SS125-09D	MR18-SS125D-09D	MR18-SS127-09D
Sample Date	11/13/09	11/13/09	11/13/09	11/13/09	11/13/09	11/13/09	11/10/09	11/13/09	11/13/09	11/13/09	11/13/09
Chemical Name											
Total Metals (MG/KG)											
Antimony	0.924 UJ	0.935 UJ	0.928 UJ	1.01 UJ	0.978 UJ	0.947 UJ	0.869 UJ	0.898 UJ	0.928 UJ	1.05 UJ	1.09 UJ
Arsenic	1.43	0.557	0.464	1.34	0.352	0.33	0.697	1.17	0.557	0.533	0.711
Copper	1.52	0.941	0.859	0.676 U	2.29	1.12	0.314 J	0.539 J	4.36	3.72	0.987
Lead	11.9	3.74	3.93	2.65	7.1	6.9	9.56 J-	3.08	8.39	7.63	4.78
Zinc	19.3	8.25	6.84	1.03 J	5.41	5.54	1.76	3.8	5.2	5.18	3.27

Notes:

J - Analyte present. Value may be biased low. Value may be higher
 J - Analyte present. Value may or may not be accurate or precise
 MG/KG - Milligrams per kilogram
 NS - Not sampled
 U - The material was analyzed for, but not detected
 UJ - Analyte not detected, quantitation limit may be inaccurate

CTO-40
Camp Lejeune - UXO-18
Validated Surface Soil Raw Analytical Results
November 2009 - February 2010

Station ID	MR18-SS79	MR18-SS80	MR18-SS81	MR18-SS82	MR18-SS83	MR18-SS84	MR18-SS85	MR18-SS86	MR18-SS87	MR18-SS88	MR18-SS89	MR18-SS90	MR18-SS91	MR18-SS92	MR18-SS93	
Sample ID	MR18-SS79-10A	MR18-SS80-10A	MR18-SS81-10A	MR18-SS82-10A	MR18-SS83-10A	MR18-SS84-10A	MR18-SS85-10A	MR18-SS86-10A	MR18-SS87-10A	MR18-SS88-10A	MR18-SS89-10A	MR18-SS90-10A	MR18-SS90D-10A	MR18-SS91-10A	MR18-SS92-10A	MR18-SS93-10A
Sample Date	02/24/10	02/24/10	02/25/10	02/25/10	02/25/10	02/25/10	02/25/10	02/25/10	02/25/10	02/24/10	02/25/10	02/25/10	02/25/10	02/25/10	02/25/10	02/25/10
Chemical Name																
Total Metals (mg/kg)																
Antimony	0.967 UJ	1.47 UJ	0.967 UJ	1.38 UJ	0.892 UJ	1.1 UJ	1.45 UJ	1.68 UJ	1.32 UJ	0.968 UJ	1.18 UJ	1.01 UJ	0.964 UJ	0.865 UJ	0.987 UJ	0.912 UJ
Arsenic	0.398	0.847	0.707	0.912	0.494	0.442	0.954	1.47	0.727	1.23	1.09	0.524	0.469	0.452	0.653	0.454
Copper	0.326 J	5.97	0.645 U	1.22	0.595 U	0.736 U	0.562 J	3.07	1.71	4.17	0.945	0.359 J	0.355 J	0.425 J	2.23	0.608 U
Lead	3.92	7.6	5.03	11.1	3.65	7.1	9.31	14.5	8.57	17.4	14.2	4.38	5.35	3.16	3.99	2.83
Zinc	1.26 J	4.38	1.61	4.33	1.23	0.749 J	2.44	20.8	6.28	13.1	3.05	1.2 J	1.3	1.02 J	1.35	1.24

Notes:

Shading indicates detections

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

mg/kg - Milligrams per kilogram

CTO-40
Camp Lejeune - UXO-18
Validated Surface Soil Raw Analytical Results
November 2009 - February 2010

Station ID	MR18-SS94	MR18-SS95	MR18-SS96	MR18-SS97	MR18-SS98	MR18-SS99
Sample ID	MR18-SS94-10A	MR18-SS95-10A	MR18-SS96-09D	MR18-SS97-09D	MR18-SS98-10A	MR18-SS99-10A
Sample Date	02/25/10	02/25/10	11/13/09	11/13/09	02/25/10	02/25/10
Chemical Name						
Total Metals (mg/kg)						
Antimony	1.97 UJ	1.07 UJ	0.882 UJ	0.924 UJ	1.01 UJ	1.41 UJ
Arsenic	1.11	0.803	0.726	1.43	0.353 J	0.61
Copper	64.4	10.4	1.32	1.52	0.671 U	0.942 U
Lead	14.8	8.66	15.9	11.9	2.21	4.23
Zinc	5.21	22.9	6.24	19.3	0.607 J	1.6 J

Notes:

Shading indicates detections
 NA - Not analyzed
 J - Analyte present, value m
 J- - Analyte present, value m
 U - The material was analyze
 UJ - Analyte not detected, qt
 mg/kg - Milligrams per kilogr

CTO-40
Camp Lejeune - UXO-18
Validated Surface Water Raw Analytical Results
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Station ID	MR18-SD/SW01	MR18-SD/SW02	MR18-SD/SW03		MR18-SD/SW04	MR18-SD/SW05	MR18-SD/SW06	MR18-SD/SW07	MR18-SD/SW08	MR18-SD/SW09	MR18-SD/SW10
Sample ID	MR18-SW01-10A	MR18-SW02-10A	MR18-SW03-10A	MR18-SW03D-10A	MR18-SW04-10A	MR18-SW05-10A	MR18-SW06-10A	MR18-SW07-10A	MR18-SW08-10A	MR18-SW09-10A	MR18-SW10-10A
Sample Date	02/23/10	02/23/10	02/23/10	02/23/10	02/23/10	02/23/10	02/23/10	02/23/10	02/23/10	02/23/10	02/23/10
Chemical Name											
Total Metals (µg/l)											
Antimony	3.75 U	3.75 U	3.75 U	3.75 U	3.75 U	3.75 U	3.75 U	3.75 U	3.75 U	3.75 U	3.75 U
Arsenic	0.849 J	0.761 J	1.5 U	0.977 J	1.06 J	0.986 J	1.5 U	1.5 U	1.5 U	1.5 U	0.866 J
Copper	2.09 J	1.91 J	2.5 U	2.5 U	2.52	5.58	2.5 U				
Lead	1.06	0.976	0.75 U	0.648 J	1.52	5.4	0.439 J	0.75 U	0.75 U	0.75 U	0.75 U
Zinc	15.4	13.4	9.42	9.04	9.75	37.4	4.08 J	7.73	8.99	5.8	7.14
Dissolved Metals (µg/l)											
Antimony, Dissolved	3.75 U	3.75 U	3.75 U	3.75 U	3.75 U	3.75 U	3.75 U	3.75 U	3.75 U	3.75 U	3.75 U
Arsenic, Dissolved	0.985 J	0.958 J	1.5 U	1.5 U	1.18 J	1.5 U	1.5 U	1.5 U	0.953 J	1.5 U	1.01 J
Copper, Dissolved	2.15 J	1.89 J	2.5 U	4.93	1.82 J	3.95	2.5 U				
Lead, Dissolved	0.61 J	0.526 J	0.75 U	0.75 U	1.05	2.08	0.75 U				
Zinc, Dissolved	14	12.6	10.8	10.4	10.2	37.7	4.94 J	7.61	10.2	7.65	8.33

Notes:

Shading indicates detections

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

U - The material was analyzed for, but not detected

µg/l - Micrograms per liter

Appendix E
Human Health Risk Screening Tables

TABLE E.1

Occurrence, Distribution, and Selection of Chemicals of Potential Concern
 Site UXO-18 Preliminary Assessment/Site Inspection
 MCB CamLej
 North Carolina

Scenario Timeframe: Current/Future
 Medium: Surface Soil
 Exposure Medium: Surface 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	Screening [3] Background [4] Value	COPC Flag	Screening [3] Toxicity Value [5] Residential RSL	COPC Flag	Screening [3] Toxicity Value [6] Industrial RSL	COPC Flag	Potential ARAR/TBC Value	Potential ARAR/TBC Source	Rationale for [7] Contaminant Deletion or Selection			
Surface Soil	7440-36-0	Antimony	ND	ND	MG/KG		0/128	0.835 - 2.53	2.5E+00	4.5E-01	YES	3.1E+00	N	NO	4.1E+01	N	NO	N/A	DBSL		
	7440-38-2	Arsenic	2.58E-01	5.4E+00	MG/KG	MR18-SS24-09D	125/128	0.278 - 1.01	5.4E+00	6.3E-01	YES	3.9E-01	C*	YES	1.6E+00	C	YES	5.8E+00	NCSSL	ASL-Res, ASL-Ind	
	7440-50-8	Copper	3.14E-01	6.4E+01	MG/KG	MR18-SS94-10A	96/128	0.556 - 1.69	6.4E+01	4.8E+00	YES	3.1E+02	N	NO	4.1E+03	N	NO	7.0E+02	NCSSL	BSL	
	7439-92-1	Lead	9.67E-01	8.6E+01	J	MG/KG	MR18-SS13-09D	128/128	0.167 - 0.506	8.6E+01	1.2E+01	YES	4.0E+02	NL	NO	8.0E+02	N	NO	2.7E+02	NCSSL	BSL
	7440-66-6	Zinc	5.32E-01	2.3E+01	MG/KG	MR18-SS95-10A	125/128	1.11 - 3.37	2.3E+01	1.1E+01	YES	2.3E+03	N	NO	3.1E+04	NM	NO	1.2E+03	NCSSL	BSL	

[1] Minimum/Maximum detected concentrations.
 [2] Maximum concentration is used for screening.
 [3] Screening Steps: The maximum concentrations were compared to background concentrations. If exceedances, the maximum concentrations were the compared to RSLs.
 [4] Background values are two times the arithmetic mean basewide background surface soil concentrations. Background values are from *Final Base Background Soil Study Report, Marine Corps Base Camp Lejeune, North Carolina*, Baker Environmental, April 25, 2001.
 [5] Oak Ridge National Laboratory (ORNL). May 2010. Regional Screening Levels for Chemical Contaminants at Superfund Sites. [Online]. Residential Soil RSLs (based on 10⁻⁶ for carcinogens and HQ of 0.1 for noncarcinogens). Available Online: <http://epa-prgs.ornl.gov/chemicals/index.shtml>
 [6] Oak Ridge National Laboratory (ORNL). May 2010. Regional Screening Levels for Chemical Contaminants at Superfund Sites. [Online]. Industrial Soil RSLs (based on 10⁻⁶ for carcinogens and HQ of 0.1 for noncarcinogens). Available Online: <http://epa-prgs.ornl.gov/chemicals/index.shtml>
 The soil value of 400 mg/kg for lead is from the Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, USEPA, July 14, 1994.
 [7] Rationale Codes
 Selection Reason: Above Screening Levels (ASL)
 Detection Limit Above Screening Level (DLASL), not quantitatively evaluated in HHRA
 Deletion Reason: Below Screening Level (BSL)
 Detection Limit Below Screening Level (DLBSL)

COPC = Chemical of Potential Concern
 ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
 NCSSL = North Carolina Soil Screening Levels (NCDENR, 2010)
 J = Estimated Value
 C = Carcinogenic
 N = Noncarcinogenic
 M = concentration may exceed ceiling
 C* = N screening level < 100x C screening level, therefore N screening value/10 used as screening level
 N/A = Not available
 ND = Non-detect
 NL = Noncarcinogenic lead residential soil RSL not adjusted by dividing by 10.

Generated by: Martha White/ATL Checked by: Debbie Stannard/WDC

TABLE E.1a

Risk Ratio Screening for Surface Soil, Maximum Detected Concentration

Site UXO-18 Preliminary Assessment/Site Inspection

MCB CamLej

North Carolina

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier)	Sample Location of Maximum Detected Concentration	Residential Soil RSL	Acceptable Risk Level	Corresponding Hazard Index ^a	Corresponding Cancer Risk ^b	Target Organ
Metals (mg/kg)								
Arsenic	125 / 128	5.4E+00	MR18-SS24-09D	3.9E-01	1E-06	NA	1E-05	NA
Cumulative Corresponding Hazard Index^c						0.0		
Cumulative Corresponding Cancer Risk^d							1E-05	

Notes:

a Corresponding Hazard Index equals maximum detected concentration divided by the RSL divided by the acceptable risk level.

b Corresponding Cancer Risk equals maximum detected concentration divided by the RSL divided by the acceptable risk level.

c Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.

d Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05,

otherwise, constituent not selected as COPC.

Constituents selected as COPCs are indicated by shading.

COPC = Constituent of Potential Concern

mg/kg = micrograms per kilogram

NA = Not available/not applicable.

Generated by: Martha White/ATL Checked by: Debbie Stannard/WDC

TABLE E.2

Occurrence, Distribution, and Selection of Chemicals of Potential Concern
 Site UXO-18 Preliminary Assessment/Site Inspection
 MCB CamLej
 North Carolina

Scenario Timeframe: Current/Future
 Medium: Surface Water
 Exposure Medium: Surface Water

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
Surface Water	7440-36-0	Antimony	ND	ND	UG/L		0/10	3.75 - 3.75	3.8E+00	N/A	5.6E+00 NR	1.5E+00	R	NO	DBSL
	7440-38-2	Arsenic	7.6E-01 J	1.1E+00 J	UG/L	MR18-SW04-10A	6/10	1.5 - 1.5	1.1E+00	N/A	1.0E+01 NC	1.8E-02	NR	NO	BSL
	7440-50-8	Copper	1.9E+00 J	5.6E+00	UG/L	MR18-SW05-10A	4/10	2.5 - 2.5	5.6E+00	N/A	1.3E+03 NR	1.5E+02	R	NO	BSL
	7439-92-1	Lead	4.4E-01 J	5.4E+00	UG/L	MR18-SW05-10A	6/10	0.75 - 0.75	5.4E+00	N/A	1.5E+01 AL	N/A		NO	BSL
	7440-66-6	Zinc	4.1E+00 J	3.7E+01	UG/L	MR18-SW05-10A	10/10	5 - 5	3.7E+01	N/A	7.4E+03 NR	1.1E+03	R	NO	BSL

- [1] Minimum/Maximum detected concentrations.
- [2] Maximum concentration is used for screening.
- [3] Background values not available.
- [4] North Carolina WQS for Human Health followed by Water Supply or Federal Ambient Water Quality Criteria, Consumption of Water and Organisms.
The tap water value of 15 ug/L for lead is the action level provided in the Drinking Water Regulations and Health Advisories.
- [5] Rationale Codes
 - Selection Reason: Above Screening Levels (ASL)
 - Deletion Reason: No Toxicity Information (NTX)
 - Below Screening Level (BSL)
 - Detection Limit Below Screening Level (DLBSL)

- COPC = Chemical of Potential Concern
- ARAR/TBC = Applicable or Relevant and Appropriate Requirement/
To Be Considered
- J = Estimated Value
- NC = North Carolina WQS for Human Health and Water Supply, 2010.
- NR = National Recommended Water Quality Criteria, Consumption of Water and Organisms, 2009.
- R = RSL, tap water RSL from Regional Screening Level Table , May 2010, if based on noncarcinogenic effects, RSL is divided by 10.
- AL = Action Level from Safe Drinking Water Act.
- ND = Not detected

Generated by: Martha White/ATL Checked by: Debbie Stannard/WDC

TABLE E.3

Occurrence, Distribution, and Selection of Chemicals of Potential Concern
 Site UXO-18 Preliminary Assessment/Site Inspection
 MCB CamLej
 North Carolina

Scenario Timeframe: Current/Future
 Medium: Sediment
 Exposure Medium: Sediment

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 Residential RSL	COPC Flag	Screening [5] Toxicity Value Industrial RSL	COPC Flag	Potential ARAR/TBC Value	Potential ARAR/TBC Source	Rationale for [6] Contaminant Deletion or Selection
Sediment	7440-36-0	Antimony	7.0E-01 J	7.0E-01 J	MG/KG	MR18-SD04-10A	1/10	0.9 - 3.33	7.0E-01	N/A	3.1E+00 N	NO	4.1E+01 N	NO	N/A		BSL
	7440-38-2	Arsenic	5.8E-01	3.5E+00	MG/KG	MR18-SD04-10A	9/10	0.36 - 1.33	3.5E+00	N/A	3.9E-01 C*	YES	1.6E+00 C	YES	N/A		ASL-Res, ASL-Ind
	7440-50-8	Copper	4.0E-01 J	5.3E+01	MG/KG	MR18-SD04-10A	9/10	0.6 - 2.22	5.3E+01	N/A	3.1E+02 N	NO	4.1E+03 N	NO	N/A		BSL
	7439-92-1	Lead	4.0E+00	1.8E+02	MG/KG	MR18-SD04-10A	10/10	0.18 - 0.666	1.8E+02	N/A	4.0E+02 NL	NO	8.0E+02 N	NO	N/A		BSL
	7440-66-6	Zinc	1.6E+00	6.3E+01	MG/KG	MR18-SD05-10A	10/10	1.2 - 4.44	6.3E+01	N/A	2.3E+03 N	NO	3.1E+04 NM	NO	N/A		BSL

[1] Minimum/Maximum detected concentrations.
 [2] Maximum concentration is used for screening.
 [3] Background values not available.
 [4] Oak Ridge National Laboratory (ORNL). May 2010. Regional Screening Levels for Chemical Contaminants at Superfund Sites. [Online]. Available: <http://epa-prgs.ornl.gov/chemicals/index.shtml>. Adjusted (noncarcinogenic RSLs adjusted by dividing by 10) residential soil RSLs.
 [5] Oak Ridge National Laboratory (ORNL). May 2010. Regional Screening Levels for Chemical Contaminants at Superfund Sites. [Online]. Industrial Soil RSLs (based on 10⁻⁶ for carcinogens and HQ of 0.1 for noncarcinogens). Available Online: <http://epa-prgs.ornl.gov/chemicals/index.shtml>. The soil value of 400 mg/kg for lead is from the Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, USEPA, July 14, 1994.
 [6] Rationale Codes
 Selection Reason: Above Screening Levels (ASL)
 Detection Limit Above Screening Level (DLASL), not quantitatively evaluated in HHRA
 Deletion Reason: Below Screening Level (BSL)
 Detection Limit Below Screening Level (DLBSL)

COPC = Chemical of Potential Concern
 ARAR/TBC = Applicable or Relevant and Appropriate Requirement/
 To Be Considered
 J = Estimated Value
 C = Carcinogenic
 N = Noncarcinogenic
 M = concentration may exceed ceiling
 C* = N screening level < 100x C screening level, therefore
 N screening value/10 used as screening level
 N/A = Not available
 ND = Non-detect
 NL = Noncarcinogenic lead residential soil RSL not adjusted by dividing by 10.

Generated by: Martha White/ATL Checked by: Debbie Stannard/WDC

TABLE E.3a

Risk Ratio Screening for Sediment, Maximum Detected Concentration
Site UXO-18 Preliminary Assessment/Site Inspection
MCB CamLej
North Carolina

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier)	Sample Location of Maximum Detected Concentration	Residential Soil RSL	Acceptable Risk Level	Corresponding Hazard Index ^a	Corresponding Cancer Index ^b	Target Organ
METAL (mg/kg)								
Arsenic	9 / 10	3.5E+00	MR18-SD04-10A	3.9E-01	1E-06	NA	9E-06	NA
Cumulative Corresponding Hazard Index^c						0.0		
Cumulative Corresponding Cancer Risk^d							9E-06	

Notes:

^a Corresponding Hazard Index equals maximum detected concentration divided by the SL divided by the acceptable risk level.

^b Corresponding Cancer Risk equals maximum detected concentration divided by the SL divided by the acceptable risk level.

^c Cumulative Corresponding Hazard Index equals sum of Corresponding Hazard Indices for each constituent.

^d Cumulative Corresponding Cancer Risk equals sum of Corresponding Cancer Risks for each constituent.

Constituent selected as COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Corresponding Cancer Risk greater than 5E-05, otherwise, constituent not selected as COPC.

Constituents selected as COPCs are indicated by shading.

COPC = Constituent of Potential Concern

HI = Hazard Index

mg/kg = milligrams per kilogram

NA = Not available/not applicable.

Generated by: Martha White/ATL Checked by: Debbie Stannard/WDC

Appendix F
Ecological Risk Screening Tables

CHECKLIST FOR ECOLOGICAL ASSESSMENTS/SAMPLING

I. SITE LOCATION

1. Site Name United States Marine Corps Base (MCB), Camp Lejeune
US EPA ID Number _____
Location UXO 18
County Onslow City Jacksonville State NC
2. Latitude 34°43'51.34" N Longitude 77°27'57.00" W
3. Attach site maps, including a topographical map, a diagram which illustrates the layout of the facility (e.g., site boundaries, structures, etc.), and maps showing all habitat areas identified in Section III of the checklist. Also, include maps which illustrate known and suspected release areas, sampling locations and any other important features, if available. Figure 3-2 is an aerial showing site boundaries and sampling locations.

II. SITE CHARACTERIZATION

1. Indicate the approximate area of the site (i.e., acres or sq. ft.) The site is approximately 176 acres.
2. Is this the first site visit? Yes No
If no, attach trip report of previous site visit(s), if available.
No trip report is available.

Dates(s) of previous site visit(s) CH2M HILL conducted investigations on several dates in 2009 and 2010.

3. Are aerial or other site photographs available? Yes No
If yes, please attach any available photo(s) to the site map to the report.
Figure 2-3 of this report.

4. Provide an approximate breakdown of the land uses on the site:

_____ % Heavy Industrial	_____ % Light Industrial	_____ % Urban
_____ % Residential	_____ % Rural	_____ % Agricultural ^b
_____ % Recreational ^a	<u>95</u> % Undisturbed	<u>5</u> % Other ^c

^aFor recreational areas, please describe the use of the area (e.g., park, playing field, etc).

^bFor agricultural areas, please list the crops and/or livestock which are present.

^cFor areas designated as "other," please describe the use of the area.

Curtis Road and Robert L. Wilson Boulevard cross the southwest corner of the site.

5. Provide an approximate breakdown of the land uses in the area surrounding the site. Indicate the radius (in miles) of the area described: 0.5 mile radius

____% Heavy Industrial 50% Light Industrial ____% Urban
____% Residential ____% Rural ____% Agricultural^b
____% Recreational^a 50% Undisturbed ____% Other^c

^aFor recreational areas, please describe the use of the area (e.g., park, playing field, golf course, etc).

^bFor agricultural areas, please list the crops and/or livestock which are present.

^cFor areas designated as "other," please describe the use of the area.

6. Has any movement of soil taken place at the site? Yes No
If yes, indicate the likely source of the disturbance, (e.g., erosion, agricultural, mining, industrial activities, removals, etc.) degree of disturbance, and estimate when these events occurred.

7. Do any sensitive environmental areas exist adjacent to or in proximity to the site, (e.g. Federal and State parks, National and State monuments, wetlands)? *Remember, flood plains and wetlands are not always obvious; do not answer "no" without confirming information. See Table 1 for a list of contacts.*

Wetlands are located within the site boundaries. The New River Aviation Memorial, a tribute to the soldiers who lost their lives in a tragic 1996 aviation accident, is also located at the southern boundary of the site adjacent at the intersection of Curtis Road and Robert L. Wilson Boulevard.

Please provide the source(s) of information used to identify these sensitive areas, and indicate their general location on the site map.

United States Marine Corps (USMC). 2006. Integrated Natural Resource Management Plan (INRMP) 2007-2011, Marine Corps Base Camp Lejeune, Onslow County, North Carolina. November.

MCB Camp Lejeune GIS Layer for Wetlands

8. What type of facility is located at the site?

Chemical Manufacturing Mixing
 Waste Disposal Other (specify)

The site is predominantly undisturbed, forested land. Curtis Road and Robert L. Wilson Boulevard cross the southwest corner of the site.

9. Identify the contaminants of potential concern (COPCs) at the site. If known, include the maximum contaminant levels. Please indicate the source of data cited (e.g., RFI, confirmatory sampling, etc).
Metals were detected in surface soil, surface water, and sediment onsite. Please see the ERS for concentration information.
10. Check any potential routes of off-site migration of contaminants observed at the site:
- Swales Depressions Drainage Ditches
- Runoff Windblown Particulates Vehicular Traffic
- Other (specify):
11. Indicate the approximate depth to groundwater (in feet mean sea level [(msl)]).
Unknown for this site, but likely less than 5 feet bgs.
12. Indicate the direction of groundwater flow (e.g., north, southeast, etc.)
Information not available for this site.
13. Is the direction of surface runoff apparent from site observations? Yes No
If yes, to which of the following does the surface runoff discharge? Indicate all that apply.
- Surface water Groundwater Sewer
- Collection Impoundment
14. Is there a navigable water body or tributary to a navigable water body?
 Yes No
15. Is there a water body anywhere on or in the vicinity of the site? If yes, also complete Section III.B.1: Aquatic Habitat Checklist -- Non-Flowing Systems and/or Section III.B.2: Aquatic Habitat Checklist -- Flowing Systems.
- Yes No
16. Is there evidence of flooding? Yes No
Wetlands and flood plains are not always obvious. Do not answer "no" without confirming information. If yes, complete Section III.C: Wetland Habitat Checklist.

17. If a field guide was used to aid any of the identifications, please provide a reference. Also, estimate the time spent identifying fauna. (Use a blank sheet if additional space is needed for text.)
18. Are any threatened and/or endangered species (plant or animal) known to inhabit the area of the site? Yes No
If yes, you are required to verify this information with the U.S. Fish and Wildlife Service or other appropriate agencies (see Table 1 for a list of contacts). If species' identities are known, please list them next.
19. Record weather conditions at the site at the time of the site visit when information for completion of this checklist was prepared:

DATE June 2009

80°F Temperature (°C/°F)

Wind (direction/speed):

Cloud Cover: Mostly Sunny

Normal daily high temperature (°C/°F):

Precipitation (rain, snow): None

20. Describe reasonable and likely future land and/or water use(s) at the site.
There are currently no development plans.
21. Describe the historical uses of the site. Include information on chemical releases that may have occurred as a result of previous land uses. For each chemical release, provide information on the form of the chemical released (i.e., solid, liquid, vapor) and the known or suspected causes or mechanism of the release (i.e., spills, leaks, material disposal, dumping, explosion, etc.).
Historical mapping from 1927 to the early 1940s indicates that the UXO 18 was undeveloped during this timeframe. Over the years, the ranges associated with the UXO-18 investigation area have been referred to by various names (USACE, 2001), including:
- B-6, 50-foot Small Arms Range
 - B-6, 50-foot, .22 Caliber Range
 - B-6, 1,000-inch Range [machine gun (MG) and .22 Caliber

According to the United States Army Corps of Engineers (USACE) Range Identification and Preliminary Range Assessment (USACE, 2001), the ranges associated with B-6 (ASR #2.44) were used between 1950 and 1961. A total of 25 target stations were

reportedly used for .22 caliber (rifle and pistol) ammunition, and 10 target stations were used for .32, .38, and .45 caliber (pistol) ammunition (USACE, 2001).

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

22. Identify the media (e.g., soil [surface or subsurface], surface water, air, groundwater) which are known or suspected to contain COCs.
Surface soil, surface water, and sediment are suspected to contain COCs.

II.A. SUMMARY OF OBSERVATIONS AND SITE SETTING

Include information on significant source areas and migration pathways that are likely to constitute complete exposure pathways.
Soil, surface water, and sediment exposure pathways may be complete.

Checklist Completed by Sara Kent

Affiliation CH2M HILL

Author Assisted by _____

Date 6/23/2010

III. HABITAT EVALUATION

III.A Terrestrial Habitat Checklist

III.A.1 Wooded

Are any wooded areas on or adjacent to the site? Yes No

If yes, indicate the wooded area on the attached site map and answer the following questions. If more than one wooded area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual wooded area. Distinguish between wooded areas by using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.A.2: Shrub/Scrub

Wooded Area Questions

On-site Off-site

Name or Designation: Unknown

1. Estimate the approximate size of the wooded area 170 acres
Please identify what information was used to determine the wooded area of the site (e.g., direct observation, photos, etc). Aerial photos available through Google earth and site photos.



2. Indicate the dominant type of vegetation in the wooded area. Provide photographs, if available.

- Evergreen
- Deciduous
- Mixed

Dominant plant species, if known: Unknown

3. Estimate the vegetation density of the wooded area.

- X Dense (i.e., greater than 75% vegetation)
- Moderate (i.e., 25% to 75% vegetation)
- Sparse (i.e., less than 25% vegetation)

4. Indicate the predominant size of the trees at the site. Use diameter at breast height.

- X 0-6 inches
- 6-12 inches
- >12 inches
- No single size range is predominant

5. Specify type of understory present, if known. Provide a photograph, if available. The understory is densely vegetated.

III.A.2 Shrub/Scrub

Are any shrub/scrub areas on or adjacent to the site? Yes No

If yes, indicate the shrub/scrub area on the attached site map and answer the following questions. If more than one shrub/scrub area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual shrub/scrub area. Distinguish between shrub/scrub areas, using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.A.3: Open Field

III.A.3 Open Field

Are any open field areas on or adjacent to the site? Yes No

If yes, indicate the open field area on the attached site map and answer the following questions. If more than one open field area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual open field area. Distinguish between open field areas, using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.A.4: Miscellaneous

III.A.4 Miscellaneous

Are other types of terrestrial habitats present at the site, other than woods, scrub/shrub and open field? Yes No

If yes, indicate the area on the attached site map and answer the following questions. If more than one of these areas are present on or adjacent to the site, make additional copies of the following questions and fill out for each individual area. Distinguish between areas by using names or other designations. Clearly identify each area on the site map.

If no, proceed to Section III.B: Aquatic Habitats.

III.B Aquatic Habitats

Note: Aquatic systems are often associated with wetland habitats. Please refer to Section III.C, Wetland Habitat Checklist.

III.B.1 Non-Flowing Systems

Are any non-flowing aquatic features (such as ponds or lakes) located at or adjacent to the site?

Yes No

If yes, indicate the aquatic feature on the attached site map and answer the following questions regarding the non-flowing aquatic features. If more than one non-flowing aquatic feature is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual aquatic feature. Distinguish between aquatic features by using names or other designations. Clearly identify each area on the site map.

If no, proceed to Section III.B.2: Flowing Systems

III.B.2 Flowing Systems

Note: Aquatic systems are often associated with wetland habitats. Please refer to Section III.C, Wetland Habitat Checklist.

Are any flowing aquatic features (such as streams or rivers) located at or adjacent to the site?

Yes No

If yes, indicate the system on the attached site map and answer the following questions regarding the flowing system. If more than one flowing system is present on or adjacent to the site, make additional copies of the following questions and complete one set for each individual aquatic feature. Distinguish between flowing systems by using names or other designation. Clearly identify each area on the site map

If no, proceed to Section III.C: Wetlands Habitats.

Flowing Aquatic Systems Questions

On-site Off-site

Name or Designation: Unknown

1. Indicate the type of flowing aquatic feature present.

- River
- Stream/Creek/Brook
- Intermittent stream
- Artificially created (ditch, etc.)
- Channeling
- Other (specify)

2. For natural systems, are there any indicators of physical alteration (e.g., channeling, debris, etc.)? Yes No

If yes, please describe the indicators observed.

3. Indicate the general composition of the bottom substrate.

- | | | |
|--|---|--|
| <input type="checkbox"/> Bedrock | <input checked="" type="checkbox"/> Sand (course) | <input type="checkbox"/> Concrete |
| <input type="checkbox"/> Boulder (>10 in.) | <input checked="" type="checkbox"/> Silt (fine) | <input type="checkbox"/> Debris |
| <input type="checkbox"/> Cobble (2.5 - 10 in.) | <input type="checkbox"/> Clay (slick) | <input type="checkbox"/> Detritus |
| <input type="checkbox"/> Gravel (0.1 - 2.5 in.) | <input checked="" type="checkbox"/> Muck (fine/black) | <input type="checkbox"/> Marl (Shells) |
| <input type="checkbox"/> Other (please specify): _____ | | |

4. Describe the condition of the bank (e.g., height, slope, extent of vegetative cover).

Unknown

5. Is the system influenced by tides? Yes No

What information was used to make this determination?

Tide charts and NWI maps

(<http://www.tides.info/?command=view&location=New+River+Inlet%2C+North+Carolina>)

6. Is the flow intermittent? Yes No

If yes, please note the information used to make this determination. USGS Topographic Maps

7. Is there a discharge from the site to the water body? Yes No
If yes, describe the origin of each discharge and its migration path. Surface water runoff from the site discharge to the drainage areas.

8. Indicate the discharge point of the water body. Specify name of the discharge, if known. The stream discharges to Southwest Creek approximately 1.2 miles south of the site.

9. Identify any field measurements and observations of water quality that were made. Provide the measurement and the units of measure in the appropriate space below:

- _____ Width (ft.)
- _____ Depth (average)
- _____ Velocity (specify units): _____
- _____ Temperature (depth of water where the reading was taken) _____
- _____ pH
- _____ Dissolved oxygen
- _____ Salinity
- _____ Turbidity (clear, slightly turbid, turbid, opaque)
(Secchi disk depth _____)
- _____ Other (specify)

10. Describe observed color and area of coloration. None observed

11. Is any aquatic vegetation present? Yes No
If yes, please identify the type of vegetation present, if known.

- Emergent Submergent Floating

12. Mark the flowing water system on the attached site map. See Figure 3-2.

13. What observations were made at the water body regarding the presence and/or absence of benthic macroinvertebrates, fish, birds, mammals, etc? None observed

III.C Wetland Habitats

Are any wetland¹ areas such as marshes or swamps on or adjacent to the site?

X Yes No

If yes, indicate the wetland area on the attached site map and answer the following questions regarding the wetland area. If more than one wetland area is present on or adjacent to the site, make additional copies of the following questions and fill out one for each individual wetland area. Distinguish between wetland areas by using names or other designations (such as location). Clearly identify each area on the site map. Also, obtain and attach a National Wetlands Inventory Map (or maps) to illustrate each wetland area.

Identify the sources of the observations and information (e.g., National Wetland Inventory, Federal or State Agency, USGS topographic maps) used to make the determination whether or not wetland areas are present.

MCB Camp Lejeune GIS Layer for Wetlands

If no wetland areas are present, proceed to Section III.D: Sensitive Environments and Receptors.

Wetland Area Questions

X On-site Off-site

Name or Designation: Unknown

1. Indicate the approximate area of the wetland (acres or ft.²) Unknown. Large forested wetland system within the site boundaries (NWI map)
2. Identify the type(s) of vegetation present in the wetland.
 - Submergent (i.e., underwater) vegetation
 - Emergent (i.e., rooted in the water, but rising above it) vegetation
 - Floating vegetation
 - Scrub/shrub
 - X Wooded
 - Other (Please describe): _____

¹Wetlands are defined in 40 CFR §232.2 as “ Areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” Examples of typical wetlands plants include: cattails, cordgrass, willows and cypress trees. National wetland inventory maps may be available at <http://nwi.fws.gov>. Additional information on wetland delineation criteria is also available from the Army Corps of Engineers.

3. Provide a general description of the vegetation present in and around the wetland (height, color, etc). Provide a photograph of the known or suspected wetlands, if available.
Forested, palustrine wetlands with some emergent vegetation.



4. Estimate the vegetation density of the wetland area.
- Dense (i.e., greater than 75% vegetation)
 - Moderate (i.e., 25% to 75% vegetation)
 - Sparse (i.e., less than 25% vegetation)
5. Is standing water present? Yes No
 If yes, is the water primarily: Fresh Brackish (NWI map)
 Indicate the approximate area of the standing water (ft.²) Unknown
 Indicate the approximate depth of the standing water, if known (ft. or in.) Unknown
6. Identify any field measurements and observations of water quality that were made.
 Provide the measurement and the units of measure in the appropriate space below:

_____ Area

_____ Depth (average)

_____ Temperature (depth of water where the reading was taken)_____

_____ pH

_____ Dissolved oxygen

_____ Salinity

_____ Turbidity (clear, slightly turbid, turbid, opaque)
 (Secchi disk depth_____)

_____ Other (specify)

7. Describe observed color and area of coloration.
None observed.
8. If known, indicate the source of the water in the wetland.
- Stream/River/Creek/Lake/Pond
 - Flooding
 - Groundwater
 - Surface runoff
9. Is there a discharge from the site to the wetland? Yes No
 If yes, please describe: Runoff from the site discharges to the wetland.
10. Is there a discharge from the wetland? Yes No
 If yes, to what water body is discharge released?
- Marine (Name: New River)
 - Surface stream/River (Name: Southwest Creek)
 - Lake/Pond (Name: _____)
 - Groundwater
 - Not sure
11. Does the area show evidence of flooding? Yes No
 If yes, indicate which of the following are present (mark all that apply).
- Standing water
 - Water-saturated soils
 - Water marks
 - Buttressing
 - Debris lines
 - Mud cracks
 - Other (Please describe):
12. If a soil sample was collected, describe the appearance of the soil in the wetland area.
 Circle or write in the best response.
- Color (blue/gray, brown, black, mottled) _____
- Water content (dry, wet, saturated/unsaturated) _____
13. Mark the observed wetland area(s) on the attached site map.

III.D Sensitive Environments and Receptors

1. Do any other potentially sensitive environmental areas² exist adjacent to or within one-half mile of the site? If yes, list these areas and provide the source(s) of information used to identify sensitive areas. *Do not answer "no" without confirmation from the U.S. Fish and Wildlife Service and other appropriate agencies. See Table 1 for a list of contacts.*
Wetlands are located within the site boundary. This information is based on GIS information (NWI maps) on wetlands and rare species provided by MCB Camp Lejeune and Onslow County and the MCB Camp Lejeune INRMP (INRMP, 2006).

2. Are any areas on or near (i.e., within one-half mile) the site owned or used by local tribes? If yes, describe.
No

3. Does the site serve or potentially serve as a habitat, foraging area or refuge by rare, threatened, endangered, candidate and/or proposed species (plants or animals), or any otherwise protected species? If yes, identify species. *This information should be obtained from the U.S. Fish and Wildlife Service and other appropriate agencies. See Table 1 for a list of contacts.*
No

4. Is the site potentially used as a breeding, roosting or feeding area by migratory bird species? If yes, identify which species.
Unknown.

5. Is the site used by any ecologically³, recreationally or commercially important species? If yes, explain.
No

² Areas that provide unique and often protected habitat for wildlife species. These areas are typically used during critical life stages such as breeding, hatching, rearing of young and overwintering. Refer to Table 2 at the end of this document for examples of sensitive environments.

³ Ecologically important species include populations of species which provide a critical (i.e., not replaceable) food resource for higher organisms. These species' functions would not be replaced by more tolerant species or perform a critical ecological function (such as organic matter decomposition) and will not be replaced by other species. Ecologically important species include pest and opportunistic species that populate an area if they serve as a food source for other species, but do not include domesticated animals (e.g., pets and livestock) or plants/animals whose existence is maintained by continuous human interventions (e.g., fish hatcheries, agricultural crops, etc).

IV. EXPOSURE PATHWAY EVALUATION

1. Do existing data provide sufficient information on the nature, rate and extent of contamination at the site?

- Yes
 No
 Uncertain

Please provide an explanation for your answer.

Data were collected from each medium across the site, providing representative samples for the area of concern.

2. Do existing data provide sufficient information on the nature, rate and extent of contamination in offsite affected areas?

- Yes
 No
 Uncertain
 No offsite contamination

Please provide an explanation for your answer.

See #1 of this section.

3. Do existing data address potential migration pathways of contaminants at the site?

- Yes
 No
 Uncertain

Please provide an explanation for your answer.

Data were collected based on potential migration pathways (i.e., overland flow).

4. Do existing data address potential migration pathways of contaminants in offsite affected areas?

- Yes
 No
 Uncertain
 No offsite contamination

Please provide an explanation for your answer. Concentrations of COPCs in surface water are not expected to be high enough to cause any discernable impact to the Southwest Creek and New River.

5. Are there visible indications of stressed habitats or receptors on or near (i.e., within one-half mile) the site that may be the result of a chemical release? If yes, explain. Attach photographs if available.

No

6. Is the location of the contamination such that receptors might be reasonably expected to come into contact with it? For soil, this means contamination in the soil 0 to 1 foot below ground surface (bgs). If yes, explain.

Inorganics were detected in areas where receptors may be exposed.

7. Are receptors located in or using habitats where chemicals exist in air, soil, sediment or surface water? If yes, explain.

Unknown. No receptors were observed during the site visit.

8. Could chemicals reach receptors via groundwater? Can chemicals leach or dissolve to groundwater? Are chemicals mobile in groundwater? Does groundwater discharge into receptor habitats? If yes, explain.

Unknown. Groundwater data is unavailable for the site.

9. Could chemicals reach receptors through runoff or erosion? Answer the following questions.

Overland runoff could contribute COPCs to onsite drainages and wetlands.

What is the approximate distance from the contaminated area to the nearest watercourse?

- 0 feet (i.e., contamination has reached a watercourse)
- 1-10 feet
- 11-20 feet
- 21-50 feet
- 51-100 feet
- 101-200 feet
- > 200 feet
- > 500 feet
- > 1000 feet

What is the slope of the ground in the contaminated area?

- 0-10%
- 10-30%
- > 30%

What is the approximate amount of ground and canopy vegetative cover in the contaminated area?

- < 25%
- 25-75%
- > 75%

Is there visible evidence of erosion (e.g., a rill or gully) in or near the contaminated area?

- Yes
- No
- Do not know

Do any structures, pavement or natural drainage features direct run-on flow (i.e., surface flows originating upstream or uphill from the area of concern) into the contaminated area?

- Yes
- No
- Do not know

Could chemicals reach receptors through the dispersion of contaminants in air (e.g., volatilization, vapors, fugitive dust)? If yes, explain.

No

Could chemicals reach receptors through migration of non-aqueous phase liquids (NAPLs)? Is a NAPL present at the site that might be migrating towards receptors or habitats? Could NAPL discharge contact receptors or their habitat?

No

Table F-1

ERS Surface Soil Screen for UXO-18
 Site UXO-18 Preliminary Assessment/Site Inspection
 MCB CamLej
 North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance ¹	Maximum Hazard Quotient	Arithmetic Mean Concentration	Mean Hazard Quotient	2 x Mean Background	Maximum Exceeds 2 x Mean Background?	Retain?	Rationale
Inorganics (MG/KG)													
Antimony	0.84 - 2.53	0 / 128	--	--	0.27	-- / --	9.37	0.59	2.18	0.447	Yes	NO	Not detected
Arsenic	0.28 - 0.51	125 / 128	5.44	MR18-SS24-09D	18.0	0 / 128	0.30	0.99	0.05	0.626	Yes	NO	HQ less than one, detected
Copper	0.59 - 1.48	96 / 128	64.4	MR18-SS94-10A	28.0	1 / 128	2.30	2.01	0.07	4.83	Yes	NO	Low frequency of exceedance
Lead	-- - --	128 / 128	86.1	MR18-SS13-09D	11.0	38 / 128	7.83	9.61	0.87	12.3	Yes	NO	See text discussion
Zinc	1.28 - 1.45	125 / 128	22.9	MR18-SS95-10A	46.0	0 / 128	0.50	4.02	0.09	10.8	Yes	NO	HQ less than one, detected

NOTES

1 - Count of detected samples exceeding or equaling Screening Value

HQ - hazard quotient

MG/KG - Milligrams per kilogram

Generated by: Sara Kent

Checked by: Kelly Taylor

Table F-1

ERS Surface Soil Screen for UXO-18
 Site UXO-18 Preliminary Assessment/Site Inspection
 MCB CamLej
 North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance ¹	Maximum Hazard Quotient	Arithmetic Mean Concentration	Mean Hazard Quotient	2 x Mean Background	Maximum Exceeds 2 x Mean Background?	Retain?	Rationale
Inorganics (MG/KG)													
Antimony	0.84 - 2.53	0 / 128	--	--	0.27	-- / --	9.37	0.59	2.18	0.447	Yes	NO	Not detected
Arsenic	0.28 - 0.51	125 / 128	5.44	MR18-SS24-09D	18.0	0 / 128	0.30	0.99	0.05	0.626	Yes	NO	HQ less than one, detected
Copper	0.59 - 1.48	96 / 128	64.4	MR18-SS94-10A	28.0	1 / 128	2.30	2.01	0.07	4.83	Yes	NO	Low frequency of exceedance
Lead	-- - --	128 / 128	86.1	MR18-SS13-09D	11.0	38 / 128	7.83	9.61	0.87	12.3	Yes	NO	See text discussion
Zinc	1.28 - 1.45	125 / 128	22.9	MR18-SS95-10A	46.0	0 / 128	0.50	4.02	0.09	10.8	Yes	NO	HQ less than one, detected

NOTES

1 - Count of detected samples exceeding or equaling Screening Value

HQ - hazard quotient

MG/KG - Milligrams per kilogram

Generated by: Sara Kent

Checked by: Kelly Taylor

Table F-2

ERS Sediment Screen for UXO-18
Site UXO-18 Preliminary Assessment/Site Inspection
MCB CamLej
North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance ¹	Maximum Hazard Quotient	Arithmetic Mean Concentration	Mean Hazard Quotient	Retain?	Rationale
Inorganics (MG/KG)											
Antimony	0.90 - 3.33	1 / 10	0.70	MR18-SD04-10A	2.00	0 / 10	0.35	0.86	0.43	NO	HQ less than one, detected
Arsenic	0.39 - 0.39	9 / 10	3.48	MR18-SD04-10A	7.24	0 / 10	0.48	1.68	0.23	NO	HQ less than one, detected
Copper	0.60 - 0.60	9 / 10	52.9	MR18-SD04-10A	18.7	1 / 10	2.83	8.94	0.48	NO	Low magnitude and frequency of exceedance
Lead	-- - --	10 / 10	182	MR18-SD04-10A	30.2	2 / 10	6.03	30.8	1.02	NO	See text for discussion
Zinc	-- - --	10 / 10	63.4	MR18-SD05-10A	124	0 / 10	0.51	17.5	0.14	NO	HQ less than one, detected

NOTES

1 - Count of detected samples exceeding or equaling Screening Value

HQ - hazard quotient

MG/KG - Milligrams per kilogram

Generated by: Sara Kent

Checked by: Kelly Taylor

Table F-3

ERS Surface Water Screen for UXO-18
 Site UXO-18 Preliminary Assessment/Site Inspection
 MCB CamLej
 North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value ¹	Frequency of Exceedance ²	Maximum Hazard Quotient	Arithmetic Mean concentration	Mean Hazard Quotient	Retain?	Rationale
Inorganics (UG/L)											
Antimony	3.75 - 3.75	0 / 10	--	--	160	-- / --	0.023	1.88	0.012	NO	Not detected, HQ less than one
Arsenic	1.50 - 1.50	6 / 10	1.06	MR18-SW04-10A	150	0 / 10	0.0071	0.85	0.006	NO	HQ less than one, detected
Copper	2.50 - 2.50	4 / 10	5.58	MR18-SW05-10A	9.00	0 / 10	0.62	1.96	0.218	NO	HQ less than one, detected
Lead	0.75 - 0.75	6 / 10	5.40	MR18-SW05-10A	25.0	0 / 10	0.22	1.15	0.046	NO	HQ less than one, detected
Zinc	-- - --	10 / 10	37.4	MR18-SW05-10A	120	0 / 10	0.31	11.9	0.099	NO	HQ less than one, detected
Dissolved Metals (UG/L)											
Antimony, Dissolved	3.75 - 3.75	0 / 10	--	--	160	-- / --	0.023	1.88	0.012	NO	Not detected, HQ less than one
Arsenic, Dissolved	1.50 - 1.50	5 / 10	1.18	MR18-SW04-10A	150	0 / 10	0.0079	0.88	0.006	NO	HQ less than one, detected
Copper, Dissolved	2.50 - 2.50	5 / 10	4.93	MR18-SW03-10A	9.00	0 / 10	0.55	2.10	0.233	NO	HQ less than one, detected
Lead, Dissolved	0.75 - 0.75	4 / 10	2.08	MR18-SW05-10A	25.0	0 / 10	0.083	0.65	0.026	NO	HQ less than one, detected
Zinc, Dissolved	-- - --	10 / 10	37.7	MR18-SW05-10A	120	0 / 10	0.31	12.4	0.103	NO	HQ less than one, detected

NOTES

1 - Freshwater Screening Values

2 - Count of detected samples exceeding or equaling Screening Value

NSV - No Screening Value

UG/L - Micrograms per liter

Generated by: Sara Kent

Checked by: Kelly Taylor

Table F-3

ERS Surface Water Screen for UXO-18
 Site UXO-18 Preliminary Assessment/Site Inspection
 MCB CamLej
 North Carolina

Chemical	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value ¹	Frequency of Exceedance ²	Maximum Hazard Quotient	Arithmetic Mean concentration	Mean Hazard Quotient	Retain?	Rationale
Inorganics (UG/L)											
Antimony	3.75 - 3.75	0 / 10	--	--	160	-- / --	0.023	1.88	0.012	NO	Not detected, HQ less than one
Arsenic	1.50 - 1.50	6 / 10	1.06	MR18-SW04-10A	150	0 / 10	0.0071	0.85	0.006	NO	HQ less than one, detected
Copper	2.50 - 2.50	4 / 10	5.58	MR18-SW05-10A	9.00	0 / 10	0.62	1.96	0.218	NO	HQ less than one, detected
Lead	0.75 - 0.75	6 / 10	5.40	MR18-SW05-10A	25.0	0 / 10	0.22	1.15	0.046	NO	HQ less than one, detected
Zinc	-- - --	10 / 10	37.4	MR18-SW05-10A	120	0 / 10	0.31	11.9	0.099	NO	HQ less than one, detected
Dissolved Metals (UG/L)											
Antimony, Dissolved	3.75 - 3.75	0 / 10	--	--	160	-- / --	0.023	1.88	0.012	NO	Not detected, HQ less than one
Arsenic, Dissolved	1.50 - 1.50	5 / 10	1.18	MR18-SW04-10A	150	0 / 10	0.0079	0.88	0.006	NO	HQ less than one, detected
Copper, Dissolved	2.50 - 2.50	5 / 10	4.93	MR18-SW03-10A	9.00	0 / 10	0.55	2.10	0.233	NO	HQ less than one, detected
Lead, Dissolved	0.75 - 0.75	4 / 10	2.08	MR18-SW05-10A	25.0	0 / 10	0.083	0.65	0.026	NO	HQ less than one, detected
Zinc, Dissolved	-- - --	10 / 10	37.7	MR18-SW05-10A	120	0 / 10	0.31	12.4	0.103	NO	HQ less than one, detected

NOTES

1 - Freshwater Screening Values

2 - Count of detected samples exceeding or equaling Screening Value

NSV - No Screening Value

UG/L - Micrograms per liter

Generated by: Sara Kent

Checked by: Kelly Taylor