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FINAL PRELIMINARY ASSESSMENT/SITE INSPECTION REPORT PROPOSED FITNESS
CENTER MILCON AREA MCB CAMP LEJEUNE NC
03/01/2011
CH2M HILL

Final

**Preliminary Assessment/Site Inspection Report
Proposed Fitness Center (P-714)
MILCON Area**

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

Contract Task Order 0133

March 2011

Prepared for

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

Under the

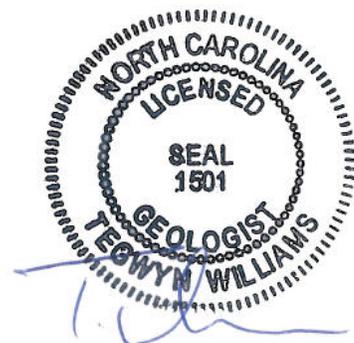
**NAVFAC CLEAN 1000 Program
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Contents

Acronyms and Abbreviations	v
1 Introduction	1-1
1.1 Objectives and Approach.....	1-1
1.2 Report Organization	1-2
2 Site Background	2-1
2.1 MCB CamLej Location and Description	2-1
2.2 Site Setting.....	2-1
2.3 Site History	2-2
2.3.1 B-6 50-foot Small Arms Range	2-2
2.3.2 B-12 Baffled Pistol Range	2-2
2.4 Regional Climate.....	2-2
2.5 Regional Geology and Hydrogeology	2-2
2.6 Site Geology and Hydrogeology	2-3
3 Field Investigation Activities	3-1
3.1 Environmental Investigation Activities.....	3-1
3.1.1 Surface Soil Sampling.....	3-1
3.1.2 Subsurface Soil Sampling	3-2
3.1.3 Monitoring Well Installation.....	3-2
3.1.4 Groundwater Sampling	3-3
3.1.5 Surface Water and Sediment Sampling	3-4
3.1.6 Quality Assurance/Quality Control Sampling	3-4
3.1.7 Data Validation	3-4
3.2 Site Survey	3-4
3.3 Investigation-derived Waste Management	3-5
4 Investigation Results	4-1
4.1 Environmental Investigation Results.....	4-1
4.1.1 Soil.....	4-1
4.1.2 Groundwater	4-2
4.1.3 Sediment and Surface Water	4-3
5 Human Health Risk Screening	5-1
5.1 Data Evaluation.....	5-1
5.2 Human Health Conceptual Site Model.....	5-1
5.3 Risk Screening Approach.....	5-2
5.4 Human Health Risk Screening Results	5-4
6 Ecological Risk Screening.....	6-1
6.1 Site Ecological Setting and Available Data.....	6-1
6.1.1 Screening Methodology	6-1
6.2 Screening Results	6-2
6.2.1 Surface Soil.....	6-2
6.2.2 Subsurface Soil	6-2

6.2.3	Groundwater.....	6-2
6.2.4	Surface Water.....	6-2
6.2.5	Sediment.....	6-2
6.3	Summary.....	6-3
7	Conclusions and Recommendations	7-1
8	References.....	8-1

Appendices

- A Archival Records Search Report
- B Soil Boring Logs and Well Completion Diagrams
- C Groundwater Sampling Data Sheets
- D Data Validation Summary Reports
- E Data Tables and Raw Analytical Data
- F Human Health Risk Screening Report Figures and Tables
- G Ecological Risk Screening Report Tables

Tables

- 2-1 Groundwater Elevation and Well Construction Information
- 3-1 Groundwater Field Parameters
- 3-2 Sample Collection Frequencies
- 4-1 Surface Soil Analytical Results
- 4-2 Subsurface Soil Analytical Results
- 4-3 Surface Soil Exceedance Summary
- 4-4 Subsurface Soil Exceedance Summary
- 4-5 Groundwater Analytical Results
- 4-6 Sediment Analytical Results
- 4-7 Surface Water Analytical Results
- 4-8 Sediment Exceedance Summary
- 4-9 Surface Water Exceedance Summary

Figures

- 1-1 Base Location Map
- 2-1 Fitness Center (P-714) Area Location Map
- 2-2 Potentiometric Surface of the Surficial Aquifer (August 2010)
- 3-1 Surface Soil Sampling Locations
- 3-2 Subsurface and Groundwater Sampling Locations
- 3-3 Sediment and Surface Water Sampling Locations
- 4-1 Surface Soil Exceedances
- 4-2 Subsurface Soil Exceedances
- 4-3 Sediment and Surface Water Exceedances

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
CTO	contract task order
°F	degrees Fahrenheit
DO	dissolved oxygen
DPT	direct push technology
ERS	Ecological Risk Screening
ESV	ecological screening value
FID	flame ionization detector
ft/ft	feet per foot
GPS	global positioning system
HHRS	Human Health Risk Screening
HQ	hazard quotient
ID	inner diameter
IDW	investigation-derived waste
MC	munitions constituents
MCAS	Marine Corps Air Station
MCB CamLej	Marine Corps Base Camp Lejeune
MEC	munitions and explosives of concern
MILCON	military construction
mm	millimeter
MPP	Master Project Plans
MRP	Munitions Response Program
MS	matrix spike
MSD	matrix spike duplicate
NAD 83	North American Datum of 1983
NAVD 88	North American Vertical Datum of 1988
NAVFAC	Naval Facilities Engineering Command
NC 2L Standards	NCAC Title 15A, Subchapter 2L Groundwater Quality Standards
NC SSL	North Carolina Soil Screening Level
NCAC	North Carolina Administrative Code

NCDENR	North Carolina Department of Environment and Natural Resources
NRWQC	National Recommended Water Quality Criteria
ORP	oxidation-reduction potential
PA	Preliminary Assessment
PPE	personal protective equipment
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RSL	regional screening level
SI	Site Inspection
TOC	top of casing
USEPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
UXO	unexploded ordnance
VOC	volatile organic compound

Introduction

This report documents the findings of a Preliminary Assessment (PA)/Site Inspection (SI) conducted at the proposed Fitness Center (P-714) Military Construction (MILCON) area located within Marine Corps Air Station (MCAS) New River in Jacksonville, North Carolina (**Figure 1-1**). The proposed MILCON area lies within the B-6, 50-foot small arms range (Archive Search Report [ASR] #2.44) and the B-12, Baffled Pistol Range (ASR #2.134). This investigation did not address the adjacent B-14 ABC Warfare Area (ASR#2.198) as it is part of a future expansion area of the Fitness Center MILCON.

The potential environmental issues associated with historical small arms activity is being addressed by the United States Marine Corps and Naval Facilities Engineering Command (NAVFAC) in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigation process.

This PA/SI was conducted by CH2M HILL under the NAVFAC Mid-Atlantic, Comprehensive Long-Term Environmental Action – Navy (CLEAN) Program, Contract N62470-08-D-1000, Contract Task Order (CTO)-133.

1.1 Objectives and Approach

The primary objectives of this environmental investigation were to evaluate the potential presence and nature of impacts to environmental media resulting from historical use of small arms munitions at the site, and to evaluate whether additional investigation and/or remediation activities are necessary prior to construction activities. Accordingly, this investigation focused on potential impacts to soil, sediment, surface water, and groundwater by munitions constituents (MC) resulting from the use of small arms ammunition. Munitions and explosives of concern (MEC) were not expected due to historic small arms range use.

This PA/SI was conducted in accordance with the *Site-Specific Work Plan for Preliminary Assessment/Site Inspection at the Proposed Fitness Center (P-714) MILCON Area, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina* (PA/SI Work Plan) (CH2M HILL, 2010a) and the *Munitions Response Program Master Project Plan, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina* (MRP MPP) (CH2M HILL, 2008).

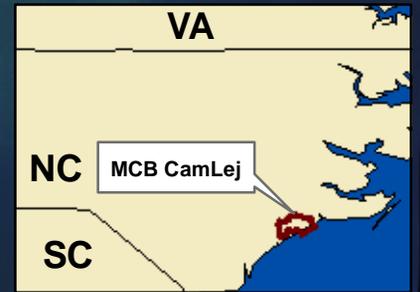
The general approach adopted during this PA/SI was as follows:

- Conduct research to identify historical activities that may have resulted in MC contamination at the site, including review of archival records and interviews with current and former installation personnel.
- Evaluate the potential presence and nature of MC contamination by conducting an investigation of soil, groundwater, surface water, and sediment.
- Conduct ecological and human health risk screening using analytical data collected at the site.

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



- Legend**
- Highways
 - Investigation Area
 - Installation Boundary

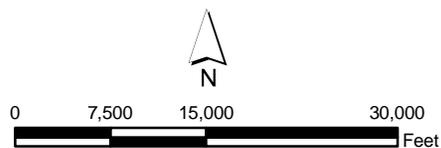


Figure 1-1
Base Location Map
Fitness Center (P-714) MILCON Area
PA/SI Report
MCB CamLej
North Carolina



Site Background

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

2.1 MCB CamLej Location and Description

Marine Corps Base Camp Lejeune (MCB CamLej) covers approximately 236 square miles in Onslow County, North Carolina and is bisected by the New River, which flows in a southeasterly direction toward the Atlantic Ocean (**Figure 1-1**). Construction of MCB CamLej began in 1941 with the objective of developing the “World’s Most Complete Amphibious Training Base.” The mission of MCB CamLej is to maintain combat-ready units for expeditionary deployment. MCB CamLej provides housing, training facilities, logistical support, and administrative supplies for Fleet Marine Force units and other assigned units. The Base is home to an active duty, dependent, retiree, and civilian population of approximately 150,000, of whom approximately 47,000 are military personnel. Land use surrounding MCB CamLej is varied, with mainly commercial properties along the northern boundary. The eastern and western boundaries of MCB CamLej are a mix of agricultural and residential land. The southern boundary of MCB CamLej extends to the New River and Atlantic Ocean.

2.2 Site Setting

The Fitness Center MILCON area is located within MCAS New River (**Figure 1-1**), on the north side of Douglas Road, roughly 0.5 miles west of the intersection of Douglas Road and Schmidt Street. The site is currently undeveloped and encompasses approximately 13 acres of predominantly wooded land. **Figure 2-1** illustrates the proposed building construction area and areas for future expansion on the site.

The northern boundary of the site is bordered by woodland and wetland areas. A small unnamed creek runs through the western corner of the site flowing south towards a wetland area south of Douglas Road. The eastern portion of the site consists of a large engineered drainage ditch.

The site topography is relatively level, with land surface elevations ranging from 8 to 24 feet amsl, sloping gently west towards Douglas Road. The firing line for the B-6 and B-12 small arms ranges are both located to the north of the Fitness Center MILCON area, and oriented aiming south as indicated on maps included in the Archival Records Search Report (**Appendix A**).

2.3 Site History

The following is a brief overview of the ranges overlapping the Fitness Center MILCON area. The Archival Records Search Report (**Appendix A**) contains more detailed information regarding the historical range locations, use, and investigative history.

2.3.1 B-6 50-foot Small Arms Range

The Range Identification and Preliminary Range Assessment (USACE, 2001), indicated that the ranges associated with the B-6 50-foot small arms range (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, however, the historical documentation does not specify the locations of these targets within B-6.

A separate PA/SI is also being conducted in the historical northern portion of the B-6 range as part of Unexploded Ordnance [UXO]-18.

2.3.2 B-12 Baffled Pistol Range

The B-12 Baffled Pistol Range (ASR #2.134), first used in 1970 (also known as the B-12 Rifle and Pistol Range), has been used for firing of .22 caliber (rifle and pistol), .38, .45, and 9 millimeter (mm) weapons. The range is equipped with a bullet trap to collect the fired rounds (Richardson, 2007). The B-12 range is active, but was temporarily closed from May 2010 through June 2011, to allow field sampling activities and future MILCON activities.

A portion of the B-12 range was the subject of a separate PA/SI for the Bachelor Enlisted Quarters MILCON site located to the southwest of the Fitness Center MILCON area across Douglas Road. The PA/SI concluded that there were no unacceptable risks to human health and the environment (CH2M HILL, 2008).

2.4 Regional Climate

The climate in Onslow County is characterized by short, mild winters and long, hot summers. Average annual net precipitation is approximately 50 inches. Ambient air temperatures generally range from 33 degrees Fahrenheit (°F) to 53°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

A discussion of the regional geology is presented in the MRP MPP (CH2M HILL, 2008).

2.6 Site Geology and Hydrogeology

The shallow soils encountered during this investigation consisted of very fine to fine-grained sand, containing varying amounts of silt and clay. The majority of the sands were poorly graded and interbedded with a lesser amount of clayey and silty sands.

The hydrogeology of the site was assessed by the installation of 8 shallow groundwater monitoring wells, screened to bracket the water table. Groundwater was encountered at depths of roughly 9 to 13 feet below ground surface (bgs) (approximately 9 to 15 feet above mean sea level [amsl]), and represents the upper surface of the Surficial aquifer. **Figure 2-2** illustrates the potentiometric surface of this unconfined aquifer on August 24, 2010 and suggests that shallow groundwater generally flows to the south and southeast, mimicking the surface topography. Horizontal hydraulic gradients were estimated to range from 0.0056 feet per foot (ft/ft) in the northern portion of the site, to 0.019 ft/ft in the southeast.

TABLE 2-1
 Groundwater Elevation and Well Construction Information
 Fitness Center (P-714) MILCON Area
 MCB CamLej
 North Carolina

Well ID	Date Installed (mm/dd/yy)	Screened Interval (ft bgs)	Bottom of Well (ft bTOC)	Surveyed Top of Casing Elevation (ft msl)	Depth to Water August 24-25, 2010 (ft bTOC)	Groundwater Elevation August 24-25, 2010 (ft msl)
FC714-MW01	8/18/10	5-15	15	23.47	10.10	13.37
FC714-MW02	8/18/10	5-15	15	23.71	8.92	14.79
FC714-MW03	8/18/10	5-15	15	23.02	9.31	13.71
FC714-MW04	8/18/10	5-15	15	23.61	9.70	13.91
FC714-MW05	8/17/10	4-14	14	20.57	10.52	10.05
FC714-MW06	8/17/10	6-16	16	24.17	10.05	14.12
FC714-MW07	8/17/10	5-15	15	20.79	11.80	8.99
FC714-MW08	8/17/10	8-18	18	24.30	12.79	11.51

Notes:

ft bgs = feet below ground surface
 ft bTOC = feet below top-of-casing
 ft msl = feet above mean sea level

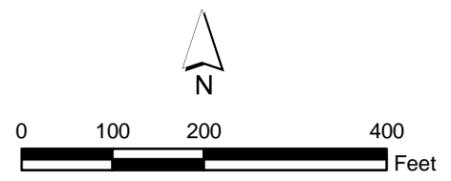
Prepared by: Betsy Reid/RDU

Checked by: Susan Forker/RDU



- Legend**
- Surveyed surface water body
 - - - Approximate location of surface water body
 - B-6, 50-ft Small Arms Range
 - B-12, Baffled Pistol Range
 - B-14, ABC Warfare Area
 - Investigation Area
 - P-174 Bldg (proposed)
 - P-174 Future Expansion Area
 - Installation Boundary
 - Jurisdictional Wetlands

Note:
Wetland Data Source :
MCB CamLej Hydrographic Department



1 inch = 200 feet



Figure 2-1
Fitness Center (P-714) Area Location Map
Fitness Center (P-714) MILCON Area
PA/SI Report
MCB CamLej
North Carolina

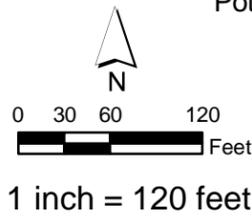




Potentiometric surface contours have been inferred between temporary well locations. Actual conditions may differ from those shown here.

Legend

- Monitoring Well Location
- Surveyed surface water body
- ⋯ Approximate location of surface water body
- Potentiometric Contour
- - - Inferred Potentiometric Contour
- Groundwater Flow Direction
- ▨ Jurisdictional Wetlands
- P-714 Bldg (proposed)
- Investigation Area



Potentiometric Surface of the Surficial Aquifer (August 2010)
 Fitness Center (P-714) MILCON Area
 PA/SI Report
 MCB CamLej
 North Carolina

Note:
 Wetland Data Source : MCB CamLej Hydrographic Department



Field Investigation Activities

During the development of the PA/SI Work Plan (CH2M HILL, 2010a), historical records were reviewed to identify potential areas of concern associated with small arms range activities at the proposed Fitness Center MILCON area. These historical activities may have resulted in environmental contamination from MC. During the environmental investigation, the portion of the site located within the B-14 ABC Warfare Area (ASR#2.198) was flagged for exclusion at the direction of MCB CamLej and environmental sample locations were distributed across the remainder of the proposed Fitness Center site.

The technical approach included in the PA/SI Work Plan was developed by the MCB CamLej Tier I Partnering Team, which includes representatives from the United States Navy, MCB CamLej, United States Environmental Protection Agency (USEPA) Region 4, and North Carolina Department of Environment and Natural Resources (NCDENR).

Site preparation activities, including land surveying and vegetation clearance activities, were conducted in July 2010. Environmental sampling was conducted from August 2, 2010, to August 30, 2010.

3.1 Environmental Investigation Activities

Environmental samples were collected in accordance with the PA/SI Work Plan (CH2M HILL, 2010a) and the MRP MPP (CH2M HILL, 2008). The distribution of environmental samples is presented on **Figures 3-1, 3-2, and 3-3**.

The following sections detail sample media collection, laboratory analyses and field activities.

3.1.1 Surface Soil Sampling

Surface soil sampling was conducted on August 2-4, 2010, and consisted of the collection of 32 surface soil samples (designated FC714-SS01 through FC714-SS32). The samples were collected using the TR-02-1 approach, and consisted of a composite of at least 30 sample aliquots collected from random locations within a 1-meter by 1-meter area. Each sample aliquot was collected from a depth interval of 0 to 2 inches bgs. Surface soil sampling locations were distributed evenly across the site as indicated on **Figure 3-1**.

All surface soil samples were collected into laboratory supplied containers and placed in a cooler with ice. A chain-of-custody was completed and accompanied the samples during shipment via Fedex to Empirical Laboratories for the following analysis:

- Select Metals – lead, antimony, copper, zinc, and arsenic (SW-846 USEPA Method 6010B)
- Perchlorate (SW-846 USEPA Method 6850)

3.1.2 Subsurface Soil Sampling

On August 16 and 17, 2010, 13 soil borings were advanced to depths of up to 20 feet bgs (**Figure 3-2**), using a direct push technology (DPT) drill rig operated by Mid-Atlantic Drilling. The DPT sampling method utilized an open core barrel sampling device along with disposable acetate liners. Down-hole sampling equipment was decontaminated between borings and new liners were used to retrieve each successive soil core. The continuous soil cores retrieved from these borings were examined and logged by the CH2M HILL geologist. In addition, the soil was field screened for the presence of volatile organic compounds (VOCs) using a flame ionization detector (FID). Soil boring logs are provided in **Appendix B**.

The 13 subsurface soil sampling locations (designated FC714-SB01 through FC714-SB13) were slightly biased towards the northern half of the site, the location of the proposed Fitness Center building, to evaluate any potential hazard to human health.

One discrete soil sample was collected from each of the 13 soil borings, from a location immediately above the estimated water table; depths ranging from 1.5 to 10 feet bgs. The majority of samples were collected from depths ranging from 3 to 9 feet bgs.

Subsurface soil samples were collected into laboratory supplied containers and placed in a cooler with ice. A chain-of-custody was completed and accompanied the samples during shipment via FedEx to Empirical Laboratories for the following:

- Select Metals – lead, antimony, copper, zinc, and arsenic (SW846 UESPA Method 6010B)
- Perchlorate (SW-846 USEPA Method 6850)

3.1.3 Monitoring Well Installation

In order to evaluate groundwater quality within the Fitness Center MILCON area, eight shallow Type II groundwater monitoring wells (FC714-MW01 through FC714-MW08) were installed to depths ranging from 14 to 18 feet bgs. The well boreholes were drilled using 4.25-inch inner diameter (ID) hollow-stem augers operated by Mid-Atlantic Drilling. Well construction details are summarized in **Table 2-1**.

Each monitoring well was constructed using 2-inch ID Schedule 40 polyvinyl chloride (PVC) riser and a 10 feet length of 0.010-inch machine-slotted screen. The well screens were placed to bracket the water table. A sand filter pack was installed around the screened interval in 1- to 2-foot lifts to approximately 2 feet above the top of the well screen. Bentonite pellets were placed above the sand filter pack and hydrated with potable water. Once the bentonite had hydrated, the remaining borehole annulus was sealed with a Portland cement grout. The wells were completed with 8-inch diameter flush-mounted manhole covers and watertight locking caps. Well completion diagrams are presented in **Appendix C**. Monitoring well installation was conducted in accordance with the PA/SI Work Plan (CH2M HILL, 2010a).

The monitoring wells were developed using a submersible pump. Development continued until the water was visually clear and water quality parameters had stabilized. Following

well development, the wells were allowed to equilibrate for at least 24 hours before sampling.

3.1.4 Groundwater Sampling

Prior to well purging and sampling, depth to water was measured in each monitoring well (**Table 2-1**). Water-level measurements were later converted to groundwater elevations using top-of-casing (TOC) elevation survey data, and used to construct a potentiometric surface of the water table map (**Figure 2-2**).

All groundwater samples were collected using a peristaltic pump and low-flow purging and sampling techniques, in accordance with the PA/SI Work Plan (CH2M HILL, 2010a). New, clean polyethylene pump tubing was used for the purging and sampling of each well. Water quality parameters (specific conductance, pH, turbidity, temperature, dissolved oxygen [DO], and oxidation-reduction potential [ORP]) were measured and recorded during the purging phase using a YSI 556 water quality meter and Hanna turbidity meter. Field parameters are summarized in **Table 3-1**. Groundwater sampling data sheets are provided in **Appendix C**.

Groundwater samples were collected after all field parameters stabilized over three successive readings and at least one well volume had been purged, or if at least three well volumes had been purged from the well. Parameters were considered stabilized when three successive measurements measured as follows:

- pH within 0.1 standard units
- Temperature measurements within 10 percent
- Specific conductivity within 3 percent
- ORP within 10 millivolts
- DO within 10 percent
- Turbidity within 10 percent or as low as practicable given sampling conditions

Prior to sample collection, the water quality meter flow-through cell was disconnected from the peristaltic pump so that the pump discharge flowed directly into the laboratory-supplied sample bottles.

Groundwater samples were collected into laboratory supplied containers with the appropriate preservative (if necessary) and placed in a cooler with ice. A chain-of-custody was completed and accompanied the samples during shipment via Fedex to Empirical Laboratories for the following analysis:

- Select Total Metals – lead, antimony, copper, zinc, and arsenic (SW846 USEPA Method 6010B)
- Dissolved Metals – lead, antimony, copper, zinc, and arsenic (SW846 USEPA Method 6010B)
- Perchlorate (SW846 USEPA Method 6850)

3.1.5 Surface Water and Sediment Sampling

On August 3, 2010, six surface water and six sediment samples were collected at co-located sites (designated FC714-SD01/SW01 through FC714-SD06/SW06) from the two surface water bodies present within the site, as indicated on **Figure 3-3**.

A handheld global positioning system (GPS) unit was used to record the locations of these surface water/sediment samples.

At each location, the surface water samples were collected prior to the sediment samples. Sediment samples were collected by advancing a trowel approximately 6 to 12 inches into the sediment. Samples were collected from downstream to upstream to avoid cross-contamination by sediment suspension.

All surface water and sediment samples were collected into laboratory supplied containers with the appropriate preservative (if necessary) and placed in a cooler with ice. A chain-of-custody was completed and accompanied the samples during shipment via Fedex to Empirical Laboratories for the following analysis:

- Select Metals – lead, antimony, copper, zinc, and arsenic (SW846 USEPA Method 6010B)
- Dissolved Metals (surface water only) – lead, antimony, copper, zinc, and arsenic (SW846 USEPA Method 6010B)
- Perchlorate (SW846 USEPA Method 6850)

3.1.6 Quality Assurance/Quality Control Sampling

Quality assurance (QA)/quality control (QC) samples were collected in accordance with the WP, including field blanks, equipment blanks, duplicates, and matrix spike (MS)/matrix spike duplicates (MSDs). Required QA/QC samples and the frequency of collection are shown in **Table 3-2**.

3.1.7 Data Validation

All analytical data was validated by DataQual Environmental Services, LLC of St. Louis, Missouri under subcontract to CH2M HILL. Data validation reports are provided in **Appendix B**.

3.2 Site Survey

Following completion of sampling activities, East Coast Land Surveyors, a North Carolina licensed surveyor, surveyed the horizontal and vertical coordinates of the eight new monitoring wells (**Figure 3-2**).

Land surveying was conducted in accordance with Section 7.4 of the MRP MPP (CH2M HILL, 2008). Elevations were accurate to the nearest 0.01 feet (0.1 feet for unpaved ground surface), and tied to the nearest North American Datum of 1988 (NAVD 88) datum benchmark. Horizontal controls were based on the metric system and referenced to the

North American Datum of 1983 (NAD 83) and the Universal Transverse Mercator (UTM) grid system, and were accurate to the nearest 0.01 ft.

3.3 Investigation-derived Waste Management

Investigation-derived waste (IDW) was disposed of in accordance with the MPP (CH2M HILL, 2010b). IDW generated during the field event consisted of well development and purge water, decontamination fluids, disposable equipment, and personal protective equipment (PPE). Soil cores and cuttings were thinly spread around each borehole. The purge water and decontamination fluids were placed in labeled 55-gallon drums and staged at the temporary storage facility located at Parachute Tower Road in the Mainside area of MCB CamLej. Disposable equipment, including PPE, poly sheeting, paper towels, and aluminum foil, were placed in black contractor's trash bags and disposed of in an on-Base dumpster.

TABLE 3-1

Groundwater Field Parameters
 Fitness Center (P-714) MILCON Area
 MCB CamLej
 North Carolina

Station ID	FC714-MW01	FC714-MW02	FC714-MW03	FC714-MW04	FC714-MW05	FC714-MW06	FC714-MW07	FC714-MW08
Sample Date	8/25/2010	8/25/2010	8/25/2010	8/25/2010	8/24/2010	8/24/2010	8/24/2010	8/24/2010
Field Parameters								
Dissolved Oxygen (mg/L)	1.35	1.46	1.30	1.53	0.47	0.90	1.37	2.37
Oxidation Reduction Potential (mV)	271.9	319.7	175.9	392.7	33.9	423.2	234.8	297
pH (SU)	4.50	4.23	4.35	4.44	4.80	3.93	4.48	4.43
Specific Conductance (mS/cm)	0.044	0.044	0.032	0.067	0.056	0.108	0.050	0.048
Temperature (°C)	19.38	20.26	19.14	19.55	19.08	21.35	19.14	19.99
Turbidity (NTU)	0.71	2.80	5.09	4.99	1.41	13.3	2.76	9.01

SU - Standard Unit

mS/cm - milliSiemens per centimeter

NTU - Nephelometric Turbidity Units

mg/L - milligrams per liter

C - Celsius

mV - millivolt

Prepared by: Betsy Reid/RDU

Checked by: Susan Forker/RDU

TABLE 3-2
Sample Collection Frequencies
Fitness Center (P-714) MILCON Area
MCB CamLej
North Carolina

Analysis	Sample Matrix	Field Samples	Field Duplicates	Equipment Blanks	Field Blanks	MS/MSDs
Subsurface Soil						
Perchlorate	Solid	13	2	2	1	1
Select Metals (lead, antimony, copper, zinc, and arsenic)		13	2	2	1	1
Surface Soil						
Perchlorate	Solid	32	4	3	1	2
Select Metals (lead, antimony, copper, zinc, and arsenic)		32	4	3	1	2
Sediment						
Perchlorate	Solid	6	1	1	1	1
Select Metals (lead, antimony, copper, zinc, and arsenic)		6	1	1	1	1
Groundwater						
Perchlorate	Aqueous	8	1	2	1	1
Select Metals (lead, antimony, copper, zinc, and arsenic)		8	1	2	1	1
Dissolved Metals		8	1	2	1	1
Surface Water						
Perchlorate	Aqueous	6	1	1	1	1
Select Metals (lead, antimony, copper, zinc, and arsenic)		6	1	1	1	1
Dissolved Metals		6	1	1	1	1

Notes:

MS/MSD = Matrix Spike and Matrix Spike Duplicate

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

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

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

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

Prepared by: Betsy Reid/RDU

Checked by: Susan Forker/RDU



Legend

- Surface Soil Sample Location
- Surveied surface water body
- ⋯ Approximate location of surface water body
- ▨ Jurisdictional Wetlands
- ▭ P-714 Bldg (proposed)
- ▭ Investigation Area

Note:
Wetland Data Source : MCB CamLej Hydrographic Department

Generated By: S.F./RDU Checked by: D.L./RDU

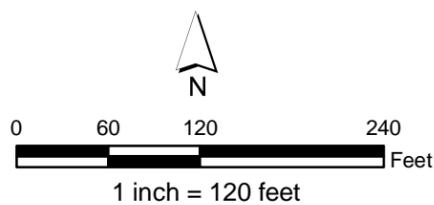
Figure 3-1
Surface Soil Sampling Locations
Fitness Center (P-714) MILCON Area
PA/SI Report
MCB CamLej
North Carolina





Legend

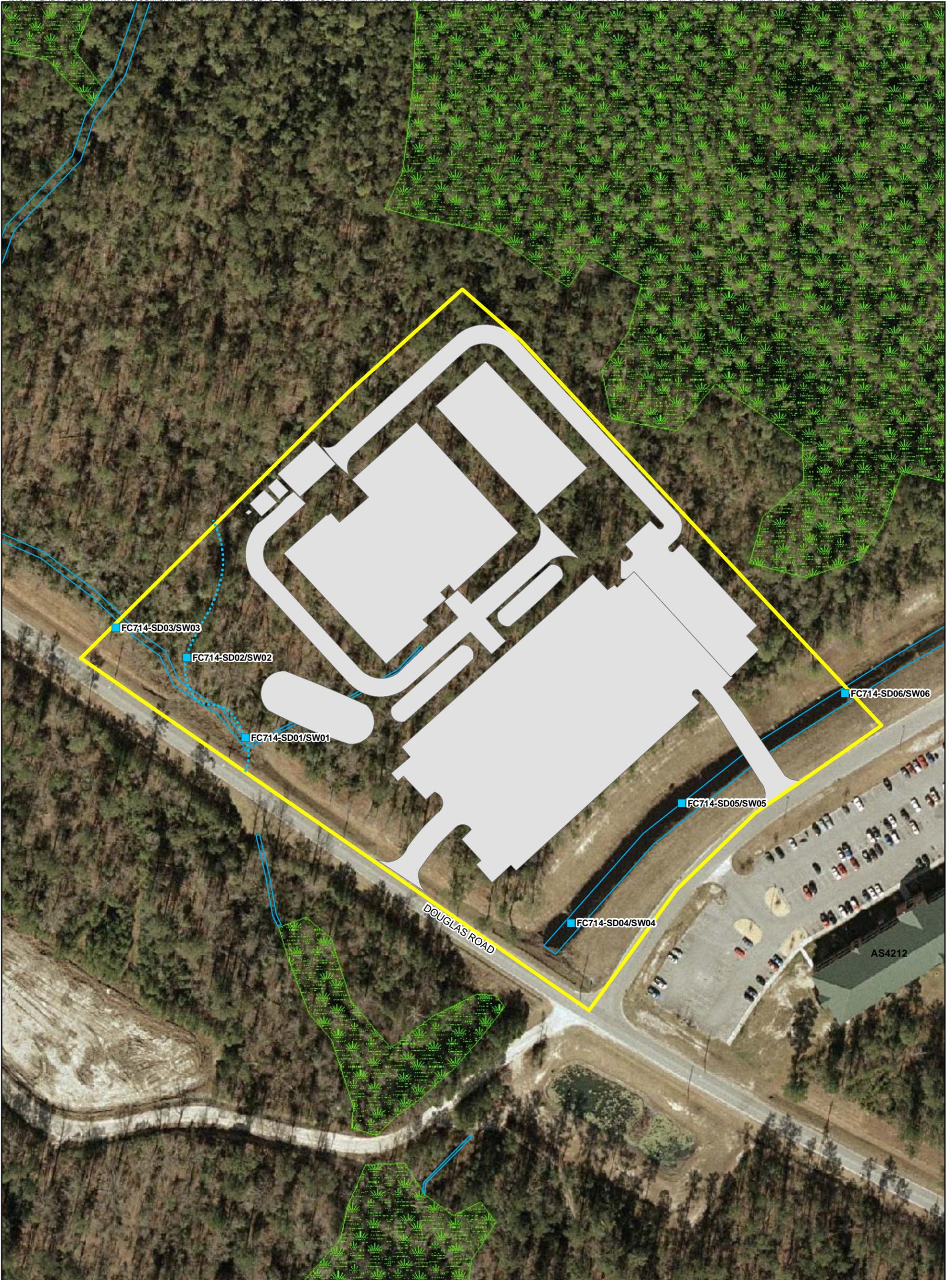
- Subsurface Soil Sample Location
- Subsurface Soil/Groundwater Sampling Location
- Surveeyed surface water body
- - - Approximate location of surface water body
- ▭ Investigation Area
- ▨ Jurisdictional Wetlands
- ▭ Physical Fitness Center - Site Area



Note:
Wetland Data Source : MCB CamLej Hydrographic Department

Figure 3-2
Subsurface and Groundwater Sampling Locations
Fitness Center (P-714) MILCON Area
PA/SI Report
MCB CamLej
North Carolina





Legend

- Surface Water/Sediment Sample Location
- Surveyyed surface water body
- ⋯ Approximate location of surface water body
- Investigation Area
- Jurisdictional Wetlands
- Physical Fitness Center - Site Area

Note:
Wetland Data Source : MCB CamLej Hydrographic Department

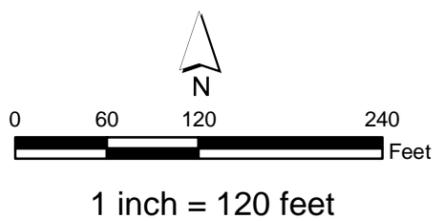


Figure 3-3
Sediment and Surface Water Sampling Locations
Fitness Center (P-714) MILCON Area
PA/SI Report
MCB CamLej
North Carolina



Investigation Results

This section presents the findings of the investigation activities conducted at the Fitness Center MILCON area during July and August 2010.

4.1 Environmental Investigation Results

The following subsections present and summarize the laboratory data from surface and subsurface soil, sediment, surface water, and groundwater samples collected at the Fitness Center MILCON area. Laboratory analytical data is presented in **Appendix E**.

4.1.1 Soil

Following the third-party data validation of the laboratory analytical data, surface and subsurface soil data were screened against the North Carolina Soil Screening Levels (NC SSLs), the Adjusted¹ USEPA Industrial and Residential Regional Screening Levels (RSLs) for Chemical Contaminant Tables (USEPA, 2010), and MCB CamLej background soil concentrations (twice the mean Base background soil concentration), which were available for metals only (Baker, 2001).

The RSLs for non-carcinogenic compounds were adjusted by dividing by 10 to conservatively account for exposure to multiple analytes. The methodology for calculating NC SSLs for contaminant migration from soil to groundwater was developed to identify chemical concentrations in soil that have the potential to impact groundwater. The NC SSLs are back calculated from acceptable groundwater concentrations and take into consideration fate and transport parameters (NCDENR, 2010a).

The concentrations of the target analytes detected in surface and subsurface soil samples are summarized in **Tables 4-1** and **4-2**, respectively. **Figures 4-1** and **4-2** illustrate the locations of the surface and subsurface soil samples that were reported to contain target analytes at concentrations greater than twice the mean Base background concentration and either the NC SSLs or the Adjusted RSLs.

Surface Soil

- **Perchlorate** – Perchlorate was not detected in any surface soil samples submitted for analysis.
- **Select Metals** – Antimony, arsenic, copper, lead, and zinc were detected at concentrations greater than twice the mean Base background concentration. Arsenic was reported to exceed the Adjusted Residential Soil RSL in 19 samples, including one detection that also exceeded the Adjusted Industrial Soil RSL. None of the target analytes were reported to exceed the NC SSLs.

¹ Based on noncarcinogenic effects to conservatively account for exposure to multiple constituents

TABLE 4-3
Surface Soil Exceedance Summary

Analyte	Frequency of Detection (number detected/ number sampled)	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Criteria Exceeded	Frequency of Exceedances
Arsenic	32/32	0.229 J	1.62	Adjusted residential RSL	19
				Adjusted industrial RSL	1
				2x mean Base background	11

mg/kg = milligrams per kilogram

Subsurface Soil

- **Perchlorate** – Perchlorate was not detected in any subsurface soil samples submitted for analysis.
- **Metals** – Arsenic, copper, lead, and zinc were detected at concentrations greater than twice the mean base background concentration. In addition, arsenic exceeded the Adjusted Residential Soil RSL in seven samples. None of the target analytes were reported to exceed the NC SSLs.

TABLE 4-4
Subsurface Soil Exceedance Summary

Analyte	Frequency of Detection (number detected / number sampled)	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Criteria Exceeded	Frequency of Exceedances
Arsenic	10/13	0.173 J	4.02	Adjusted residential RSL	7
				2x mean Base background	2

mg/kg = milligrams per kilogram

4.1.2 Groundwater

This section presents the results for laboratory analysis of groundwater samples collected from the eight shallow monitoring wells. Groundwater results were screened against North Carolina Administrative Code (NCAC) Title 15A, Subchapter 2L Groundwater Quality Standards (NC 2L Standards) (NCAC, 2010), Adjusted USEPA Tap Water RSLs, and MCB CamLej background groundwater concentrations (twice the mean Base background groundwater concentration), which were available for inorganic analytes only (Baker, 2002). The NC 2L Standards are the maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the state, which may be tolerated without creating a threat to human health or otherwise rendering the groundwater unsuitable for its intended purpose.

The detections and exceedances of NC 2L Standards, USEPA RSLs, and/or twice the mean Base background levels are presented in **Table 4-5**. The groundwater sampling locations are depicted on **Figure 3-2**. None of the groundwater samples contained target analytes that exceeded the Base background concentrations and at least one of the screening levels (NC 2L Standards or USEPA Adjusted Tap Water RSLs).

- **Perchlorate**—Perchlorate was not detected in any of the groundwater samples submitted for analysis
- **Metals**—Arsenic, lead, and zinc were detected at concentrations below screening criteria in at least one groundwater sample. Arsenic exceeded the Adjusted Tap Water RSL in one sample.

4.1.3 Sediment and Surface Water

This section presents the results for laboratory analysis of sediment and surface water samples collected from six locations within the Fitness Center MILCON area. The detections and exceedances of USEPA RSLs are presented in **Tables 4-6** and **4-7**. The sediment sampling locations that exceeded at least one of the screening levels (USEPA Adjusted Residential and Industrial Soil RSLs) are depicted in **Figure 4-3**.

- **Perchlorate**—Perchlorate was not detected in any of the sediment samples.
- **Metals**—arsenic, copper, lead and zinc were detected in all 6 sediment samples. Arsenic exceeded the Adjusted Residential Soil RSL in five samples.

TABLE 4-8
Sediment Exceedance Summary

Analyte	Frequency of Detection (number detected/ number sampled)	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Criteria Exceeded	Frequency of Exceedances
Arsenic	6/6	0.303 J	18.6	Residential RSL	5
				Industrial RSL	3

mg/kg = milligrams per kilogram

- **Perchlorate**—Perchlorate was detected in three surface water samples, but did not exceed screening criteria.
- **Metals**—Four total metals (arsenic, copper, lead, and zinc) and three dissolved metals (arsenic, lead, and zinc) were detected in at least one surface water sample. In addition, arsenic exceeded the Adjusted Residential Soil RSL and National Recommended Water Quality Criteria (NRWQC) in five samples and NC2B-SW in one sample.

TABLE 4-9
Surface Water Exceedance Summary

Analyte	Frequency of Detection (number detected / number sampled)	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Criteria Exceeded	Frequency of Exceedances
Total Arsenic	5/6	0.639 J	14.5	Adjusted Tap Water RSL	5
				NRWQC	5
				NC2B-SW	1
Dissolved Arsenic	2/5	0.509 J	0.817 J	Adjusted Tap Water RSL	2
				NRWQC	2

µg/L = micrograms per liter

TABLE 4-1
 Surface Soil Analytical Results
 Fitness Center (P-714) MILCON Area
 MCB CamLej
 North Carolina

Station ID	MCB CamLej Background SS 2X Mean	CLEAN NCSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	FC714-SS01	FC714-SS02	FC714-SS03		FC714-SS04	FC714-SS05	FC714-SS06	FC714-SS07	FC714-SS08	FC714-SS09	FC714-SS10	FC714-SS11
Sample ID					FC714-SS01-10C	FC714-SS02-10C	FC714-SS03-10C	FC714-SS03D-10C	FC714-SS04-10C	FC714-SS05-10C	FC714-SS06-10C	FC714-SS07-10C	FC714-SS08-10C	FC714-SS09-10C	FC714-SS10-10C	FC714-SS11-10C
Sample Date					08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10
Chemical Name																
Explosives (µg/kg)																
No Detections																
Total Metals (mg/kg)																
Antimony	0.447	--	41	3.1	0.742 UJ	0.585 UJ	0.664 UJ	0.663 UJ	0.675 UJ	0.818 UJ	0.555 UJ	0.657 UJ	0.706 UJ	0.593 UJ	0.918 J	0.664 UJ
Arsenic	0.626	5.8	1.6	0.39	1.62	0.298 J	0.874	0.66	0.395 J	0.847	0.372 J	0.553	0.535	0.344 J	0.485 J	1.01
Copper	4.83	700	4,100	310	252	0.731 J	0.78 J	0.573 J	1.1 J	4.38	0.78 J	0.832 J	1.66	0.738 J	1.19 J	1.82
Lead	12.3	270	800	400	24	6.09	11.9	13.2	7.83	16.5	7.65	10.1	8.96	6.99	6.34	13.4
Zinc	10.8	1,200	31,000	2,300	11.4	3.24	5.12	4.32	1.91	5.54	2.46	2.64	5.3	2.81	9.52	7.69

Notes:

Shading indicates exceedance of two times the mean base background concentration for surface soil

Bold text indicates exceedance of Adjusted Industrial Soil RSL

Underline indicates exceedance of Adjusted Residential Soil RSL

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

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

µg/kg - Micrograms per kilogram

Created by: Betsy Reid/RDU

Checked by: Susan Forker/RDU

TABLE 4-1
 Surface Soil Analytical Results
 Fitness Center (P-714) MILCON Area
 MCB CamLej
 North Carolina

Station ID	MCB CamLej Background SS 2X Mean	CLEAN NCSSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	FC714-SS12	FC714-SS13	FC714-SS14		FC714-SS15	FC714-SS16	FC714-SS17	FC714-SS18	FC714-SS19	FC714-SS20	FC714-SS21	FC714-SS22
Sample ID					FC714-SS12-10C	FC714-SS13-10C	FC714-SS14-10C	FC714-SS14-D-10C	FC714-SS15-10C	FC714-SS16-10C	FC714-SS17-10C	FC714-SS18-10C	FC714-SS19-10C	FC714-SS20-10C	FC714-SS21-10C	FC714-SS22-10C
Sample Date					08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/03/10	08/02/10	08/02/10	08/03/10	08/03/10
Chemical Name																
Explosives (µg/kg)																
No Detections																
Total Metals (mg/kg)																
Antimony	0.447	--	41	3.1	0.656 UJ	0.644 UJ	0.542 UJ	0.544 UJ	0.56 UJ	0.616 UJ	0.535 UJ	0.641 UJ	0.837 UJ	0.579 UJ	0.71 UJ	0.586 UJ
Arsenic	0.626	5.8	1.6	0.39	<u>0.732</u>	0.293 J	<u>0.544</u>	<u>0.512</u>	0.851	<u>0.537</u>	0.377	0.36 J	<u>0.439 J</u>	<u>0.634</u>	<u>0.679</u>	0.229 J
Copper	4.83	700	4,100	310	0.655 J	1.77	0.418 J	0.472 J	0.848 J	0.439 J	0.839 J	2	3.77	0.544 J	2.48	2.81
Lead	12.3	270	800	400	8.73	7.49	5.46	5.28	9.09	6.27	15.2	7.46	11.5	7.47	14.3	5.01
Zinc	10.8	1,200	31,000	2,300	3.08	4.34	2.18	2.14	2.42	1.52	2.87	3.78	8.46	3.01	5.49	3.94

Notes:

Shading indicates exceedance of two times the mean base background concentration for surface soil

Bold text indicates exceedance of Adjusted Industrial Soil RSL

Underline indicates exceedance of Adjusted Residential Soil RSL

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

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

µg/kg - Micrograms per kilogram

Created by: Betsy Reid/RDU

Checked by: Susan Forker/RDU

TABLE 4-1
 Surface Soil Analytical Results
 Fitness Center (P-714) MILCON Area
 MCB CamLej
 North Carolina

Station ID	MCB CamLej	CLEAN NCSSLs	Adjusted Industrial	Adjusted Residential	FC714-SS23	FC714-SS24	FC714-SS25	FC714-SS26	FC714-SS27	FC714-SS28	FC714-SS29	FC714-SS30	FC714-SS31	FC714-SS32		
Sample ID	Background SS 2X	(January, 2010)	Soil RSLs (May, 2010)	Soil RSLs (May, 2010)	FC714-SS23-10C	FC714-SS24-10C	FC714-SS25-10C	FC714-SS26-10C	FC714-SS27-10C	FC714-SS27-D-10C	FC714-SS28-10C	FC714-SS29-10C	FC714-SS30-10C	FC714-SS31-10C	FC714-SS31-D-10C	FC714-SS32-10C
Sample Date	Mean				08/02/10	08/02/10	08/04/10	08/03/10	08/03/10	08/03/10	08/02/10	08/04/10	08/03/10	08/03/10	08/03/10	08/03/10
Chemical Name																
Explosives (µg/kg)																
No Detections																
Total Metals (mg/kg)																
Antimony	0.447	--	41	3.1	0.589 UJ	0.567 UJ	0.582 UJ	0.588 UJ	0.547 UJ	0.682 UJ	0.797 UJ	0.659 UJ	0.591 UJ	0.573 UJ	0.554 UJ	0.589 UJ
Arsenic	0.626	5.8	1.6	0.39	0.352 J	0.28 J	0.359 J	<u>0.397 J</u>	0.298 J	0.3 J	0.64	0.641	0.295 J	<u>0.545</u>	<u>0.487</u>	0.631
Copper	4.83	700	4,100	310	0.789 J	0.574 J	1.1 J	1.41	8.5 J	2.52 J	3.38	0.493 J	0.62 J	1.24	1.3	2.47
Lead	12.3	270	800	400	13.7	5.75	5.71	11.8	3.75	4.38	8.77	6.9	5.1	8.02	8.99	9.72
Zinc	10.8	1,200	31,000	2,300	5.67	4.22	3.2	4.22	3.37	4.21	10.5	2.52	2.83	4.12	4.34	4.52

Notes:

Shading indicates exceedance of two times the mean base background concentration for surface soil

Bold text indicates exceedance of Adjusted Industrial Soil RSL

Underline indicates exceedance of Adjusted Residential Soil RSL

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

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

µg/kg - Micrograms per kilogram

Created by: Betsy Reid/RDU

Checked by: Susan Forker/RDU

TABLE 4-2
 Subsurface Soil Analytical Results
 Fitness Center (P-714) MILCON Area
 PA/SI Report
 MCB CamLej
 North Carolina

Station ID	Camp Lejeune Background SB 2X Mean	CLEAN NCSSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	FC714-SB01/TW01		FC714-SB02/TW02	FC714-SB03/TW03	FC714-SB04/TW04	FC714-SB05/TW05	FC714-SB06/TW06	FC714-SB07/TW07
					FC714-SB01-5-6-10C	FC714-SB01D-5-6-10C	FC714-SB02-6-7-10C	FC714-SB03-4-5-10C	FC714-SB04-5-6-10C	FC714-SB05-4-5-10C	FC714-SB06-7-8-10C	FC714-SB07-5-6-10C
Sample ID					08/17/10	08/17/10	08/17/10	08/17/10	08/17/10	08/16/10	08/16/10	08/16/10
Sample Date												
Chemical Name												
Explosives (µg/kg)												
No Detections												
Total Metals (mg/kg)												
Arsenic	2.12	5.8	1.6	0.39	<u>1.32</u>	<u>1.24</u>	<u>0.839</u>	<u>1.3</u>	3.5	0.383 U	0.316 U	0.294 J
Copper	8.49	700	4,100	310	0.728 J	0.68 J	0.424 J	0.414 J	0.855 J	0.458 J	0.421 U	0.411 U
Lead	2.56	270	800	400	2.84	2.62	3.22	2.8	4.8	2.99	1.64	0.953
Zinc	6.59	1,200	31,000	2,300	1.82	2.19	1.41	1.47	2.52	1.37	0.859 J	0.514 U

Notes:
 Shading indicates exceedance of two times the mean base background concentration for subsurface soil

Bold text indicates exceedance of Adjusted Industrial Soil RSL

Underline indicates exceedance of Adjusted Residential Soil RSL

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

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

U - The material was analyzed for, but not detected

mg/kg - Milligrams per kilogram

µg/kg - Micrograms per kilogram

Created by: Betsy Reid/RDU

Checked by: Susan Forker/RDU

TABLE 4-2

Subsurface Soil Analytical Results
 Fitness Center (P-714) MILCON Area
 PA/SI Report
 MCB CamLej
 North Carolina

Station ID	Camp Lejeune Background SB 2X Mean	CLEAN NCSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	FC714-SB08/TW08	FC714-SB09		FC714-SB10	FC714-SB11	FC714-SB12	FC714-SB13
Sample ID					FC714-SB08-9-10-10C	FC714-SB09-3-4-10C	FC714-SB09D-3-4-10C	FC714-SB10-6-7-10C	FC714-SB11-1.5-2.5-10C	FC714-SB12-2-3-10C	FC714-SB13-8-9-10C
Sample Date					08/16/10	08/17/10	08/17/10	08/17/10	08/17/10	08/17/10	08/16/10
Chemical Name											
Explosives (µg/kg)											
No Detections											
Total Metals (mg/kg)											
Arsenic	2.12	5.8	1.6	0.39	<u>0.41</u>	0.308 U	0.173 J	4.02	0.325 J	<u>0.446</u>	0.307 U
Copper	8.49	700	4,100	310	0.978 J	0.41 U	0.415 U	1.11 J	0.466 U	0.394 J	0.41 U
Lead	2.56	270	800	400	2.84	1.04	1.13	4.49	2.05	3.77	0.967
Zinc	6.59	1,200	31,000	2,300	4.78	0.513 U	0.736 J	1.87	0.703 J	1.67	0.676 J

Notes:

Shading indicates exceedance of two times the mean base background concentration for subsurface soil

Bold text indicates exceedance of Adjusted Industrial Soil RSL

Underline indicates exceedance of Adjusted Residential Soil RSL

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

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

U - The material was analyzed for, but not detected

mg/kg - Milligrams per kilogram

µg/kg - Micrograms per kilogram

Created by: Betsy Reid/RDU

Checked by: Susan Forker/RDU

TABLE 4-5
 Groundwater Analytical Results
 Fitness Center (P-714) MILCON Area
 PA/SI Report
 MCB CamLej
 North Carolina

Station ID	Camp Lejeune Background GW 2X Mean	NC 2L Standards (January, 2010)*	Adjusted Tap Water RSLs (May, 2010)	FC714-SB01/TW01	FC714-SB02/TW02		FC714-SB03/TW03	FC714-SB04/TW04	FC714-SB05/TW05	FC714-SB06/TW06	FC714-SB07/TW07	FC714-SB08/TW08
Sample ID				FC714-GW01-10C	FC714-GW02-10C	FC714-GW02D-10C	FC714-GW03-10C	FC714-GW04-10C	FC714-GW05-10C	FC714-GW06-10C	FC714-GW07-10C	FC714-GW08-10C
Sample Date				08/25/10	08/25/10	08/25/10	08/25/10	08/25/10	08/24/10	08/24/10	08/24/10	08/24/10
Chemical Name												
Explosives (µg/l)												
No Detections												
Total Metals (µg/l)												
Arsenic	5.77	10	0.045	1.25 U	1.08 J	1.25 U	1.25 U	1.25 U				
Lead	2.8	15	15	0.872 J	1.04 J	1.05 J	0.75 UJ	0.906 J	0.75 UJ	1.89 J	0.987 J	1.05 J
Zinc	42.1	1,000	1,100	8.33 J	8.64 J	8.42 J	12.1 J	11.4 J	20 J	9.07 J	10.7 J	8.03 J
Dissolved Metals (µg/l)												
Arsenic, Dissolved	5.77	10	0.045	1.25 U	1.14 J	1.25 U	1.25 U	1.25 U				
Lead, Dissolved	2.8	15	15	0.755 J	1.34 J	1.05 J	0.968 J	0.97 J	0.75 UJ	2.05 J	1 J	1.18 J
Zinc, Dissolved	42.1	1,000	1,100	8.03 J	11.8 J	8.31 J	10.6 J	14.4 J	14.8 J	8.67 J	8.97 J	9.13 J

Notes:

Bold text indicates exceedance of Adjusted Tap Water RSL

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

* - The MCL-Groundwater value is reported in place of the NC 2L Standards where the MCL value is more conservative.

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

µg/l - Micrograms per liter

Created by: Betsy Reid/RDU
 Checked by: Susan Forker/RDU

TABLE 4-6

Sediment Analytical Results
 Fitness Center (P-714) MILCON Area
 PA/SI Report
 MCB CamLej
 North Carolina

Station ID	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	FC714-SD01/SW01	FC714-SD02/SW02		FC714-SD03/SW03	FC714-SD04/SW04	FC714-SD05/SW05	FC714-SD06/SW06
Sample ID			FC714-SD01-10C	FC714-SD02-10C	FC714-SD02-D-10C	FC714-SD03-10C	FC714-SD04-10C	FC714-SD05-10C	FC714-SD06-10C
Sample Date			08/03/10	08/03/10	08/03/10	08/03/10	08/03/10	08/03/10	08/03/10
Chemical Name									
Explosives (µg/kg)									
No Detections									
Total Metals (mg/kg)									
Arsenic	1.6	0.39	0.338 J	0.303 J	<u>0.412</u> J	<u>0.485</u>	9.32	18.6	8.8
Copper	4,100	310	2.54	1.43	1.6	2.38	3.33	14.6	10.2
Lead	800	400	5.81	8.24	10.4	10.8	4.87	20.6	21.9
Zinc	31,000	2,300	3.51	1.86	2.64	4.9	121	366	238

Notes:

Bold text indicates exceedance of Adjusted Industrial Soil RSL

Underline indicates exceedance of Adjusted Residential Soil RSL

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

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

mg/kg - Milligrams per kilogram

µg/kg - Micrograms per kilogram

Created by: Betsy Reid/RDU

Checked by: Susan Forker/RDU

TABLE 4-7

Surface Water Analytical Results
 Fitness Center (P-714) MILCON Area
 PA/SI Report
 MCB CamLej
 North Carolina

Station ID	NC2B-SW-Human Health & Water Supply ¹	NRWQC-Human Health - Organisms & Water + Organisms ²	Adjusted Tap Water RSLs (May, 2010)	FC714-SD01/SW01		FC714-SD02/SW02	FC714-SD03/SW03	FC714-SD04/SW04	FC714-SD05/SW05	FC714-SD06/SW06
				FC714-SW01-10C	FC714-SW01-D-10C	FC714-SW02-10C	FC714-SW03-10C	FC714-SW04-10C	FC714-SW05-10C	FC714-SW06-10C
Sample ID				08/03/10	08/03/10	08/03/10	08/03/10	08/03/10	08/03/10	08/03/10
Sample Date										
Chemical Name										
Explosives (µg/l)										
Perchlorate	--	--	2.6	0.1 U	0.1 U	0.1 U	0.1 U	0.104 J	0.219 J	0.277 J
Total Metals (µg/l)										
Arsenic	10	0.018	0.045	0.639 J	1.19 J	1.25 U	0.718 J	0.64 J	14.5	0.908 J
Copper	--	1300	150	2.5 U	1.63 J	2.5 U	2.5 U	2.5 U	6.54	2.5 U
Lead	--	--	15	1.15 J	1.93	0.913 J	0.617 J	0.484 J	8.87	0.393 J
Zinc	--	7400	1,100	2.5 U	4.63 J	2.5 U	2.5 U	4.8 J	179	1.89 J
Dissolved Metals (µg/l)										
Arsenic, Dissolved	10	0.018	0.045	0.509 J	0.817 J	1.25 U	1.25 U	1.25 U	1.25 U	0.7 J
Lead, Dissolved	--	--	15	0.386 J	0.421 J	0.499 J	0.508 J	0.75 U	0.75 U	0.75 U
Zinc, Dissolved	--	7400	1,100	2.5 U	1.45 J	2.5 U	2.5 U	1.74 J	1.48 J	2.5 U

Notes:

Bold box indicates exceedance of NC2B-SW-Human Health + Water Supply

Underline indicates exceedance of NRWQC criteria

Bold text indicates exceedance of Adjusted Tap Water RSLs

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

1 - NC2B-SW-Human Health and NC2B-SW-Water Supply were combined to show the most conservative criteria

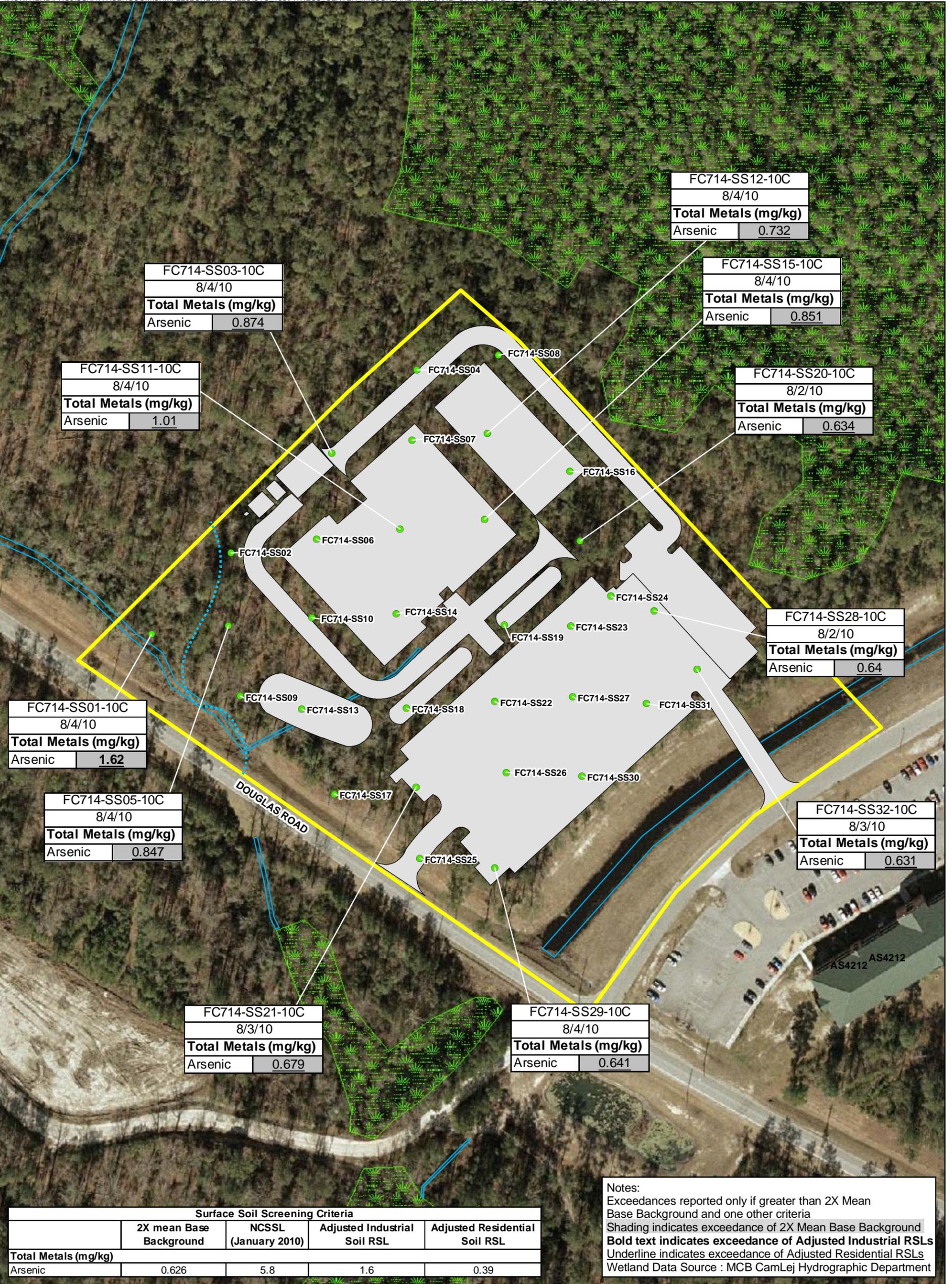
2 - NRWQC-Human Health - Water+ Organisms and NRWQC-Human Health Organisms were combined to show the most conservative criteria

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

Created by: Betsy Reid/RDU
 Checked by: Susan Forker/RDU



- Legend**
- Surface Soil Sample Location
 - Surveyed surface water body
 - ⋯ Approximate location of surface water body
 - Investigation Area
 - P-714 Bldg (proposed)
 - Jurisdictional Wetlands

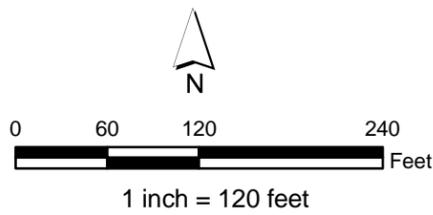


Figure 4-1
 Surface Soil Exceedances
 Fitness Center (P-714) MILCON Area
 PA/SI Report
 MCB CamLej
 North Carolina





- Legend**
- Subsurface Soil Sample Location
 - Subsurface Soil/Groundwater Sample Location
 - Surveyed surface water body
 - ⋯ Approximate location of surface water body
 - ▭ P-714 Bldg (proposed)
 - ▨ Jurisdictional Wetlands
 - ▭ Investigation Area

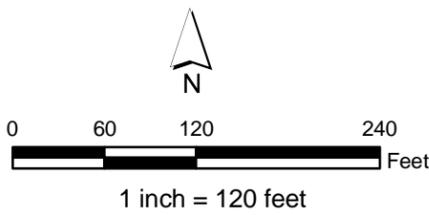
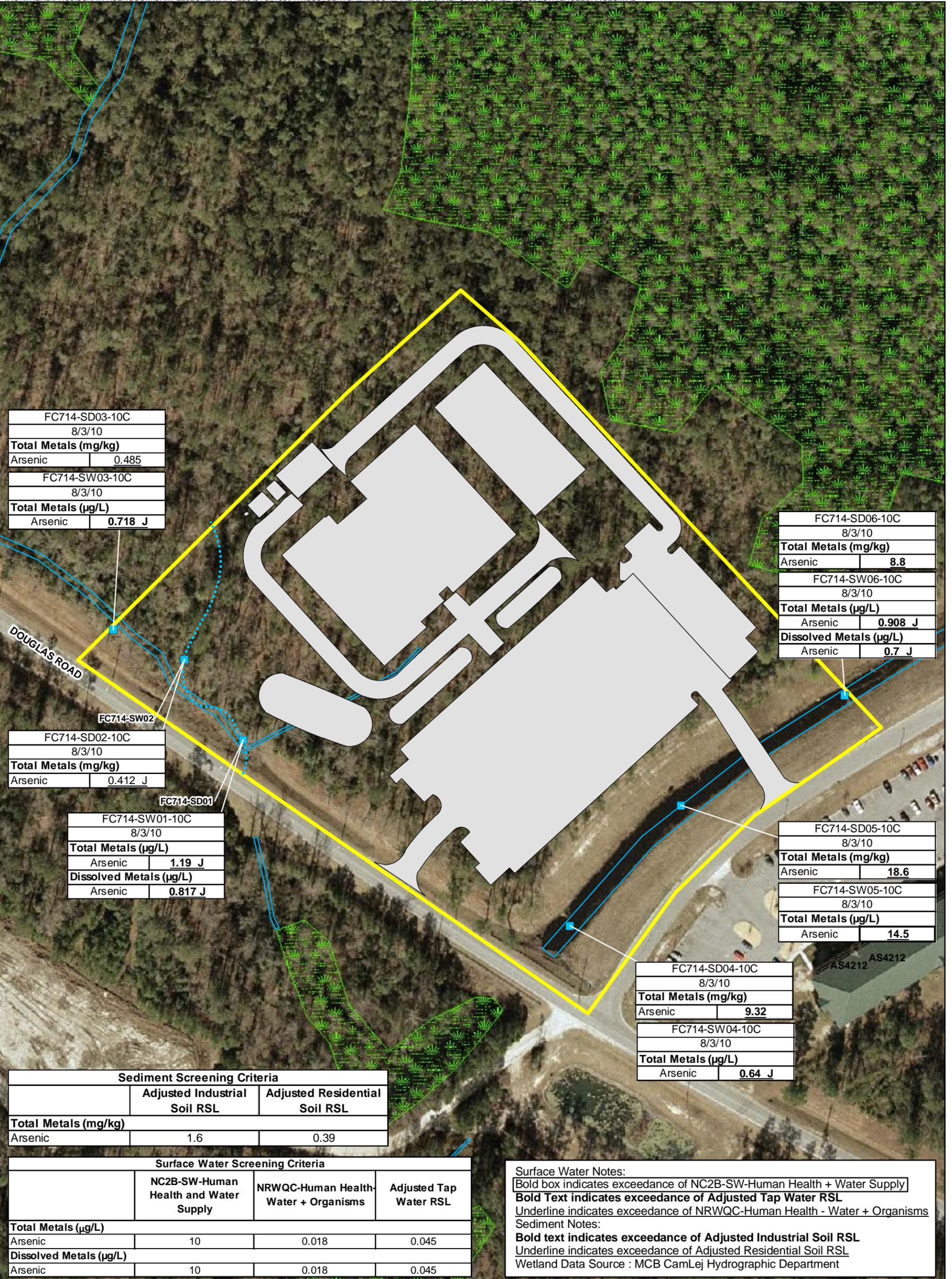


Figure 4-2
 Subsurface Soil Exceedances
 Fitness Center (P-714) MILCON Area
 PA/SI Report
 MCB CamLej
 North Carolina





- Legend**
- Surface Water/Sediment Sample Location
 - Surveied surface water body
 - ⋯ Approximate location of surface water body
 - 🌿 Jurisdictional Wetlands
 - ▭ P-714 Bldg (proposed)
 - ▭ Investigation Area

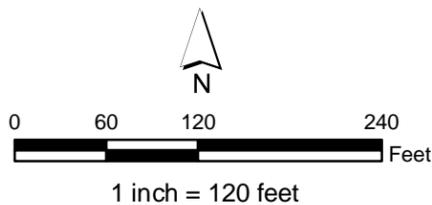


Figure 4-3
Sediment and Surface Water Exceedances
Fitness Center (P-714) MILCON Area
PA/SI Report
MCB CamLej
North Carolina



Human Health Risk Screening

A conservative preliminary human health risk screening (HHRS) was performed to assess the potential for human health risks associated with exposure to site media (surface soil, subsurface soil, sediment, surface water, and groundwater at the proposed Fitness Center MILCON area. The HHRS provides a preliminary indication of potential risks from chemicals of potential concern (COPCs) at the site, and is used to help determine whether a site requires further evaluation (e.g., a baseline risk assessment or additional data collection), or future unrestricted use (residential use, the most conservative site use, or any other potential future site use, including construction activities) of the site is acceptable based on human health risks. The HHRS was performed in a phased approach, as described below.

5.1 Data Evaluation

Soil, sediment, surface water, and groundwater analytical sample data collected from the Fitness Center MILCON area in August 2010 were evaluated in the HHRS. Thirty-two surface soil samples were collected by compositing a minimum of 30 sample aliquots from random locations within a 1-m by 1-m sampling location at an interval of 0 to 2 inches bgs. Thirteen subsurface soil samples ranging from depths of 1 to 10 feet bgs were collected and evaluated in the HHRS. Six surface water and six sediment samples were collected at co-located locations from the two surface water bodies present at the site (a small creek that runs through the northwest portion of the site and a drainage ditch that runs along the southeastern edge of the site). Samples were combined from both of these water bodies for evaluation in the HHRS. Groundwater samples were collected from eight monitoring wells and evaluated in the HHRS.

The data included in the HHRS were validated. A review of the data identified the following criteria for data usability:

- Data qualified with an R (rejected) were not used in the HHRS.
- Estimated values flagged with a J qualifier were treated as detected concentrations.
- For duplicate samples, the maximum concentration between the two samples was used as the sample concentration.
- Unfiltered groundwater samples were analyzed in the risk evaluations following USEPA Region IV guidance (USEPA, 2000).

5.2 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 soil, surface water, sediment, and groundwater is presented in **Figure 5-1, Appendix F**.

Potential current receptors include visitors and trespassers. 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, and inhalation of particulate emissions from the surface soil. VOCs are not associated with past site use; therefore, inhalation of VOC emissions from site media is not a potentially complete exposure route.

Current planned future site use includes construction of a fitness center at the site. Potential receptors would include current receptors, workers at the new fitness center, and the construction workers involved with the construction of the fitness center. Additionally, although unlikely based on planned future site use, future residents are assumed to be a worst-case exposure scenario, to evaluate unrestricted future site use. Future receptors could be exposed to surface and subsurface soil if future construction at the site results in re-working the soil, and exposing the subsurface soil. Exposure routes for future exposure to the surface and subsurface 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 the surface water and sediment, through incidental ingestion and dermal contact.

Potable water supplies for MCB CamLej and the surrounding residential area are provided by water supply wells that pump groundwater from the Castle Hayne aquifer; therefore, there is no current exposure to shallow groundwater at the Fitness Center MILCON area. There are no active water supply wells within a 2,000-foot radius of the Fitness Center MILCON area. The groundwater use patterns are already established for MCB CamLej and the area around the Fitness Center MILCON area, thus use of shallow groundwater for industrial or residential purposes is unlikely. Additionally, the Surficial aquifer at MCB CamLej is not suitable for potable water use due to high dissolved solids, hardness and fluctuating water levels that negatively affect water yields. However, state and federal governing policies assume that underground fresh water resources are potable, and should be maintained as such; therefore, a potable use scenario was evaluated in this risk assessment. It was conservatively assumed if future residential development of the site occurs the residents could potentially use the groundwater as a potable water supply. The residents would be exposed through ingestion and dermal contact while bathing. As VOCs are not associated with the historic site use, inhalation of VOCs while bathing is not a complete pathway. Additionally, due to the groundwater depth (from 9 to 13 feet bgs), construction workers could be exposed to the groundwater through dermal contact during construction activities.

Vapor intrusion from groundwater (or soil) to indoor air is not a complete pathway because VOCs are not associated with historic use of the site.

5.3 Risk Screening Approach

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:

Step 1

The maximum detected analyte concentrations for each medium were compared to USEPA risk-based screening levels (RSLs; USEPA, 2010a), other human health risk screening levels (if appropriate), and two times the mean background concentration (for inorganics in soil and groundwater). RSLs based on noncarcinogenic effects were divided by 10 to account for exposure to multiple chemicals [i.e., were adjusted to a Hazard Quotient (HQ) of 0.1, from the HQ of 1.0 used on the USEPA 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 soil and sediment data were compared to residential 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, site workers, construction workers, trespassers/visitors). The Federal Remediation Branch Target Screening Values (NCDENR, 2010b) are also shown on the Step 1 soil screening tables; however they were not used to identify COPCs. The groundwater data were compared to tap water RSLs. The Maximum Contaminant Levels (MCLs) (USEPA, 2010a) and the North Carolina Classifications and Groundwater Quality Standards (NCDENR, 2010c) are also shown on the Step 1 groundwater screening tables; however they were not used to identify the groundwater COPCs to carry forward to Step 2. The surface water data were compared to NC 2B water quality standards for human health (if available), or the NRWQC for Human Health (water and organisms criteria). If neither of these were available, the tap water RSL was used for comparison.

If the maximum detected concentration in soil, groundwater, surface water, or sediment exceeded the appropriate screening value and background concentration, the screening level risk evaluation proceeded to Step 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 media were summed to calculate the cumulative corresponding 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.

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 media, 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 4.00.05 (USEPA, 2010b) was used to test the data distribution and calculate 95 percent UCL used for the Step 3 risk ratio calculations. In cases where there was less than five samples in the data set, or the recommended UCL exceeded the maximum detected concentration, the maximum concentration was used as the exposure point concentration (EPC).

5.4 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, sediment, surface water, groundwater, and subsurface soil.

Surface Soil

Tables 2.1 and 2.1a, Appendix F, present the risk-based screening and risk ratio evaluation for surface soil. As shown on **Table 2.1 in Appendix F**, one metal (arsenic) was identified as a COPC. Based on Step 2 of the screening process (**Table 2.1a, Appendix F**) arsenic was eliminated as a COPC. 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.

Surface Water

Tables 2.2 through 2.2b, Appendix F present the risk-based screening for surface water. As shown on **Table 2.2, Appendix F**, one metal (arsenic) exceeded the first step of the screening and was identified as a COPC for evaluation in Step 2. **Table 2.2a, Appendix F**, used the RSLs (USEPA, 2010a) even if surface water screening values (NC 2B and NRWQC) were available, as these surface water screening values are not necessarily risk-based. Based on Step 2 (risk ratio using maximum detected concentration, **Table 2.2a, Appendix F**), arsenic remained a COPC and was carried forward to Step 3 (**Table 2.2b, Appendix F**), where the 95% UCL concentration resulted in arsenic having a cumulative carcinogenic risk above the screening criteria. Therefore, arsenic was identified as a COPC for surface water based on the human health screening evaluation. Future exposure to surface water could potentially result in risks above acceptable levels.

Preliminary human health risk-based screening indicates the potential for unacceptable risks associated with exposure to arsenic in surface water at one location (SW05) situated within the man-made drainage ditch which runs along the eastern side of the site. However, the screening values used to evaluate this surface water are conservatively based on use as a potable water supply or recreational fishing activities. Based on the shallow nature of the surface water drainage, it is unlikely to support fishing activities and will not be used as a potable supply. The concentration of arsenic detected in all other samples would not result in unacceptable risks in the HHRS.

Sediment

Tables 2.3 and 2.3a, Appendix F, present the risk-based screening and risk ratio evaluation for sediment. One metal, (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 concentrations, **Table 2.3a, Appendix F**), 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 human health risks.

Groundwater

The risk-based screening and risk ratio evaluation for groundwater data are presented in **Table 2.4 of Appendix F**. None of the detected chemicals exceeded the first step of the screening. Exposure to groundwater at the Fitness Center MILCON area is not expected to result in any unacceptable human health risks.

Subsurface Soil

Tables 2.5 and 2.5a, Appendix F, present the risk-based screening and risk ratio evaluation for subsurface soil at the FC. As shown on **Table 2.5, Appendix F**, one metal (arsenic) exceeded the first step of the screening and was identified as a COPC for evaluation in Step 2. Based on Step 2 of the screening process (**Table 2.5a, Appendix F**), arsenic was eliminated as a COPC for subsurface soil. Therefore, exposure to subsurface soil at the proposed Fitness Center MILCON area is not expected to result in any unacceptable human health risks.

Comparison of Detection Limits for Non-Detected Analytes to Screening Levels

All of the detection limits for soil and surface water for the non-detected analytes were below the RSLs. For sediment, there was one metal with a detection limit above the residential soil RSL, however, the detected concentrations were within an order of magnitude of the RSL. For groundwater, there was one metal with a detection limit that exceeded the screening level, however, the detection limits were within an order of magnitude of the screening value. Based on past site use and results of those constituents detected in the site media, this is not expected to effect the results of this risk evaluation.

Ecological Risk Screening

This section presents the results of the ecological risk screening (ERS) conducted for the Fitness Center MILCON area.

6.1 Site Ecological Setting and Available Data

The site encompasses approximately 13 acres of predominantly wooded land. A large wetland area is located to the northeast of the site and a smaller wetland area is located south of Douglas Road. Additionally, a small unnamed creek runs through the western corner of the site and a man-made drainage ditch runs along the southeastern side of the site. The small unnamed creek crosses Douglas Road via an underground culvert and is assumed to flow into the wetlands south of the site and eventually feed into Southwest Creek located approximately 1,000 feet further south. The site topography is relatively level at approximately 20 feet amsl, sloping gently west towards Douglas Road and more steeply sloping towards the man-made drainage ditch at the southern boundary of the site. The ecological checklist in **Appendix G-1** identifies the terrestrial and aquatic habitats on-site.

A total of 32 surface soil samples (and 4 duplicates) from 0-6 inches below ground surface (bgs), 5 subsurface samples (and 1 duplicate) from 0 to 5 feet bgs, 8 groundwater samples (and 1 duplicate), 6 surface water samples (with 1 duplicate), and 6 sediment samples (and 1 duplicate) from 0 to 6 inches bgs were collected from the site (**Figures 3-1, 3-2, and 3-3**). All samples were analyzed for antimony, arsenic, copper, lead, zinc, and perchlorate. Dissolved concentrations of metals in groundwater and surface water were also available.

6.1.1 Screening Methodology

For each medium (surface soil, subsurface soil, groundwater, surface water, and sediment), the maximum and arithmetic mean concentrations were calculated and Ecological Screening Values (ESVs) intended to be protective of ecological receptors were identified. HQs were calculated by dividing the exposure concentrations by the ESVs. It should be noted that ESVs for metals in water are generally based on dissolved concentrations and comparing them to total metals concentrations is conservative and may overestimate risk.

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

A selection hierarchy was also applied to surface water and groundwater. The National Recommended Water Quality Criteria (NRWQC) was preferentially selected over the Region 4 values (EPA, 2009b). However, when no NRWQC was available for a constituent, the Region 4 value was selected as the ESV for that constituent. Surface water from this site is considered freshwater. Groundwater is likely to discharge to freshwater wetlands or streams and was screened using freshwater ESVs.

For sediment, EPA Region 4 values were used.

When an ESV value was not available for a detected analyte, a supplemental screening value from published literature was used, as available.

A base background study was conducted at MCB CamLej in June and July 2000 (Baker, 2001). As part of the ERS, surface soil and groundwater background concentrations were compared to site-specific media concentrations. Additional lines of evidence in the evaluation included the frequency of detection, frequency of exceedance, magnitude of exceedance, and identification of potential laboratory contaminants.

6.2 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 G-1** presents the surface soil screen, **Table G-2** presents the subsurface soil screen, **Table G-3** presents the groundwater screen, **Table G-4** presents the surface water screen, and **Table G-5** presents the sediment screen. Ecological risk screening tables are located in **Appendix G**.

6.2.1 Surface Soil

Of the detected analytes in surface soil with available ESVs or supplemental screening values, antimony, copper, and lead had maximum-based HQs greater than one. Antimony and copper had a low detection frequency (1 out of 32 samples) and low frequency of exceedance (1 out of 32 samples), respectively. Lead concentrations were within range of CampLej background levels and had a low magnitude of exceedance (HQ less than 3). Consequently, analytes in surface soils are not expected to pose significant risk to ecological receptors.

6.2.2 Subsurface Soil

None of the detected analytes had maximum-based HQs greater than one and, therefore, analytes in subsurface soil are not expected to pose significant risk to ecological receptors.

6.2.3 Groundwater

The analytes in groundwater had maximum-based HQs less than one and were either not detected or detected concentrations were consistent with MCB CamLej background levels. Consequently, risk from these analytes is considered negligible.

6.2.4 Surface Water

Of the analytes with available ESVs or supplemental screening values, lead and zinc (based on total concentrations) were the only analytes with a maximum-based HQ greater than one. However, based on concentrations in the filtered samples maximum-based HQs were both less than one. Consequently, risk from these metals is considered negligible and analytes in surface water are not expected to pose significant risk to ecological receptors.

6.2.5 Sediment

Arsenic and zinc had HQs greater than one in sediment. However, these constituents had low magnitudes of exceedance (HQs less than 3) and mean-based HQs less than one. As a result, risk from these analytes is considered negligible.

6.3 Summary

Based on the available data, no significant risks to populations of ecological receptors were identified within the Fitness Center MILCON area.

Conclusions and Recommendations

The PA/SI involved collection of environmental media samples (i.e., surface soil, subsurface soil, groundwater, sediments, and surface water) within the proposed Fitness Center MILCON area. Subsequent laboratory analysis of these samples detected arsenic in exceedance of Base background levels and regulatory screening criteria in surface and subsurface soil, sediment, and surface water samples. Based on the results of the risk screenings, the target analytes detected are not anticipated to pose unacceptable risks to current or future human or ecological receptors. Therefore, no further environmental evaluation is recommended and MILCON activities for the investigated portion of the Fitness Center are recommended to proceed as planned.

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Appendix A
Archival Records Search Report

Draft

**Archival Records Search Report for the Preliminary
Assessment/Site Inspection of
Proposed Fitness Center (P-714) MILCON Area**

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

Contract Task Order 0133

June 2010

Prepared for

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

Under the

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

Prepared by



CH2MHILL

Raleigh, North Carolina

Contents

Acronyms and Abbreviations	v
1. Introduction, Purpose, and Scope.....	1-1
2. Site Information.....	2-1
2.1 Facility Information	2-1
2.1.1 Climate and Meteorology	2-1
2.1.2 Topography, Geology and Hydrology	2-1
2.2 Ownership History	2-2
2.2.1 Camp Lejeune Ownership History	2-2
2.3 Site History	2-3
2.3.1 B-6, 50-ft (or 1000-inch) Small Arms Range (ASR #2.44).....	2-3
2.3.2 B-12, Baffled Pistol Range (ASR #2.134)	2-4
2.3.3 Current Site Conditions	2-4
2.4 Previous Investigations	2-5
3. Findings.....	3-1
4. References	4-1

Figures

1-1	Site Map
2-1	Historical Aerial - 1956
2-2	Historical Aerial - 1962
2-3	Historical Aerial - 1989
2-4	B-6 Range Overlay
2-5	B-12 Range Overlay

Attachments

1	Resource Review Summary
2	Property Map - Area B
3	Existing Conditions - 2005

Acronyms and Abbreviations

ARSR	Archival Records Search Research
AHEC	AH Environmental Consultants
BEQ	Bachelor Enlisted Quarters
°F	degrees Fahrenheit
ft	feet/foot
GIS	Geographic Information Systems
IR	Installation Restoration
MC	munitions constituent
MCB CamLej	Marine Corps Base Camp Lejeune
MEC	munitions of explosive concern
MILCON	Military Construction
mm	millimeter
MRP	Munitions Response Program
msl	above sea level
NCWQS	North Carolina Water Quality Standards
NFA	no further action
PA/SI	Preliminary Assessment/Site Inspection
PRGs	Preliminary Remediation Goals
PSW	public supply well
SAR	Small Arms Range
SSLs	Soil Screening Levels
U.S.	United States
USEPA	United States Environmental Protection Agency
WWII	World War II

Introduction, Purpose, and Scope

Marine Corps Base Camp Lejeune (MCB CamLej) is investigating potential hazards associated with two former Small Arms Range (SAR) fans at the proposed Fitness Center (P-714), herein referred to as the “Fitness Center” as part of military construction (MILCON) activities. The Fitness Center Site lies within the B-6, 50-foot small arms range (ASR#2.134) and B-12, Baffled Pistol Range (ASR#2.44) SAR fans, shown on **Figure 1-1**. The Fitness Center MILCON site encompasses approximately 13 acres of wooded land located north of Douglas Road, roughly 0.5 miles west of Perimeter Street within Marine Corps Air Station (MCAS) New River (**Figure 1-1**).

The results of the environmental investigation will determine if any impacts to soil and groundwater have occurred within the boundary of the Fitness Center related to past range activities. To support site investigation efforts, this archival records search report (ARSR) has been prepared to provide a narrative of the historical activities at the B-6 and B-12 Ranges that may have resulted in environmental contamination with munitions of explosive concern (MEC).

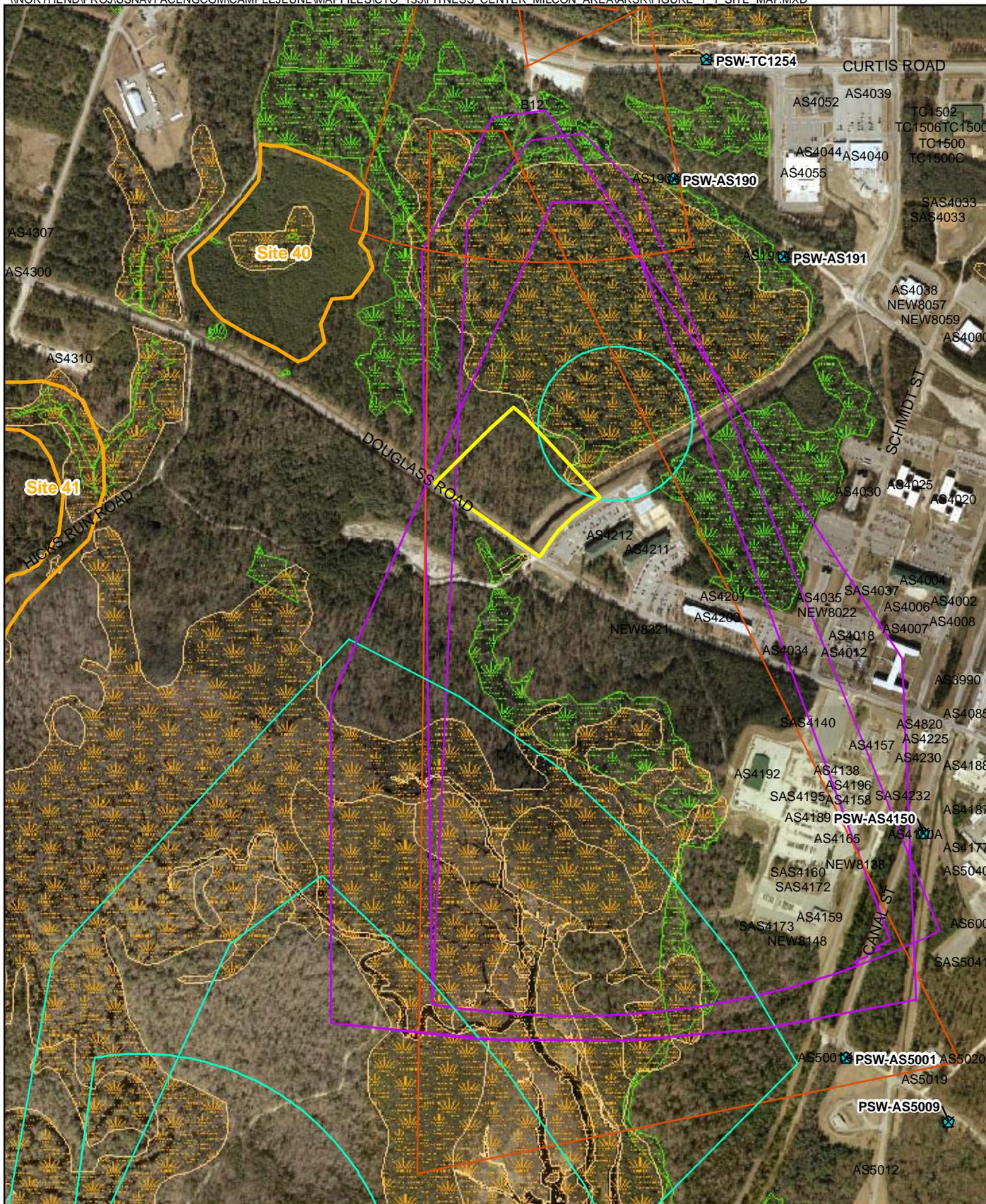
The ARSR is an investigative review of existing information about the site and its surrounding area, with an emphasis on obtaining information from personnel and historical resources that might indicate a potentially hazardous release to the environment. **Figure 1-1** shows the site boundary in relation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

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

A summary of the resources identified and reviewed during the preparation of this ARSR is provided in **Attachment 1**, and includes a detailed list of aerial and Base photographs, historical maps and records, and current Base records reviewed at Gray Research Center on MCB Quantico, Virginia, the National Archives at College Park, Maryland, and at MCB Camp Lejeune.

Primary cartographic references used in ARSRs include:

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



- Legend**
- Potable Water Supply Well
 - IR Sites
 - Site Area
 - B-6, 50-ft Small Arms Range
 - B-12, Baffled Pistol Range
 - B-14, ABC Warfare Area
 - Planning Wetlands
 - Jurisdictional Wetlands

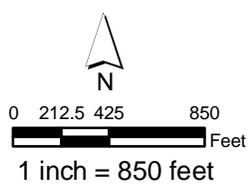
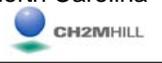


Figure 1-1
 Site Map
 Fitness Center (P-714) MILCON Area
 Archival Records Search Report
 MCB CamLej
 North Carolina



Site Information

2.1 Facility Information

MCB CamLej is located on the Atlantic coast in Jacksonville, North Carolina. The city of Jacksonville is located in Onslow County and is the principal support community for the Base. MCB CamLej 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 CamLej supports a total population of approximately 150,000 people, including active duty military and dependants, retirees, and civilian employees (Global Security, 2008).

2.1.1 Climate and Meteorology

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

2.1.2 Topography, Geology and Hydrology

The land surface at MCB CamLej has been alternately exposed and submerged over time by water and marine deposits from an ancient inland sea. These deposits were laid down to form the weakly dissected alluvial plane. The deposits are mostly sands layered with clay and marine shells. Elevations range from sea level at the waterways to 72 ft above mean sea level (msl) between the New River and United States (U.S.) Route 17. MCB CamLej consists of both broad, level flatlands and gently rolling hills.

Southeastern North Carolina and MCB CamLej are within the Tidewater region of the Atlantic Coastal Plain Physiographic Province. The Tidewater region is generally swampy and of low relief, with elevations averaging about 20 ft above msl. The MCB CamLej area is underlain by an eastward thickening sediment wedge of marine and non-marine origins ranging in age from early Cretaceous to Holocene. The eastward thickening wedge of sediment begins at the western boundary of Atlantic Coastal Plain physiographic province, known as the Fall Line, and dips southeastward towards the coast. Along the coastline, several thousands of feet of interlayered, unconsolidated sediment are present consisting of

gravel, sand, silt, clay deposits, calcareous clays, shell beds, sandstone and limestone that was deposited over pre-Cretaceous crystalline basement rock. These sediment units are often distinguished by minor amounts of detrital carbonate shells, and secondary minerals such as glauconite, siderite, and chlorite (Cardinell, Berg, and Lloyd, 1993).

Fluctuations in sea level on a subsiding continental margin in marine and near-shore environments are believed to have controlled Historical Coastal Plain sedimentation and deposition (Winner and Coble, 1989). Confining units associated with specific aquifers within the Coastal Plain region are composed of less permeable beds of clay and silt. Within the MCB CamLej area, approximately 1,500 ft of a sedimentary sequence overlie the crystalline basement rock. This sedimentary sequence composes seven aquifers and their associated confining units including the Surficial, Castle Hayne, Beaufort, Peedee, Black Creek, and Upper and Lower Cape Fear aquifers (Cardinell, Berg, and Lloyd, 1993).

Interstream areas generally provide the recharge of aquifers within the Coastal Plain region. Recharge to the aquifers has been estimated to have a yearly range of 5 to 21 inches of rainfall (Heath, 1989). In general, natural discharge of groundwater from the Coastal Plain aquifer system is into streams, swamps, and lakes. Evapotranspiration from the soil zone and upward leakage through confining units into streams, estuaries, swamps, and even the ocean also contribute to groundwater discharge. The New River estuary serves as the principal discharge area for groundwater from the Castle Hayne aquifer within the vicinity of MCB CamLej (Harned, Lloyd, and Treece, 1989).

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 Fitness Center is located in Area B, along the west side of the New River from Brinson Creek to Southwest Creek/Hicks (or Hickory) Run, **Attachment 2**. Area B included 47 tracts of land. The Fitness Center appears to be located in parcel B-212, as shown in **Attachment 2**, the 1941 Property Map for Area B (Bureau of Yards and Docks, 1941). The facility at that time was known as Marine Barracks New River, NC and was changed to MCB CamLej in 1942 (Global Security, 2008).

2.3 Site History

The Fitness Center and immediate area are described over time below and the two historical ranges will be discussed in depth in the following sections. A review of Existing Conditions maps provided by the MCB CamLej Public Works Office was conducted. Maps showing roads, utilities, potable water supply wells, and buildings were available for the years 1946 to 1960, 1963, 1964, 1966, 1979, 1984, and 2005. No buildings or utilities were identified in the immediate area of the Fitness Center until 2005 when buildings AS4212 and AS4211 appear to the southeast (**Attachment 3**).

Aerial photographs from the years 1956, 1962, and 1989 were reviewed to identify any potential features indicating historical site use. The 1956 aerial photograph shows the area as undeveloped and wooded (**Figure 2-1**). An unpaved road is located south of the Fitness Center area. The 1962 aerial photograph is also undeveloped and wooded with the same unpaved road south of the Site (**Figure 2-2**). The 1989 aerial photograph (**Figure 2-3**) shows Douglass Road and cleared areas to the southwest and southeast of the Fitness Center area. The cleared area to the southeast is the current location of buildings AS4212 and AS4211. A man-made drainage ditch appears to be present along the southeast edge of the Fitness Center area, where vegetation appears to be younger than the surrounding areas.

2.3.1 B-6, 50-ft (or 1000-inch) Small Arms Range (ASR #2.44)

The B-6 50-ft (or 1000-inch) Small Arms Range (B-6 Range) was identified in the *Final Range Identification and Preliminary Range Assessment* by the United States Army Corps of Engineers (USACE, 2000). The B-6 Range is currently undergoing a Preliminary Assessment/Site Inspection (PA/SI) as part of the Munitions Response Program (MRP) at MCB CamLej. Range Overlay Maps from the *Final Range Identification and Preliminary Range Assessment* show the B-6 range fan appearing in different locations throughout the ranges history (USACE, 2001). Only one range fan overlaps the Fitness Center; however, information on the B-6 Range was undifferentiated in historical documents and all MEC-related hazards associated with the Range are assumed to be present in all range areas.

The B-6 Range first appears on a 1951 range overlay map. Base Order 1101.0B, dated 5 May 1960, stated 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. Small arms were used at this range in an unknown quantity. The PA/SI was conducted in the range fans depicted on Plates 5, 6, and 8 (**Figure 2-4**).

The 1951 range overlay map, Plate 5, depicts a small 50-ft small arms range fan with the firing direction to the southeast, **Figure 2-4**. The 1953 range overlay map, Plate 6, shows a larger 1000 inch range with the firing direction to the south. The 1954 range overlay map, Plate 8, 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, Plate 10, and shows a larger range fan located significantly more south of the other locations with a southeastern firing position, **Figure 2-4**. Only the range fan from the 1958 overlay overlaps the Fitness Center.

The B-6 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 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. Lead in the soil [may be an] issue. [The] area is presently very wooded” (Richardson, 2008).

Sampling has not occurred in the Fitness Center MILCON Area.

2.3.2 B-12, Baffled Pistol Range (ASR #2.134)

The B-12 Range was identified in the 1960 Master Shore Station Development Plan as shown on Figure A-1. The B-12 Range was also identified on the 1970, 1976, 1986, and 1993 Range Overlay Maps, presented on **Figure 2-5**. Based on the *Final Range Identification and Preliminary Range Assessment*, the B-12 Range was in use from approximately 1960 until at least 2001. All referenced figures depicting the B-12 Range show the B-12 range fans as being located in approximately the same location, south of Curtis Road. The range fan maps show the B-12 range fan with some variation in shape and size, extending southeast towards Douglass Road and Perimeter Street. *Regulations Governing Use of Firing Range 5, Field Training and Facilities and Maneuver Areas* listed the following types of munitions as having been employed at this site: .22 caliber rifles, service pistols, and revolvers (USMC, 1996). The *Final Range Identification and Preliminary Range Assessment* also listed the .38 caliber, .45 caliber, and 9 millimeter (mm) weapons as munitions used at the B-12 Range (USACE, 2001).

An interview with the Base Safety specialist (Richardson, 2007) confirmed the type of ammunition fired at the B-12 Range included .22 caliber, .38 caliber, .45 caliber, and 9 mm rounds. Initially, the range utilized a large dirt berm as a backstop to catch rounds at impact. Later, the range was equipped with a bullet trap to collect the fired rounds (Richardson, 2007).

2.3.3 Current Site Conditions

The site currently appears to be densely vegetated, with evidence of a drainage channel along the southeast side of the site, and Douglass Road along the southwest side, **Figure 1-1**.

A wetland area is located to the northeast and across Douglass Road. According to the 2002 Wellhead Protection Plan Update for MCB CamLej by AH Environmental Consultants (AHEC), the closest public water supply (PSW) wells are located to the northeast, approximately 2,000 ft away (AHEC, 2002). PSW-AS 190 and PWS-AS191 are located northeast of the site and both wells are currently active water supply well sources according to the AHEC report. Installation Restoration (IR) sites 40 and 41 are located to the west of the Fitness Center. Site 41 has been closed and No Further Action (NFA) is required on the site. Site 40 is still under investigation.

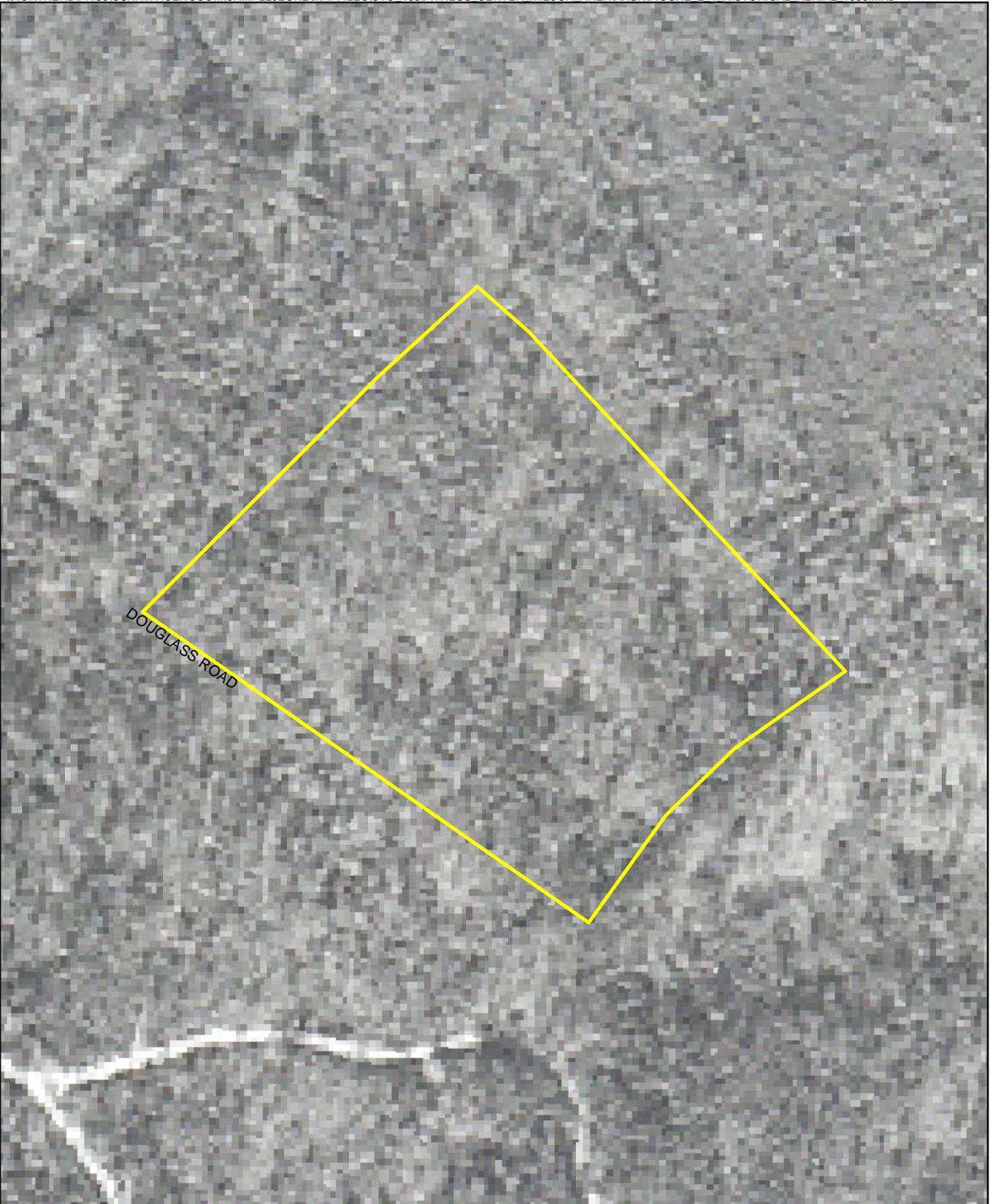
2.4 Previous Investigations

B-12 Baffled Pistol Range, Proposed Bachelor Enlisted Quarters Site

In 2008, an Environmental Investigation was conducted within the B-12 range in the proposed Bachelor Enlisted Quarters (BEQ) MILCON Site. The site is located across Douglass Street to the south west of the Fitness Center MILCON Site. Surface and subsurface soil, groundwater, surface water, and sediment were sampled and analyzed for metals and perchlorate. Analytical results were screened against MCB CamLej background levels (Baker, 2001), and USEPA Preliminary Remediation Goals (PRGs) and North Carolina Groundwater Quality Standards (NCGWQS) for all applicable media. The results of the investigation were as follows:

- In surface and subsurface soil, arsenic was the only analyte that exceeded twice the average Base background levels and Region IX residential soil PRGs or NC Soil Screening Levels (SSLs).
- In groundwater, total arsenic, dissolved arsenic, total chromium, and total lead were the only analytes that exceeded twice the average Base background levels and Region IX tap water PRGs or NCGWQS.
- In surface water, total cadmium and total lead were the only analytes that exceeded USEPA national recommended water quality criteria. Perchlorate was detected in one surface water sample, but there is currently no surface water standard for this compound.
- In sediment, total arsenic was the only analyte that exceeded Region IX residential soil PRGs.

Based on analytical results and the findings of the ecological and human health screenings, the presence of munitions constituent (MC) contamination had been adequately characterized, and there were no unacceptable risks for human and ecological receptors at the proposed BEQ location.



Legend
■ Site Area

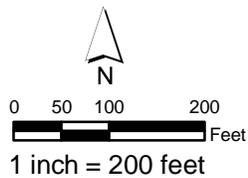
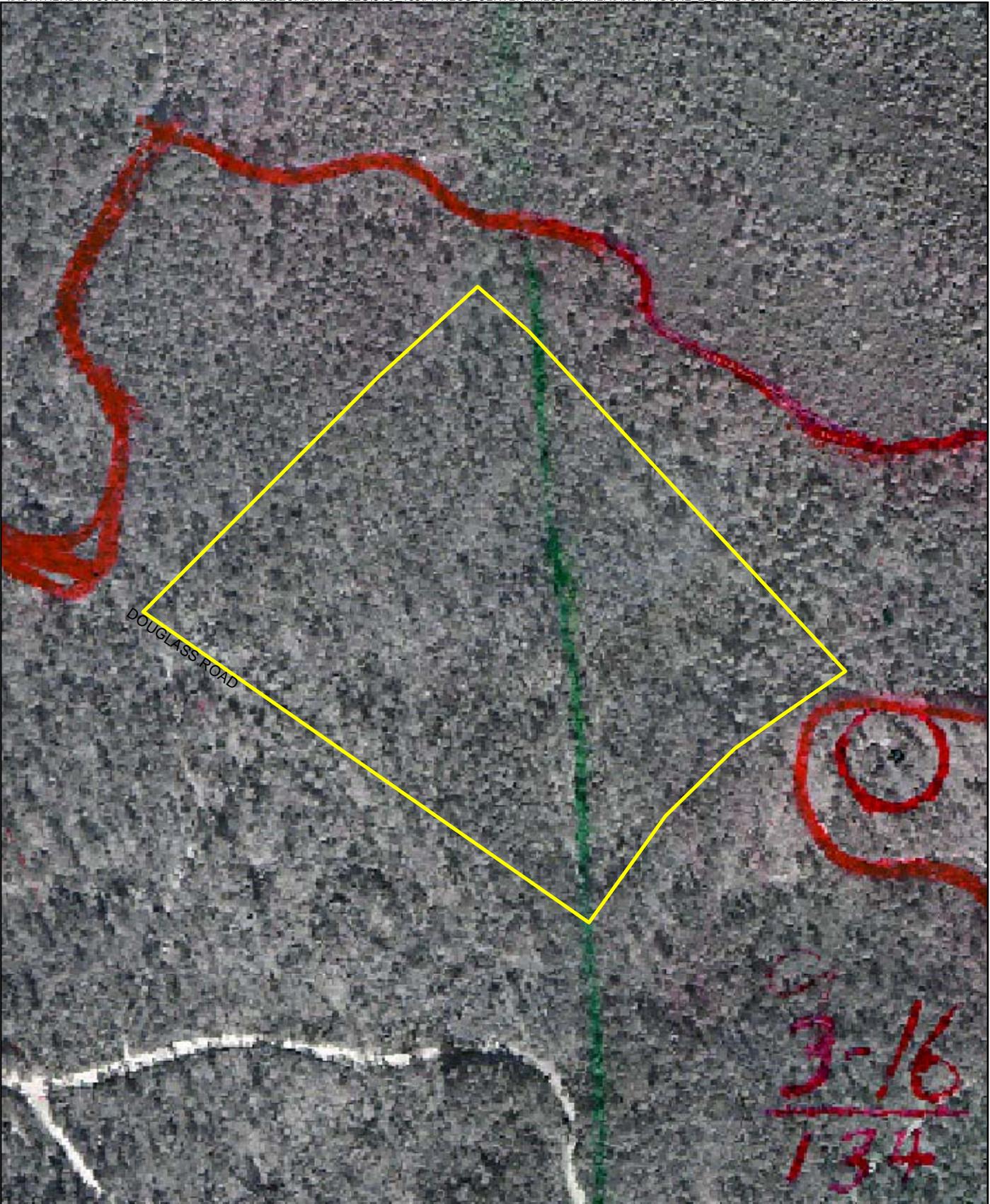


Figure 2-1
Historical Aerial - 1956
Fitness Center (P-714) MILCON Area
Archival Records Search Report
MCB CamLej
North Carolina





Legend
■ Site Area

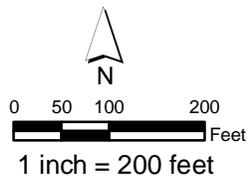


Figure 2-2
Historical Aerial - 1962
Fitness Center (P-714) MILCON Area
Archival Records Search Report
MCB CamLej
North Carolina





Legend
■ Site Area

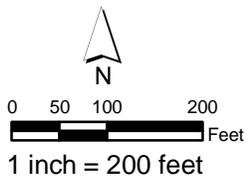


Figure 2-3
Historical Aerial - 1989
Fitness Center (P-714) MILCON Area
Archival Records Search Report
MCB CamLej
North Carolina



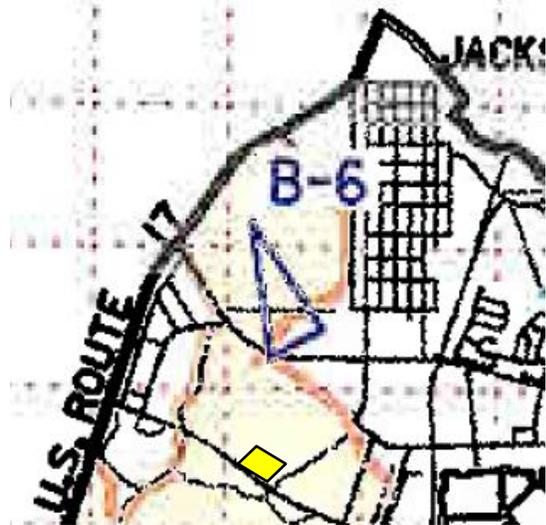


Plate 5 (1951)

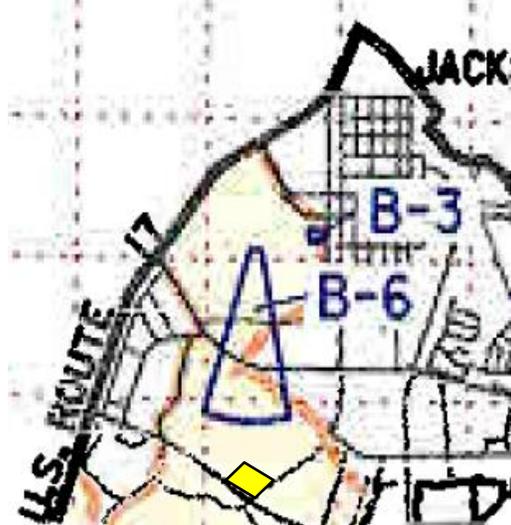


Plate 6 (1953)

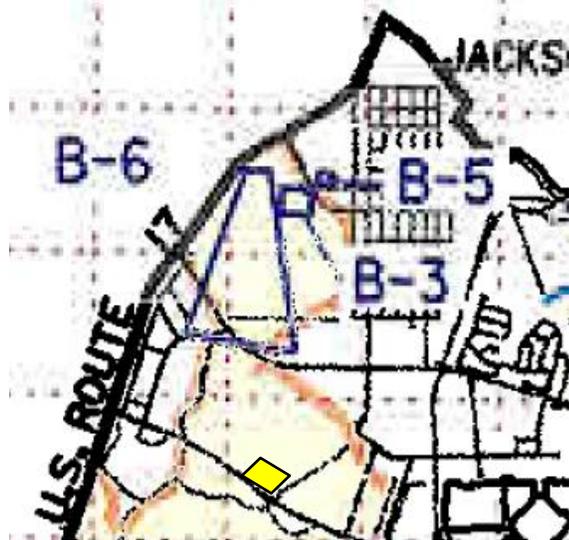
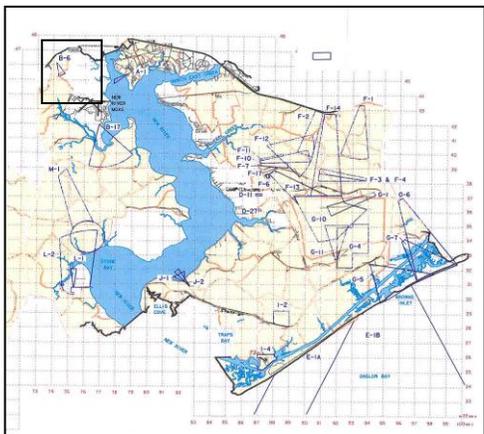


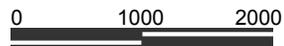
Plate 8 (1954)



Plate 10 (1958)



◆ Approximate location of Fitness Center



Approximate scale in Meters

Figure 2-4
 B-6 Range Overlay Maps – 1951, 1953, 1954, 1958
 Fitness Center (P-714)
 Archival Records Research Report
 MCB CamLej
 North Carolina

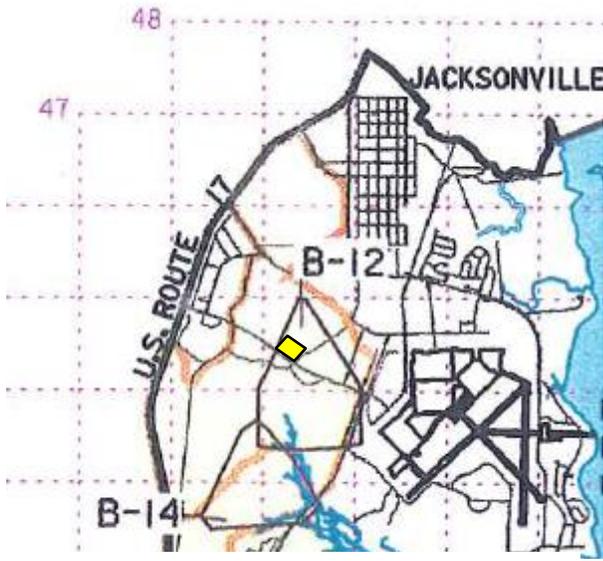


Plate 13 (1970)

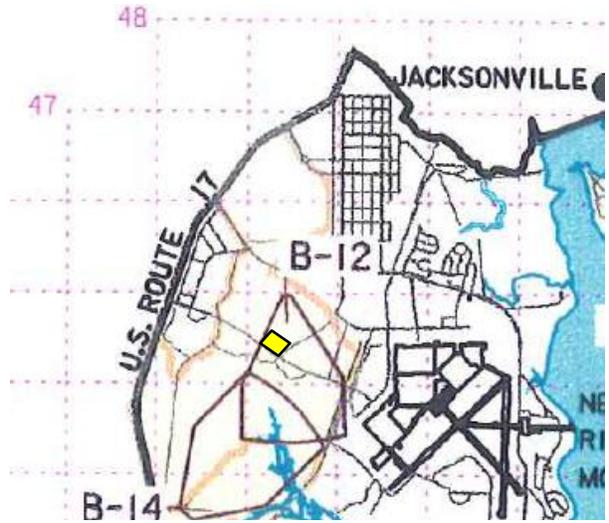


Plate 16 (1976)



Plate 18 (1986)

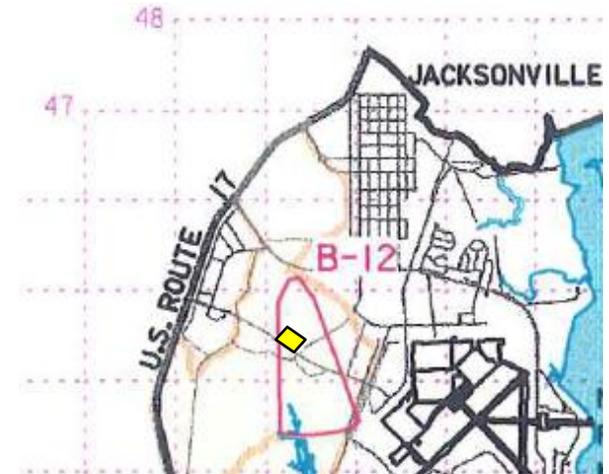
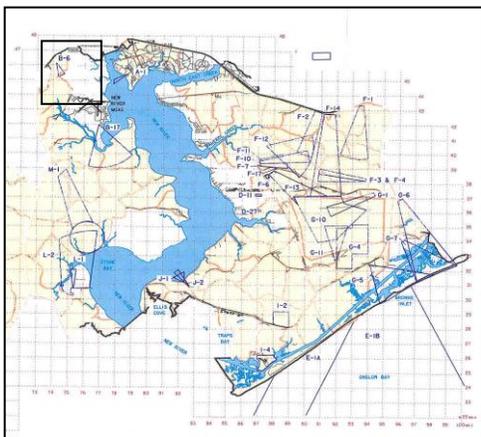


Plate 20 (1993)



Approximate location of Fitness Center

0 1000 2000

Approximate scale in Meters

Figure 2-5
 B-12 Range Overlay Maps – 1970, 1976, 1986, 1993
 Fitness Center (P-714)
 Archival Records Research Report
 MCB CamLej
 North Carolina

Findings

Throughout the history of the B-6 range, small arms were used in an unknown quantity that included .22 caliber rifle and pistol, .32, .38, and .45 caliber pistols (USACE, 2001). Explosives hazards exist with complete rounds if found near the firing line. The estimated depth of munitions is at the ground surface, however, ground movement due to construction over the years could have resulted in rounds being buried at varying depths (USACE, 2001). Lead as well as explosives is a potential hazard at the site in the currently wooded area (Richardson, 2008). There is no evidence for the B-6 historical range fans that munitions other than small arms were used in the area.

Historically, the B-12 range was used from approximately 1960 to at least 2001. The use of .22 caliber rifles, service pistols, and revolvers is recorded for the range (USMC, 1996) as well as the use of .38 caliber, .45 caliber, and 9mm weapons (USACE, 2001). An interview with Base Safety specialist (Richardson, 2007) confirmed the munitions used at the B-12 range included .22 caliber, .38 caliber, and 9 mm rounds. In 2008, an environmental investigation was conducted at the range. During this investigation surface and subsurface soil, groundwater, surface water, and sediment were sampled and analyzed for metals and perchlorate. Based on the analytical results from this investigation arsenic is a potential hazard in surface and subsurface soil. Total and dissolved arsenic, total chromium, and total lead are potential hazards in the groundwater. Total cadmium and lead are potential hazards in the surface water, and total arsenic is a potential hazard in the sediment. Based on the analytical results from the site and the ecological and human health risk screenings, the presence of MC contamination had been adequately characterized, and there were no unacceptable risks for human and ecological receptors at the studied location.

Based on archival records review, there is no evidence that munitions other than small arms were used within the Fitness Center area.

SECTION 4

References

AH Environmental Consultants (AHEC). 2002. *Wellhead Protection Plan – 2002 Update, Marine Corps Base, Camp Lejeune, North Carolina*. August.

[\wolfpack\Projects\NavyClean\CampLejeune\Program-Wide-Files\Wellhead Protection Plan](#)

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

Bureau of Yards and Docks. 1941. *Marine Barracks, New River North Carolina, Property Map Area B*. July 26.

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Loftfield, Thomas C., Principal Investigator. 1981. *Archeological and Historical Survey of USMC Base, Camp Lejeune*. Naval Facilities Engineering Command Norfolk, Coastal Zone Resource Corp, Vol. II. Contract # N62470-79-C-4273. University of North Carolina, Wilmington. August.

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

Winner, M. and R. Coble. 1989. *Hydrogeologic Framework of the North Carolina Coastal Plain Aquifer System.* U.S. Geological Survey Open File Report 87-690.

Attachment 1
Resource Review Summary

Resource Review Summary – B-6 Range

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 B-6, 50 Foot Small Bore Range.

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 Corp Library Review

Text Division

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

Site Visit: November 12, 2008

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

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

- “New River, North Carolina”, 1972. Published by the Defense Mapping Agency.
- “Approaches to New River”, 1987, 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.*

Resource Review Summary – B-12 Range

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

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

Marine Corp Library Review

Text Division

Contact: Annette Amerman

Site Visit: November 1, 2007

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

No pertinent documents were obtained from the file review.

National Archives and Records Administration Review

Text Division

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

Site visits on November 5 and 6, 2007

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

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

The boxes contained information primarily related to weapons test results, weapons cost distribution, weapons training classes, weapon specifications, and cleaning and

maintenance. The material was not specific to Camp Lejeune and included information for several MC bases.

List of Documents Obtained from National Archives

No pertinent documents were obtained from the file review.

MCB Camp Lejeune Base Site Visit and Records Review

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

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

List of Documents Obtained from Camp Lejeune

Base Real Estate Office

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

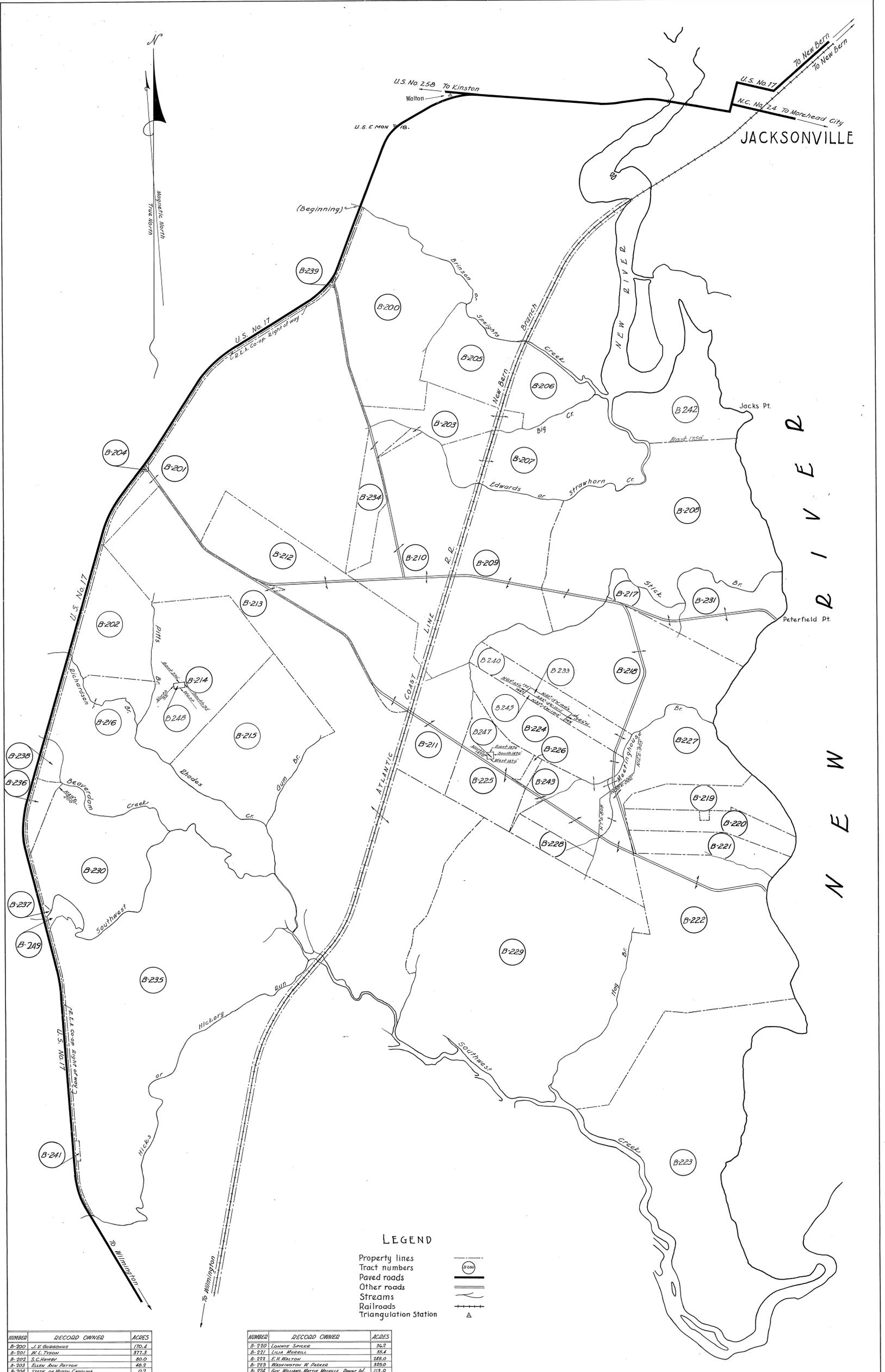
Base Library

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

Environmental Office

No pertinent documents were obtained from the file review.

Attachment 2
Property Map - Area B



LEGEND

- Property lines
- Tract numbers
- Paved roads
- Other roads
- Streams
- Railroads
- Triangulation Station



NUMBER	RECORD OWNER	ACRES
B-200	J. H. GARDNER	170.4
B-201	M. L. TROOP	377.3
B-202	S. C. HENRY	80.0
B-203	ELEN ANN PATTON	46.2
B-204	STATE OF NORTH CAROLINA	0.2
B-205	C. L. ANDREWS	56.4
B-206	C. D. KODWICK	40.4
B-207	JOHN D. WALICK	127.2
B-208	T. J. MORTON, SR.	276.0
B-209	MARY PHILLIPS (Wife of Philip, Deceased)	143.7
B-210	BERTHA H. LINTIC	156.0
B-211	R. HELLVILLE	50.0
B-212	MARY E. ANDREWS	146.0
B-213	ATLANTIC CHRISTIAN COLLEGE	327.6
B-214	ROSSO HENRY	131.8
B-215	LEITE JUSTICE ESTATE	137.7
B-216	W. LEE HUMPHREY	187.0
B-217	SAM DUDLEY	77.0
B-218	GEORGE WATTS	179.9
B-219	JESSIE SPICER	33.8

NUMBER	RECORD OWNER	ACRES
B-220	EDMIE SPICER	36.2
B-221	LULA MURKIN	35.4
B-222	E. H. WALTON	248.0
B-223	WASHINGTON W. PATTER	326.0
B-224	GUY WILLIAMS (Wife of Marie, Deceased)	118.0
B-225	R. M. WALTON ET AL.	17.3
B-226	GUY WILLIAMS	2.0
B-227	GUY WILLIAMS	105.0
B-228	MICHAEL EDEN	18.7
B-229	D. M. DIXON	421.0
B-230	WASHINGTON HUMPHREY, HEIRS	127.0
B-231	T. J. MORTON, JR.	79.0
B-232	JAMES POLLOCK, HEIRS	3.89
B-233	WILIE PATTEN	20.0
B-234	H. A. SANDLIN	504.0
B-235	W. W. PATTER, ET AL.	12.5
B-236	EDGAR H. HUMPHREY	0.6
B-237	EDGAR H. HUMPHREY	10.0
B-238	EDGAR H. POLLOCK	0.2
B-239	JAMES H. SANDLIN & STATE OF NORTH CAROLINA	0.5
B-240	S. R. FREEMAN	36.57
B-241	E. A. WILLIAMS	1.0
B-242	G. F. PHILLIPS	89.0
B-243	G. L. HELLVILLE	128.0
B-244	OSCAR POLLOCK	3.44
B-245	MARY WILLIAMS, HEIRS	0.5
B-246	LEITE JUSTICE	0.5
B-247	W. W. PATTER	4.9

REVISION SCHEDULE

- Corrected B-208, B-214, B-224, B-225, B-227, B-230, B-236, B-240.
- Added B-245, B-233, B-242, B-247, B-248, B-249.
- Contract Number added to Title Block.

I hereby certify that this map was compiled from information contained in maps and deeds recorded in the Onslow County Registry, aerial photographs, and partial surveys made on the ground by Boney and Broadfoot. The items entered as revisions represent information added from surveys made since original date of compilation.

BONEY AND BROADFOOT
 Dated - July 18, 1941.
 By: *[Signature]*
 Acting Chief Engineer

Approved: March 25, 1941

[Signature]
 District Engineer, Quartermaster, U.S.M.C.

(A) 7-17-41	See Schedule of Revisions	G.O.H.
Revision Date	Brief	By
Reviewed by	NAVY DEPARTMENT	BUREAU OF YARDS & DOCKS
Chief Dfnn.		
Proj Mgrs.	Approved: March 24, 1941	Y. & D. Drawing No.
Design Mgr.	<i>[Signature]</i>	157-173
Chief of Bureau		
CONTRACT NO. 4717		
MARINE CORPS BASE NEW RIVER, N.C.		
PROPERTY MAP AREA B		
BONEY AND BROADFOOT ARCHITECTS AND ENGINEERS		WILMINGTON, N.C.
Submitted: March 24, 1941		<i>[Signature]</i>
Scale 1" = 660 FT.		By: <i>[Signature]</i>

159370

Attachment 3
Existing Conditions - 2005

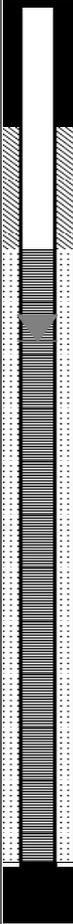
Appendix B
Soil Boring Logs and
Well Completion Diagrams

Boring Number: FC714-SB05

Sheet: 1 of 1

Client: NAVFAC
Project: CTO-133 Fitness Center MILCON
Location: MCB CamLej
Project Number: 403741.FI.FS

Driller: Mid Atlantic Drilling
Drilling Method: Geoprobe DT22
Sampling Method: Dual Tube
Logged by: K. Rogers
Start/Finish Date: 8/16/2010

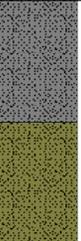
Depth (ft)	Sample Information					Soil Description	PID (ppm)	Comments	Well Construction
	Sample #	Sample Type	Recovery (inches)	SPT (6"-12"-6")	Soil Log				
0						Ground Surface			
1	1	HA-1	60			Silty Sand, SM , very dark gray, dry to moist, loose, fine grained. Dark brown, moist, loose.		Collected FC714-SB05-4-5-10C for Select Metals (lead, antimony, copper, zinc and arsenic) and Perchlorate	
5						Poorly Graded Sand, SP , light gray/white, very moist to wet, loose.			
2	2	DP-1	30		No Recovery 	Poorly Graded Sand, SP , light gray/white, wet, loose. Dark gray, wet, medium dense, trace silt. Dark gray, wet, soft, trace of silt.			
10	3	DP-2	48			Well Graded Sand, SW , gray, wet, loose, fine to coarse grained.			
4	4	DP-3	48		 	Clayey Sand, SC , gray, wet, soft, fine grained. Well Graded Sand, SW , white, wet, loose, fine to coarse grained, loose.			
15					  	Poorly Graded Sand, SP , orange, wet, loose, coarse grained, trace silt. Tan, wet, loose, fine grained. Orange, wet, loose, coarse grained.			
5	5	DP-4	48			Gray, loose, fine to medium grained, trace clay.			
20						End of Log			

Boring Number: FC714-SB07

Sheet: 1 of 1

Client: NAVFAC
Project: CTO-133 Fitness Center MILCON
Location: MCB CamLej
Project Number: 403741.FI.FS

Driller: Mid Atlantic Drilling
Drilling Method: Geoprobe DT22
Sampling Method: Dual Tube
Logged by: K. Rogers
Start/Finish Date: 8/16/2010

Depth (ft)	Sample Information					Soil Description	PID (ppm)	Comments	Well Construction
	Sample #	Sample Type	Recovery (inches)	SPT (6"-12"-6")	Soil Log				
0						Ground Surface			
1	1	HA-1	60		 <p>Poorly Graded Sand/Silty Sand, SP-SM, dark gray, dry, very loose, fine to very fine grained. Brown, dry, very loose, fine to very fine grained. Tan, dry to moist, very loose, fine to very fine grained.</p>				
5	2	DP-1	34		 <p>Poorly Graded Sand, SP, tan, moist, loose, fine grained. Poorly Graded Sand/ Clayey Sand, SP-SC, orangish brown, medium dense, trace silt. Poorly Graded Sand, SP, white with tan (mottled), wet, fine grained, very loose.</p>		Collected FC714-SB07-5-6-10C for Select Metals (lead, antimony, copper, zinc, and arsenic) and Perchlorate.		
10	3	DP-2	48		 <p>Gray, wet, loose, fine grained. Light brown, wet, fine grained, medium dense, trace silt. Poorly Graded Sand/ Clayey Sand, SP-SC, brown and gray, wet, soft/loose, very fine grained. Clayey Sand, SC, gray with tan, wet, medium dense/soft clay.</p>				
15	4	DP-3	48		 <p>Poorly Graded Sand, SP, gray, wet, medium density, fine grained. Tan and gray, wet, medium dense, fine grained.</p>				
20						End of Log			

Boring Number: FC714-SB09

Sheet: 1 of 1

Client: NAVFAC
Project: CTO-133 Fitness Center MILCON
Location: MCB CamLej
Project Number: 403741.FI.FS

Driller: Mid Atlantic Drilling
Drilling Method: Geoprobe DT22
Sampling Method: HA
Logged by: K. Rogers
Start/Finish Date: 8/17/2010

Depth (ft)	Sample Information				Soil Log	Soil Description	Comments
	Sample #	Sample Type	Recovery (in)	SPT (6"-6"-6")			
0						Ground Surface	Collected FC714-SB09-3-4-10C and FC714-SB09D-3-4-10C for Select Metals (lead, antimony, copper, zinc, and arsenic) and Perchlorate
	1	HA-1	60			Silty Sand, SM , brown, dry, very fine grained, loose.	
						Poorly Graded Sand, SP , tan, moist, loose, fine grained.	
5						Poorly Graded Sand, SP , light tan, moist to wet at 5', very loose, fine to medium grained.	
						End of Log	
10							
15							
20							

Boring Number: FC714-SB10

Sheet: 1 of 1

Client: NAVFAC
Project: CTO-133 Fitness Center MILCON
Location: MCB CamLej
Project Number: 403741.FI.FS

Driller: Mid Atlantic Drilling
Drilling Method: Geoprobe DT22
Sampling Method: Dual Tube
Logged by: K. Rogers
Start/Finish Date: 8/17/2010

Depth (ft)	Sample Information				Soil Log	Soil Description	Comments
	Sample #	Sample Type	Recovery (in)	SPT (6"-6"-6")			
0						Ground Surface	
1	1	HA-1	60			<p>Silty Sand, SM, dark brown, dry, very fine grained with roots, poorly graded. Tan, dry to moist, poorly graded.</p> <p>Light gray to tan, dry to moist, poorly graded.</p>	During drilling PID=0
5						No Recovery	
2	2	DP-1	28			<p>Silty Sand, SM, gray and tan, dry to moist, poorly graded.</p> <p>Clayey Sand, SC, light gray and tan, moist.</p> <p>Silty Sand, SM, tan, wet, fine grained.</p>	<p>Collected FC714-SB10-6-7-10C for Select Metals (lead, antimony, copper, zinc, and arsenic) and Perchlorate</p> <p>Water level at 7.5' bgs</p>
10						End of Log	
15							
20							

Boring Number: FC714-SB11

Sheet: 1 of 1

Client: NAVFAC
Project: CTO-133 Fitness Center MILCON
Location: MCB CamLej
Project Number: 403741.FI.FS

Driller: Mid Atlantic Drilling
Drilling Method: Geoprobe DT22
Sampling Method: HA
Logged by: K. Rogers
Start/Finish Date: 8/17/2010

Depth (ft)	Sample Information				Soil Log	Soil Description	Comments
	Sample #	Sample Type	Recovery (in)	SPT (6"-6"-6")			
0					Ground Surface		
	1	HA-1	48			<p><u>Sandy Silt, SM</u>, gray, dry, loose, fine grained.</p> <p>Dark brown, moist, fine grained, loose.</p> <p><u>Poorly Graded Sand, SP</u>, gray, wet, fine grained.</p>	<p>Collected FC714-SB11-1.5-2.5-10C for Select Metals (lead, antimony, copper, zinc, and arsenic) and Perchlorate</p> <p>Water level at 3.5' bgs</p>
5					End of Log		
10							
15							
20							

Boring Number: FC714-SB12

Sheet: 1 of 1

Client: NAVFAC
Project: CTO-133 Fitness Center MILCON
Location: MCB CamLej
Project Number: 403741.FI.FS

Driller: Mid Atlantic Drilling
Drilling Method: Geoprobe DT22
Sampling Method: HA
Logged by: K. Rogers
Start/Finish Date: 8/17/2010

Depth (ft)	Sample Information				Soil Log	Soil Description	Comments
	Sample #	Sample Type	Recovery (in)	SPT (6"-6"-6")			
0						Ground Surface	Collected FC714-SB12-2-3-10C for Select Metals (lead, antimony, copper, zinc, and arsenic) and Perchlorate
1	HA-1	36			<p>Silty Sand, SM, grayish brown, dry to moist, very fine grained with roots, loose.</p> <p>Grayish brown, dry to moist, cemented silt.</p>		
5					End of Log		
10							
15							
20							

Boring Number: FC714-SB13

Sheet: 1 of 1

Client: NAVFAC
Project: CTO-133 Fitness Center MILCON
Location: MCB CamLej
Project Number: 403741.FI.FS

Driller: Mid Atlantic Drilling
Drilling Method: Geoprobe DT22
Sampling Method: Dual tube
Logged by: K. Rogers
Start/Finish Date: 8/16/2010

Depth (ft)	Sample Information				Soil Log	Soil Description	Comments
	Sample #	Sample Type	Recovery (in)	SPT (6"-6"-6")			
0						Ground Surface	
						Roots and silt	
	1	HA-1	60			Silty Sand, SM , gray, moist, loose	
						Dark brown, moist, loose	
						Poorly Graded Sand, SP , tan, moist, loose, fine grained.	
						Poorly Graded Sand/Silty Sand, SP-SM , tan, moist, medium dense, fine grained, trace clay.	
5						No Recovery	
	2	DP-1	24			Poorly Graded Sand/Silty Sand, SP-SM , tan, moist, medium dense, fine grained, trace clay.	
						Poorly Graded Sands, SP , white, moist to saturated, loose, fine grained.	Collected FC714-SB13-8-9-10C for Select Metals (lead, antimony, copper, zinc, and arsenic) and Perchlorate
10	3	DP-2	48			Clayey Sand, SC , gray with orange mottling, saturated, medium dense.	Water level at 9.5' bgs
						End of Log	
15							
20							

Appendix C
Groundwater Sampling Data Sheets

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: MCB CAMP LEJEUNE
 Event: CTO-133 Fitness Center (P-714)
 Date: 8-25-10
 Weather: 90° Sunny

Project Number: 403741.FI.FS
 Well ID: FCT14-GW01
 Sample ID: FCT14-GW01-10C
 Sampling Team: David S RDU
 Betty R RDU

Total Depth: 15 FT.(BTOC)
 Depth to water: (H) 10 FT.(BTOC)
 Water Column: 5 FT.
 (x) .163 GAL/FT.
 Well Volume: .815 GAL. x 3 = 2.45
 Total Purge Vol.: 2.75 GAL.
 Purge Device: Peristaltic Pump

Measuring Device: YSI # 05248 ; HANNA 88999
 Date and Time: 8-25-10

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

FIELD PARAMETERS									
Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color/Odor/Comments
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10		
1055	10.10	19.50	0.041	1.34	4.35	311.9	30.3	300	2.5 L
1100	10.10	19.37	0.044	1.37	4.57	288.1	6.71	300	4.0 L
1105	10.10	19.32	0.044	1.32	4.36	293.0	3.01	300	5.5 L
1110	10.10	19.38	0.044	1.33	4.49	270.5	1.27	300	7.0 L
1115	10.10	19.36	0.044	1.33	4.43	263.2	0.97	300	8.5 L
1120	10.10	19.38	0.044	1.35	4.50	271.9	0.71	300	10 L

SAMPLE DATA									
Date:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other:	Color/Odor/Comments	
8/25/10									
Time: 1120	19.38	0.044	1.35	4.50	271.9	0.71	300	10.10	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
Select Metals (lead, antimony, copper, zinc, arsenic)	HNO3	250 mL poly	1
Dissolved Metals (lead, antimony, copper, zinc, arsenic)	<4°C	250 mL poly	1
Perchlorate	<4°C	250 mL poly	1

Observations/Notes: 2.75 gal Purge begin @ 1050
 Tubing Intake @ 13 ft bgs

MS/MSD: YES (NO) MS ID: SD ID:

Duplicate: YES (NO) Duplicate ID:

Signature(s): Betty Reid

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: MCB CAMP LEJEUNE
 Event: CTO-133 Fitness Center (P-714)
 Date: 8-25-10
 Weather: 80° Sunny

Project Number: 403741.FI.FS
 Well ID: WL AW03 FC714-TW03
 Sample ID: FC714-GW03-10C
 Sampling Team: Betsy R. RDC
David S. RDC

Total Depth: 15 FT.(BTOC)
 Depth to water: (1) 9.31 FT.(BTOC)
 Water Column: 5.69 FT.
(x) .163 GAL/FT.
 Well Volume: .927 GAL. x 3 = 2.78
 Total Purge Vol.: 3 GAL.

Measuring Device: YSI #05248; NANMA 08199
 Date and Time: 8-25-10

Purge Device: Peristaltic Pump

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

FIELD PARAMETERS									
Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Volume purged Galer/Odor/Comments
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10		
0905	9.34	19.56	0.030	1.60	4.50	245.3	42.1	300	1.5 L
0910	9.34	19.31	0.031	1.46	4.48	211.9	31.8	300	3.0 L
0915	9.35	19.28	0.031	1.39	4.46	208.1	20.5	300	4.5 L
0920	9.35	19.23	0.031	1.41	4.51	176.6	13.3	300	6.0 L
0925	9.35	19.15	0.032	1.36	4.43	180.3	7.80	300	7.5 L
0930	9.35	19.17	0.032	1.33	4.41	173.5	7.17	300	9 L
0935	9.35	19.14	0.032	1.30	4.35	175.9	5.09	300	10.5 L

SAMPLE DATA									
Date:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other:	Color / Odor / Comments	
10-25-10							OTW		
Time: 0935									
Method: Low-Flow	19.14	.032	1.30	4.35	175.9	5.09	9.35		

Sample information: method, container number, size, and type, preservative used.			
Analysis	Preservative	Container requirements	No. of containers
Select Metals (lead, antimony, copper, zinc, arsenic)	HNO3	250 mL poly	1
Dissolved Metals (lead, antimony, copper, zinc, arsenic)	<4°C	250 mL poly	1
Perchlorate	<4°C	250 mL poly	1

Observations/Notes: 3 gal Purge began at 0900

Total Volume Purged: 3 gal

MS/MSD: YES NO MS ID: _____
 SD ID: _____

Duplicate: YES NO Duplicate ID: _____

Signature(s): Betsy RDC



GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: MCB CAMP LEJEUNE
 Event: CTO-133 Fitness Center (P-714)
 Date: 8/24/10
 Weather: 75°

Project Number: 403741.FIFS
 Well ID: FC714-TW05
 Sample ID: FC714-GW05-10C
 Sampling Team: D. Seel/ROU, R. R. ROU

Total Depth: 14 FT.(BTOC)
 Depth to water: (-) 10.52 FT.(BTOC)
 Water Column: 3.48 FT.
 (x) 0.163 GAL/FT.
 Well Volume: 0.56 GAL.
 Total Purge Vol.: 2.0 GAL.

Measuring Device: YSI# 05248
 Date and Time: #080999
 HANNA

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

Purge Device: Peristaltic Pump

FIELD PARAMETERS									
Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color/Odor/Comments
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10		DTW
1340	0.8	19.06	0.056	0.39	4.70	59.0	1.83	300	10.55
1345	1.2	19.03	0.056	0.37	4.75	45.7	1.38	300	10.55
1350	1.6	19.04	0.057	0.41	4.86	37.1	1.25	300	10.55
1355	2.0	19.08	0.056	0.47	4.80	33.9	1.41	300	10.55

SAMPLE DATA									
Date: 8/24/10	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: DTW	Color / Odor / Comments	
Time: 1355									
Method: low flow	19.08	0.056	0.47	4.80	33.9	1.41	10.5		

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
Select Metals (lead, antimony, copper, zinc, arsenic)	HNO3	250 mL poly	1
Dissolved Metals (lead, antimony, copper, zinc, arsenic)	<4°C	250 mL poly	1
Perchlorate	<4°C	250 mL poly	1

Observations/Notes:
 Total Volume Purged: 2.0
 Purge start 1330
 Purge rate = 0.3L/min tubing intake @ 12 ft

MS/MSD: YES NO
 MS ID:
 SD ID:

Duplicate: YES NO Duplicate ID:

Signature(s):



GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: MCB CAMP LEJEUNE
 Event: CTO-133 Fitness Center (P-714)
 Date: 8/24/10
 Weather: 750

Project Number: 403741.FI.FS
 Well ID: FC714-mw06
 Sample ID: FC714-Gw06
 Sampling Team: D. Seed/ROU; Jessy R/ROU

Total Depth: 16 FT.(BTOC)
 Depth to water: 10.05 FT.(BTOC)
 Water Column: 5.95 FT.
 (x) = 163 GAL/FT.
 Well Volume: 0.96 GAL. x 3 = 2.9
 Total Purge Vol.: 2.9 GAL.

Measuring Device: YSI # ~~556~~ 05248
 Date and Time: # 08999
 HANNA

Purge Device: Peristaltic Pump

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

FIELD PARAMETERS									
Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color / Odor / Comments
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10		DTW
1620	0.4	20.51	0.094	1.82	3.83	4145	19.8	300	10.24
1625	0.8	20.50	0.096	1.75	3.86	438.7	13.7	300	10.42
1630	1.2	20.47	0.100	1.65	3.79	443.7	8.60	300	10.42
1635	1.6	20.47	0.102	1.47	3.81	432.1	15	300	10.58
1640	2.0								
1645	2.4	20.73	0.109	1.42	3.81	429	17.6	200	10.74
1650	2.9	21.35	0.108	6.90	3.93	423.2	13.3	200	10.75

2.4

SAMPLE DATA									
Date:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other:	Color / Odor / Comments	
8/24/10	21.35	0.108	6.90	3.93	423.2	13.3	Div	10.75	

Sample information: method, container number, size, and type, preservative used.			
Analysis	Preservative	Container requirements	No. of containers
Select Metals (lead, antimony, copper, zinc, arsenic)	HNO3	250 mL poly	1
Dissolved Metals (lead, antimony, copper, zinc, arsenic)	<4°C	250 mL poly	1
Perchlorate	<4°C	250 mL poly	1

Observations/Notes: Total Volume Purged: 2.9 Purge start @ 1615 Purge rate .36/min → changed to .24/min @ 1645 tubing intake @ 12 ft bloc

MS/MSD: YES NO MS ID: FC714-Gw06-10C-MS
 SC ID: FC714-Gw06-10C-5V

Duplicate: YES NO Duplicate ID:

Signature(s): *[Signature]*

GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: MCB CAMP LEJEUNE
 Event: CTQ-133 Fitness Center (P-714)
 Date: 8/24/10
 Weather: 75

Project Number: 403741.FI.FS
 Well ID: FC714-MW07
 Sample ID: FC714-G1007-106
 Sampling Team: O. Scott RDU, Retty R. RDU

Total Depth: 15 FT.(BTOC)
 Depth to water: (H) 11.8 FT.(BTOC)
 Water Column: 3.2 FT.
 (x) 0.163 GAL/FT.
 Well Volume: 0.52 GAL x 1.5
 Total Purge Vol.: 1.6 GAL.

Measuring Device: YSTA 05248
 Date and Time: 8/24/10 05999
 HANNA

Purge Device: Peristaltic Pump

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
2	0.163
4	0.653
6	1.469

FIELD PARAMETERS

Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color / Odor / Comments
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10		DTW
1525	0.4	19.27	0.048	1.72	4.53	273.8	9.69	300	11.88
1530	0.8	19.20	0.049	1.39	4.48	268.7	5.88	300	11.90
1535	1.2	19.11	0.044	1.40	4.53	249	4.59	300	11.91
1540	1.6	19.14	0.050	1.37	4.48	234.8	2.76	300	11.92

SAMPLE DATA

Date: 8/24/10	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other: DTW	Color / Odor / Comments
Time: 1540								
Method: Low Flow	19.14	0.050	1.37	4.48	234.8	2.76	11.92	

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
Select Metals (lead, antimony, copper, zinc, arsenic)	HNO3	250 mL poly	1
Dissolved Metals (lead, antimony, copper, zinc, arsenic)	<4°C	250 mL poly	1
Perchlorate	<4°C	250 mL poly	1

Observations/Notes:
 Total Volume Purged: 1.6 purge time 1520 start
 purge rate = 0.34/min
 tubing intake 13 ft bloc

MS/MSD: YES NO
 MS ID:
 SD ID:

Duplicate: YES NO
 Duplicate ID:

Signature(s):



GROUNDWATER SAMPLING DATA SHEET

Client: NAVFAC Mid-Atlantic
 Location: MCB CAMP LEJEUNE
 Event: CTO-133 Fitness Center (P-714)
 Date: 8/24/10
 Weather: 73°

Project Number: 403741.FI.FS
 Well ID: FC714-mw08
 Sample ID: FC714-GW08-10C
 Sampling Team: D. Seed/RDU; Barry R/RDU

Total Depth: 18 FT.(BTOC)
 Depth to water: (1) 12.79 FT.(BTOC)
 Water Column: 5.21 FT.
 (x) 0.163 GAL/FT.
 Well Volume: 0.84 GAL x 3 = 2.5
 Total Purge Vol.: 1.2 GAL.

Measuring Device: YSI# 05248
 Date and Time: turb # 080909

Purge Device: Peristaltic Pump

Well Dia. (inches)	Volume (gallons/foot)
0.75	0.023
1	0.041
(2)	(0.163)
4	0.653
6	1.469

FIELD PARAMETERS									
Time	Depth to Water (ft bgs)	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Flow Rate (mL/min)	Color / Odor / Comments
Stabilization Criteria		± 10%	± 3%	± 10%	± 0.1	± 10 mV	± 10% or <10		OTW
1435	0.4	20.24	0.043	2.71	4.42	291	26.9	300	12.95
1440	0.8	20.05	0.048	2.49	4.33	300	13.9	300	12.95
1445	1.2	19.99	0.048	2.37	4.43	297	9.02	300	12.95

SAMPLE DATA									
Date:	Time:	Temp. °C	Cond. mS/cm	DO mg/L	pH SU	ORP mV	Turbidity NTU	Other:	Color / Odor / Comments
8/24/10	1445	19.99	0.048	2.37	4.43	297	9.01	OTW	12.95

Sample information: method, container number, size, and type, preservative used.

Analysis	Preservative	Container requirements	No. of containers
Select Metals (lead, antimony, copper, zinc, arsenic)	HNO3	250 mL poly	1
Dissolved Metals (lead, antimony, copper, zinc, arsenic)	<4°C	250 mL poly	1
Perchlorate	<4°C	250 mL poly	1

Observations/Notes: 1.2 purge started @ 1430 tubing intake @ 15 ft btlc
 Total Volume Purged: 1.2 purge rate .3L/min

MS/MSD: YES NO MS ID: SD ID:

Duplicate: YES NO Duplicate ID:

Signature(s):

Appendix D
Data Validation Summary Reports

DataQual

Environmental Services, LLC

CH2M HILL
 5700 Cleveland Street
 Suite 101
 Virginia Beach, VA 23462

October 5, 2010
 SDG# 1008185
 Empirical Laboratories
 MCB Camp Lejeune, North Carolina – CTO-133

Dear Ms. Shaw,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 1008185. The data validation was performed in accordance with the SW846 methods 6850 for Perchlorate and 6010B for metals. Also used in the validation of these samples were The National Functional Guidelines for Organic Data Review (June, 2008), as applicable, the National Functional Guidelines for Inorganic Data Review (October, 2004), as applicable, and good professional judgment. All areas of concern are discussed in the body of the report and a summary of data qualifications is provided.

Sample ID	Lab ID	Matrix	Perchlorate	Metals
FC714-SB05-4-5-10C	1008185-01	soil	X	X
FC714-SB08-9-10-10C	1008185-02	soil	X	X
FC714-SB07-5-6-10C	1008185-03	soil	X	X
FC714-SB13-8-9-10C	1008185-04	soil	X	X
FC714-SB06-7-8-10C	1008185-05	soil	X	X
FC714-SB10-6-7-10C	1008185-06	soil	X	X
FC714-SB02-6-7-10C	1008185-07	soil	X	X
FC714-SB01-5-6-10C	1008185-08	soil	X	X
FC714-SB01D-5-6-10C	1008185-09	soil	X	X
FC714-SB04-5-6-10C	1008185-10	soil	X	X
FC714-SB03-4-5-10C	1008185-11	soil	X	X
FC714-SB12-2-3-10C	1008185-12	soil	X	X
FC714-FB081710	1008185-13	water	X	X
FC714-EB01-081710-SB	1008185-14	water	X	X
FC714-SB11-1.5-2.5-10C	1008185-15	soil	X	X
FC714-SB09-3-4-10C	1008185-16	soil	X	X
FC714-SB09D-3-4-10C	1008185-17	soil	X	X
FC714-EB02-081710-SB	1008185-18	water	X	X
FC714-SB11-1.5-2.5-10C MS	1008185-15MS	soil	X	X
FC714-SB11-1.5-2.5-10C MSD	1008185-15MSD	soil	X	X

The following quality control sample was provided with this SDG: sample FC714-SB01D-5-6-10C-field duplicate of sample FC714-SB01-5-6-10C; sample FC714-SB09D-3-4-10C-field duplicate of sample FC714-SB09-3-4-10C; samples FC714-EB01-081710-SB and FC714-EB02-081710-SB-equipment blanks; sample FC714-FB-081710-field blank.

The samples were evaluated based on the following criteria:

- Data Completeness *
- Technical Holding Times *
- HPLC Performance *
- Initial/Continuing Calibrations *
- CRI Standards *
- Interference Check Sample *
- Blanks
- Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Post Digestion Spike Recoveries *
- Serial Dilutions *
- Field Duplicates *
- Identification/Quantitation *
- Reporting Limits *

* - indicates that no qualifications were required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page. Please note that when a compound or analyte is flagged due to blank contamination the BL qualifier code takes precedence over all other qualifier codes except a code that explains rejected data.

Perchlorate

No qualifications were required to the data.

Metals

The preparation blank associated with the metals soil samples exhibited contamination for the analyte zinc. Qualifications were required in the samples.

The matrix spike recoveries in solid samples were low for one analyte. Qualifications were applied to the data.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/16-17/10 and samples were received at the laboratory 8/19/10. All sample preparation and analysis was performed within method holding time requirements.

Metals

Contamination was noted in associated blanks and qualification was required in the associated samples. Required action is noted in the following tables.

Blank ID	Analyte	Concentration	Action Level	Q Flag
0107004-BLK1	zinc	0.437J mg/Kg	RL	U at RL

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag	Q Code
all field samples > MDL ≤ RL	zinc	U at RL	MBL

Matrix Spikes

Metals

The matrix spike analyses exhibited non-compliant %Rs. Specific action is noted in the following table.

MS/MSD	Analyte	Samples Affected	%R	Q Flag	Q Code
FC714-SS11-1.5-2.5-10C	antimony	all soil samples	41.5/43.7	J/UJ	MSL

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,



Laura Maschhoff
President



Jacqueline Cleveland
Vice-President

Summary of Data Qualifications

Perchlorate

Sample ID	Compound	Results	Q-Flag	Q Code
No qualifications.				

Select Metals

Sample ID	Analyte	Results	Q-Flag	Q Code
all field samples > MDL ≤ RL	zinc	+J	U at RL	MBL
all soil samples	antimony	+/-	J/UJ	MSL

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
R	result is rejected; the presence or absence of the analyte cannot be verified
D	result value is based on dilution analysis result
NJ	analyte has been tentatively identified, estimated value
L	analyte present, biased low
UL	not detected, quantitation limit is probably higher
K	analyte present, biased high

Inorganic Field/Lab Blank Qualification Flags (Q-Flags)

NA	The sample result for the blank contaminant is greater than the sample RL and is greater than 5X (10X for common laboratory contaminants) the blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.
RL-U	The sample result for the blank contaminant is less than the sample RL and the result is raised to the RL and flagged U.
R or J+	The blank contaminant concentration was greater than the RL and the sample result is greater than the RL but less than 10X the blank contaminant concentration. The reported results are flagged either as rejected R or biased high J+ based on the professional judgment of the validator. (see NFG, Rev. date 10/04, p. 17 for extracted blanks (PB))

Organic Field/Lab Blank Qualification Flags (Q-Flags)

NA	The sample result for the blank contaminant is greater than the sample RL and is greater than 5X (10X for common laboratory contaminants) the blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.
RL-U	The sample result for the blank contaminant is less than the sample RL but is less than 5X (10X for common laboratory contaminants) the blank value, so the result is raised to the RL and flagged U.
U	The sample result for the blank contaminant is greater than the sample RL but is less than 5X (10X for common laboratory contaminants) the blank value, so the result is flagged U at the reported value.

General Abbreviations

RL	reporting limit
MDL	method detection limit
CRQL/CRDL	contract required quantitation/detection limit
Q Code	qualifier code
+	positive result
-	non-detect result

QUALIFIER CODE REFERENCE

Qualifier	Description
TN	Tune
BSL	Blank Spike/LCS - High Recovery
BSH	Blank Spike/LCS - Low Recovery
BD	Blank Spike/Blank Spike Duplicate (LCS/LCSD) Precision
BRL	Below Reporting Limit
ISL	Internal Standard - Low Recovery
ISH	Internal Standard - High Recovery
MSL	Matrix Spike and/or Matrix Spike Duplicate - Low Recovery
MSH	Matrix Spike and/or Matrix Spike Duplicate - High Recovery
MI	Matrix interference obscuring the raw data
MDP	Matrix Spike/Matrix Spike Duplicate Precision
2S	Second Source - Bad reproducibility between tandem detectors
SSL	Spiked Surrogate - Low Recovery
SSH	Spiked Surrogate - High Recovery
SD	Serial Dilution Reproducibility
ICL	Initial Calibration - Low Relative Response Factors (RRF)
ICH	Initial Calibration - High Relative Response Factors (RRF)
ICB	Initial Calibration - Bad Linearity or Curve Function
CCL	Continuing Calibration - Low Recovery or %Difference
CCH	Continuing Calibration - High Recovery or %Difference
LD	Lab Duplicate Reproducibility
HT	Holding Time
PD	Pesticide Degradation
2C	Second Column - Poor Dual Column Reproducibility
LR	Concentration Exceeds Linear Range
BL	Blank Contamination (MBL, TBL, EBL, FBL)
RE	Redundant Result - due to Re-analysis or Re-extraction
DL	Redundant Result - due to Dilution
FD	Field Duplicate
OT	Other - explained in data validation report
%SOL	High moisture content

ANALYSIS DATA SHEET

FC714-SB05-4-5-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008185-01

Sampled: 08/16/10 13:20

Received: 08/19/10 08:30

% Solids: 76.32

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.320	0.639	0.959	1	U <i>MS</i>	SW6010B	0107004	09/09/10 17:11
7440-38-2	Arsenic		0.192	0.383	0.447	1	U	SW6010B	0107004	09/09/10 17:11
7440-50-8	Copper	0.458	0.320	0.511	1.28	1	J	SW6010B	0107004	09/09/10 17:11
7439-92-1	Lead	2.99	0.0959	0.192	0.639	1		SW6010B	0107004	09/09/10 17:11
7440-66-6	Zinc	1.37	0.320	0.639	1.28	1		SW6010B	0107004	09/09/10 17:11

JAC
10/5/10

008

ANALYSIS DATA SHEET

FC714-SB08-9-10-10C

Laboratory: <u>Empirical Laboratories, LLC</u>	SDG: <u>1008185</u>		
Client: <u>CH2M Hill, Inc.</u>	Project: <u>Lejeune CTO-133</u>		
Matrix: <u>Solid</u>	Laboratory ID: <u>1008185-02</u>	File ID: <u>PERC000019.D</u>	
Sampled: <u>08/16/10 13:55</u>	Prepared: <u>09/01/10 09:24</u>	Analyzed: <u>09/03/10 16:07</u>	
Solids: <u>93.42</u>	Preparation: <u>LCMS_PERC6850_S</u>	Dilution: <u>1</u>	
Batch: <u>0101006</u>	Sequence: <u>0125004</u>	Calibration: <u>0243002</u>	Instrument: <u>LCMS1</u>

CAS NO.	COMPOUND	CONC. (ug/Kg dry)	DL	LOD	LOQ	Q
14797-73-0	Perchlorate		0.642	1.07	2.14	U

MS
09/29/10

ANALYSIS DATA SHEET

FC714-SB01D-5-6-10C

Laboratory:	<u>Empirical Laboratories, LLC</u>	SDG:	<u>1008185</u>
Client:	<u>CH2M Hill, Inc.</u>	Project:	<u>Lejeune CTO-133</u>
Matrix:	<u>Solid</u>	Laboratory ID:	<u>1008185-09</u>
		File ID:	<u>PERC000030.D</u>
Sampled:	<u>08/17/10 11:30</u>	Prepared:	<u>09/01/10 09:24</u>
		Analyzed:	<u>09/03/10 19:23</u>
Solids:	<u>88.67</u>	Preparation:	<u>LCMS PERC6850 S</u>
		Dilution:	<u>1</u>
Batch:	<u>0101006</u>	Sequence:	<u>0125004</u>
		Calibration:	<u>0243002</u>
		Instrument:	<u>LCMS1</u>

CAS NO.	COMPOUND	CONC. (ug/Kg dry)	DL	LOD	LOQ	Q
14797-73-0	Perchlorate		0.677	1.13	2.26	U

MM
092910

ANALYSIS DATA SHEET

FC714-SB08-9-10-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008185-02

Sampled: 08/16/10 13:55

Received: 08/19/10 08:30

% Solids: 93.42

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.266	0.533	0.799	1	UN UT MS	SW6010B	0107004	09/09/10 17:15
7440-38-2	Arsenic	0.410	0.160	0.320	0.373	1		SW6010B	0107004	09/09/10 17:15
7440-50-8	Copper	0.978	0.266	0.426	1.07	1	J	SW6010B	0107004	09/09/10 17:15
7439-92-1	Lead	2.84	0.0799	0.160	0.533	1		SW6010B	0107004	09/09/10 17:15
7440-66-6	Zinc	4.78	0.266	0.533	1.07	1		SW6010B	0107004	09/09/10 17:15

JAC
10/5/10

ANALYSIS DATA SHEET

FC714-SB07-5-6-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008185-03

Sampled: 08/16/10 15:30

Received: 08/19/10 08:30

% Solids: 97.35

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.257	0.514	0.770	1	U+MS	SW6010B	0107004	09/09/10 17:20
7440-38-2	Arsenic	0.294	0.154	0.308	0.360	1	J	SW6010B	0107004	09/09/10 17:20
7440-50-8	Copper		0.257	0.411	1.03	1	U	SW6010B	0107004	09/09/10 17:20
7439-92-1	Lead	0.953	0.0770	0.154	0.514	1		SW6010B	0107004	09/09/10 17:20
7440-66-6	Zinc		0.257	0.514	1.03	1	U	SW6010B	0107004	09/09/10 17:20

JAC
10570

ANALYSIS DATA SHEET

FC714-SB13-8-9-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008185-04

Sampled: 08/16/10 16:15

Received: 08/19/10 08:30

% Solids: 95.65

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.256	0.512	0.769	1	U <i>WMS</i>	SW6010B	0107004	09/09/10 17:24
7440-38-2	Arsenic		0.154	0.307	0.359	1	U	SW6010B	0107004	09/09/10 17:24
7440-50-8	Copper		0.256	0.410	1.02	1	U	SW6010B	0107004	09/09/10 17:24
7439-92-1	Lead	0.967	0.0769	0.154	0.512	1		SW6010B	0107004	09/09/10 17:24
7440-66-6	Zinc	1.02-0.676	0.256	0.512	1.02	1	<i>Y U MSL</i>	SW6010B	0107004	09/09/10 17:24

JAC
10/10

ANALYSIS DATA SHEET

FC714-SB06-7-8-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/16/10 17:05
 % Solids: 91.83

SDG: 1008185
 Project: Lejeune CTO-133
 Laboratory ID: 1008185-05
 Received: 08/19/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.263	0.526	0.789	1	U MS	SW6010B	0107004	09/09/10 17:29
7440-38-2	Arsenic		0.158	0.316	0.368	1	U	SW6010B	0107004	09/09/10 17:29
7440-50-8	Copper		0.263	0.421	1.05	1	U	SW6010B	0107004	09/09/10 17:29
7439-92-1	Lead	1.64	0.0789	0.158	0.526	1		SW6010B	0107004	09/09/10 17:29
7440-66-6	Zinc	1.05 0.859	0.263	0.526	1.05	1	U/MBL	SW6010B	0107004	09/09/10 17:29

JAC
10570

ANALYSIS DATA SHEET

FC714-SB10-6-7-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008185-06

Sampled: 08/17/10 09:30

Received: 08/19/10 08:30

% Solids: 83.97

CAS NO.	Analyte	Conc. (ng/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.285	0.570	0.855	1	1 <i>MSL</i>	SW6010B	0107004	09/09/10 17:33
7440-38-2	Arsenic	4.02	0.171	0.342	0.399	1		SW6010B	0107004	09/09/10 17:33
7440-50-8	Copper	1.11	0.285	0.456	1.14	1	J	SW6010B	0107004	09/09/10 17:33
7439-92-1	Lead	4.49	0.0855	0.171	0.570	1		SW6010B	0107004	09/09/10 17:33
7440-66-6	Zinc	1.87	0.285	0.570	1.14	1		SW6010B	0107004	09/09/10 17:33

JAC
10/5/10

ANALYSIS DATA SHEET

FC714-SB02-6-7-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008185-07

Sampled: 08/17/10 10:20

Received: 08/19/10 08:30

% Solids: 87.69

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.278	0.556	0.834	1	UN <i>MSL</i>	SW6010B	0107004	09/09/10 17:38
7440-38-2	Arsenic	0.839	0.167	0.334	0.389	1		SW6010B	0107004	09/09/10 17:38
7440-50-8	Copper	0.424	0.278	0.445	1.11	1	J	SW6010B	0107004	09/09/10 17:38
7439-92-1	Lead	3.22	0.0834	0.167	0.556	1		SW6010B	0107004	09/09/10 17:38
7440-66-6	Zinc	1.41	0.278	0.556	1.11	1		SW6010B	0107004	09/09/10 17:38

SAC
10570

ANALYSIS DATA SHEET

FC714-SB01-5-6-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008185-08

Sampled: 08/17/10 11:25

Received: 08/19/10 08:30

% Solids: 88.46

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.281	0.562	0.844	1	UN MS	SW6010B	0107004	09/09/10 17:42
7440-38-2	Arsenic	1.32	0.169	0.337	0.394	1		SW6010B	0107004	09/09/10 17:42
7440-50-8	Copper	0.728	0.281	0.450	1.12	1	J	SW6010B	0107004	09/09/10 17:42
7439-92-1	Lead	2.84	0.0844	0.169	0.562	1		SW6010B	0107004	09/09/10 17:42
7440-66-6	Zinc	1.82	0.281	0.562	1.12	1		SW6010B	0107004	09/09/10 17:42

JAC
10/5/10

ANALYSIS DATA SHEET

FC714-SB01D-5-6-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008185-09

Sampled: 08/17/10 11:30

Received: 08/19/10 08:30

% Solids: 88.67

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.272	0.545	0.817	1	<i>EN KMS</i>	SW6010B	0107004	09/09/10 17:47
7440-38-2	Arsenic	1.24	0.163	0.327	0.381	1		SW6010B	0107004	09/09/10 17:47
7440-50-8	Copper	0.680	0.272	0.436	1.09	1	J	SW6010B	0107004	09/09/10 17:47
7439-92-1	Lead	2.62	0.0817	0.163	0.545	1		SW6010B	0107004	09/09/10 17:47
7440-66-6	Zinc	2.19	0.272	0.545	1.09	1		SW6010B	0107004	09/09/10 17:47

JAC
10/5/10

ANALYSIS DATA SHEET

FC714-SB04-5-6-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008185-10

Sampled: 08/17/10 13:55

Received: 08/19/10 08:30

% Solids: 88.03

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.285	0.571	0.856	1	SW	MSL-SW6010B	0107004	09/09/10 17:51
7440-38-2	Arsenic	3.50	0.171	0.343	0.400	1		SW6010B	0107004	09/09/10 17:51
7440-50-8	Copper	0.855	0.285	0.457	1.14	1	J	SW6010B	0107004	09/09/10 17:51
7439-92-1	Lead	4.80	0.0856	0.171	0.571	1		SW6010B	0107004	09/09/10 17:51
7440-66-6	Zinc	2.52	0.285	0.571	1.14	1		SW6010B	0107004	09/09/10 17:51

JAC
10570

035

ANALYSIS DATA SHEET

FC714-SB03-4-5-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/17/10 15:10
 % Solids: 87.63

SDG: 1008185
 Project: Lejeune CTO-133
 Laboratory ID: 1008185-11
 Received: 08/19/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.280	0.559	0.839	1	UN ML	SW6010B	0107004	09/09/10 18:09
7440-38-2	Arsenic	1.30	0.168	0.336	0.392	1		SW6010B	0107004	09/09/10 18:09
7440-50-8	Copper	0.414	0.280	0.448	1.12	1	J	SW6010B	0107004	09/09/10 18:09
7439-92-1	Lead	2.80	0.0839	0.168	0.559	1		SW6010B	0107004	09/09/10 18:09
7440-66-6	Zinc	1.47	0.280	0.559	1.12	1		SW6010B	0107004	09/09/10 18:09

Handwritten: ML 10570

ANALYSIS DATA SHEET

FC714-SB12-2-3-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008185-12

Sampled: 08/17/10 16:00

Received: 08/19/10 08:30

% Solids: 91.06

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.264	0.528	0.792	1	UN <i>MSL</i>	SW6010B	0107004	09/09/10 18:13
7440-38-2	Arsenic	0.446	0.158	0.317	0.370	1		SW6010B	0107004	09/09/10 18:13
7440-50-8	Copper	0.394	0.264	0.422	1.06	1	J	SW6010B	0107004	09/09/10 18:13
7439-92-1	Lead	3.77	0.0792	0.158	0.528	1	X	SW6010B	0107004	09/09/10 18:13
7440-66-6	Zinc	1.67	0.264	0.528	1.06	1		SW6010B	0107004	09/09/10 18:13

JAC
10/5/10

037

ANALYSIS DATA SHEET

FC714-FB081710

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Water

Laboratory ID: 1008185-13

Sampled: 08/17/10 16:15

Received: 08/19/10 08:30

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U	SW6010B	0103001	09/07/10 15:18
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0103001	09/07/10 15:18
7440-50-8	Copper		1.25	2.50	6.00	1	U	SW6010B	0103001	09/07/10 15:18
7439-92-1	Lead		0.375	0.750	1.25	1	U	SW6010B	0103001	09/07/10 15:18
7440-66-6	Zinc		1.25	2.50	5.00	1	U	SW6010B	0103001	09/07/10 15:18

JHC
10/5/10

ANALYSIS DATA SHEET

FC714-EB01-081710-SB

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Water

Laboratory ID: 1008185-14

Sampled: 08/17/10 16:20

Received: 08/19/10 08:30

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	I	U	SW6010B	0103001	09/07/10 15:23
7440-38-2	Arsenic		0.500	1.25	1.50	I	U	SW6010B	0103001	09/07/10 15:23
7440-50-8	Copper		1.25	2.50	6.00	I	U	SW6010B	0103001	09/07/10 15:23
7439-92-1	Lead		0.375	0.750	1.25	I	U	SW6010B	0103001	09/07/10 15:23
7440-66-6	Zinc		1.25	2.50	5.00	I	U	SW6010B	0103001	09/07/10 15:23

JAC
10/5/10

ANALYSIS DATA SHEET

FC714-SB11-1.5-2.5-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/17/10 16:35
 % Solids: 82.99

SDG: 1008185
 Project: Lejeune CTO-133
 Laboratory ID: 1008185-15
 Received: 08/19/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.291	0.582	0.873	1	U <i>MSL</i>	SW6010B	0107004	09/09/10 18:18
7440-38-2	Arsenic	0.325	0.175	0.349	0.407	1	<i>J</i>	SW6010B	0107004	09/09/10 18:18
7440-50-8	Copper		0.291	0.466	1.16	1	U	SW6010B	0107004	09/09/10 18:18
7439-92-1	Lead	2.05	0.0873	0.175	0.582	1	X	SW6010B	0107004	09/09/10 18:18
7440-66-6	Zinc	1.16 0.705	0.291	0.582	1.16	1	<i>U</i> <i>MSL</i>	SW6010B	0107004	09/09/10 18:18

JAC
10/5/10

ANALYSIS DATA SHEET

FC714-SB09-3-4-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008185-16

Sampled: 08/17/10 16:55

Received: 08/19/10 08:30

% Solids: 94.72

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.256	0.513	0.769	1	U MBL	SW6010B	0107004	09/09/10 18:41
7440-38-2	Arsenic		0.154	0.308	0.359	1	U	SW6010B	0107004	09/09/10 18:41
7440-50-8	Copper		0.256	0.410	1.03	1	U	SW6010B	0107004	09/09/10 18:41
7439-92-1	Lead	1.04	0.0769	0.154	0.513	1	X	SW6010B	0107004	09/09/10 18:41
7440-66-6	Zinc	1.03 0.452	0.256	0.513	1.03	1	X MBL	SW6010B	0107004	09/09/10 18:41

JAC
10/5/10

ANALYSIS DATA SHEET

FC714-SB09D-3-4-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008185-17

Sampled: 08/17/10 17:00

Received: 08/19/10 08:30

% Solids: 96.76

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.260	0.519	0.779	1	UN MSL	SW6010B	0107004	09/09/10 18:46
7440-38-2	Arsenic	0.173	0.156	0.312	0.364	1	J	SW6010B	0107004	09/09/10 18:46
7440-50-8	Copper		0.260	0.415	1.04	1	U	SW6010B	0107004	09/09/10 18:46
7439-92-1	Lead	1.13	0.0779	0.156	0.519	1	X	SW6010B	0107004	09/09/10 18:46
7440-66-6	Zinc	1.04 0.736	0.260	0.519	1.04	1	Y U	MSL SW6010B	0107004	09/09/10 18:46

JAC
10/3/10

ANALYSIS DATA SHEET

FC714-EB02-081710-SB

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Water

Laboratory ID: 1008185-18

Sampled: 08/17/10 17:05

Received: 08/19/10 08:30

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	I	U	SW6010B	0103001	09/07/10 15:28
7440-38-2	Arsenic		0.500	1.25	1.50	I	U	SW6010B	0103001	09/07/10 15:28
7440-50-8	Copper		1.25	2.50	6.00	I	U	SW6010B	0103001	09/07/10 15:28
7439-92-1	Lead		0.375	0.750	1.25	I	U	SW6010B	0103001	09/07/10 15:28
7440-66-6	Zinc		1.25	2.50	5.00	I	U	SW6010B	0103001	09/07/10 15:28

JAC
10570

EMPIRICAL LABORATORIES, LLC - CHAIN OF CUSTODY RECORD

SHIP TO: 621 Mainstream Drive, Suite 270 ♦ Nashville, TN 37228 ♦ 615-345-1115 ♦ (fax) 615-846-5426

10919

9 044
1008185 Summ Package

Send Results to:		Send Invoice to:		Analysis Requirements:												Lab Use Only:					
Name <u>Erin & Rebekha Shaw</u>		Name <u>David Lubell</u>		<div style="display: flex; justify-content: space-between;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);"> * PRE METALS 60108 PERCENTAGE 6850 </div> </div>												VOA Headspace			Y	N	NA
Company <u>CH2M Hill</u>		Company <u>CH2M Hill</u>														Field Filtered			Y	N	NA
Address <u>5300 Cleveland St Ste 101</u>		Address <u>3201 BEECHMOUNT ST</u>														Correct Containers			Y	N	NA
City <u>VIRGINIA BEACH</u>		City <u>Raleigh</u>														Discrepancies			Y	N	NA
State, Zip <u>VA</u>		State, Zip <u>NC 27604</u>														Cust. Seals Intact			Y	N	NA
Phone <u>757-671-6279</u>		Phone <u>919-760-875-4311</u>		Containers Intact			Y	N	NA												
Fax <u>757-497-6885</u>		Fax <u>919-875-8491</u>		Airbill #: <u>5345</u>																	
E-mail <u>rebekha.shaw@ch2m.com</u>		E-mail <u>dlubell@ch2m.com</u>		CAR #: _____																	
Project No./Name:		Sampler's (Signature):																			
Lab Use Only Lab #	Date/Time Sampled	Sample Description	Sample Matrix													Comments	No. of Bottles	Lab Use Only Containers/Pres.			
1008185-01	8-16-10/1320	FC714-SB05-4-5-10C	SO	✓	✓														2	2M	
-02	8-16-10/1355	FC714-SB08-4-10-10C	SO	✓	✓														2		
-03	8-16-10/1330	FC714-SB07-5-6-10C	SO	✓	✓														2		
-04	8-16-10/1615	FC714-SB13-8-9-10C	SO	✓	✓														2		
-05	8-16-10/1705	FC714-SB06-7-8-10C	SO	✓	✓														2		
-06	8-17-10/1130	FC714-SB10-6-7-10C	SO	✓	✓														2		
-07	8-17-10/1020	FC714-SB02-6-7-10C	SO	✓	✓														2		
-08	8-17/1125	FC714-SB01-5-6-10C	SO	✓	✓														2		
-09	8-17/1130	FC714-SB01D-5-6-10C	SO	✓	✓														2		
-10	8-17/1355	FC714-SB04-5-6-10C	SO	✓	✓														2		
-11	8-17/1510	FC714-SB03-4-5-10C	SO	✓	✓														2		
-12	8-17/1600	FC714-SB12-2-3-10C	SO	✓	✓														2	✓	
Sample Kit Prep'd by: (Signature)		Date/Time	Received By: (Signature)		REMARKS: *metals - lead, antimony, copper, zinc, and Arsenic												Details:				
Relinquished by: (Signature)		Date/Time	Received By: (Signature)														Page <u>1</u> of <u>2</u>				
Relinquished by: (Signature)		Date/Time	Received By: (Signature)														Cooler No. <u>1</u> of <u>1</u>				
Received for Laboratory by: (Signature)		Date/Time	Temperature														Date Shipped <u>8-18</u>				
					Shipped By <u>KR</u>																
					Turnaround <u>per cont.</u>																

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers.

EMPIRICAL LABORATORIES, LLC - CHAIN OF CUSTODY RECORD
 SHIP TO: 621 Mainstream Drive, Suite 270 ♦ Nashville, TN 37228 ♦ 615-345-1115 ♦ (fax) 615-846-5426

10917

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10

Send Results to:		Send Invoice to:		Analysis Requirements:						Lab Use Only:					
Name <u>Rebekha Shaw</u>		Name <u>DAVID Lubell</u>		STATE METALS 6010 B Select	PERCHLORATE 6B50							VOA Headspace	Y	<input checked="" type="radio"/>	NA
Company <u>CH2M HILL</u>		Company <u>CH2M HILL</u>				Field Filtered	Y	<input checked="" type="radio"/>	NA						
Address <u>5700 Cleveland St Ste 101</u>		Address <u>3201 Birchleaf Ct Ste 300</u>				Correct Containers	<input checked="" type="radio"/>	<input checked="" type="radio"/>	NA						
City <u>VIRGINIA BEACH</u>		City <u>RALEIGH</u> *				Discrepancies	Y	<input checked="" type="radio"/>	NA						
State, Zip <u>VA</u>		State, Zip <u>NC 27604</u>				Cust. Seals Intact	<input checked="" type="radio"/>	<input checked="" type="radio"/>	NA						
Phone <u>757-671-6279</u>		Phone <u>919-875-4311</u>				Containers Intact	<input checked="" type="radio"/>	<input checked="" type="radio"/>	NA						
Fax <u>757-497-6885</u>		Fax <u>919-875-8491</u>								Airbill #:	<u>5345</u>				
E-mail <u>rebekha.shaw@ch2m.com</u>		E-mail <u>dlubell@ch2m.com</u>								CAR #:	<u>-</u>				
Project No./Name:		Sampler's (Signature):													
Lab Use Only Lab #	Date/Time Sampled	Sample Description	Sample Matrix								Comments	No. of Bottles	Lab Use Only Containers/Pres.		
1008185-13	8.17/1615	FC714-FB081710	R1	✓	✓						HNO ₃ - metals pres.	2	1C, 1C, 1C		
-14	8.17/1620	FC714-EB01-081710	R1	✓	✓						HNO ₃ - Met. Pres.	2	↓		
-15	8.17/1625	FC714-SB11-1.5-2.5-10C	SO	✓	✓							2	2M		
	8.17/1635	FC714-SB11-1.5-2.5-10C-MS	SO	✓	✓							2			
	8.17/1635	FC714-SB11-1.5-2.5-10C-SD	SO	✓	✓							2			
-16	8.17/1655	FC714-SB09-3-4-10C	SO	✓	✓							2			
-17	8.17/1700	FC714-SB09D-3-4-10C	SO	✓	✓							2	↓		
-18	8.17/1705	FC714-EB02-081710	SO R1	✓	✓							2	1C-Ni, 1C		
Sample Kit Prep'd by: (Signature)		Date/Time	Received By: (Signature)		REMARKS: metals - Lead, antimony, copper, zinc, and arsenic						Details:				
Relinquished by: (Signature)		Date/Time	Received By: (Signature)								Page <u>2</u> of <u>2</u>				
Relinquished by: (Signature)		Date/Time	Received By: (Signature)								Cooler No. <u>1</u> of <u>1</u>				
Received for Laboratory by: (Signature)		Date/Time	Temperature								Date Shipped <u>8.18</u>				
					Shipped By <u>KK</u>										
					Turnaround <u>per Sow</u>										

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers.

1008185 Summ Package

Corrections to COCs

TO: Whom It May Concern

COPIES: File
Data Package

FROM: Troy Horn
Environmental Information Specialist
CH2M HILL

DATE: August 23, 2010

This memo is to document corrections made to entries on the Chains of Custodies (COC) and logins for Camp Lejeune CTO-133, Fitness Center, August 2010.

These corrections include updates to sample IDs on Work Order 1008185.

Correct Sample ID	Incorrect Sample ID on COC and login	Date Collected	Time Collected
FC714-EB01-081710-SB	FC714-EB01-081710	8/17/2010	16:20
FC714-EB02-081710-SB	FC714-EB02-081710	8/17/2010	17:05

DataQual

Worksheets - Perchlorate

Data Completeness

The data package was received complete and intact. Resubmissions were not required. (Method 6850)

Laboratory: Empirical

Holding Times

Sampling Date: 8/16-17/10
Received Date: 8/19/10
Analysis Dates: 8/30-9/3/10

Cooler Temp: 3.8°C

All holding time requirements were met.

Calibrations and Verifications

Mass assignments were verified. The submitted calibrations were within criteria or no qualifications were required.

Internal Standards

All criteria were met.

Blank Summary

Blank qualification guidelines:

- No action is taken if a compound is found in the blank but not in the sample.
- Sample weight, volume or dilution factor must be taken into consideration when applying criteria.
- Qualification/Action codes where applied as stated in table below:
-

Blank Type	Blank Result	Sample Result	Action for Samples
Method, Field	Detects	Not detected	No qualifications
	< RL	< RL	Report RL value with a U
		≥ RL	Use professional judgment
	> RL	< RL	Report RL value with a U
		≥ RL and < blank concentration	Report the concentration for the sample with a U, or qualify the data as unusable R
		≥ RL and ≥ blank concentration	Use professional judgment
	= RL	< RL	Report RL value with a U
		≥ RL	Use professional judgment
	Gross contamination	Detects	Qualify results as unusable R

There was no contamination exhibited in the method blanks. QC blanks associated for these samples were: equipment blanks FC714-EB01-081710-SB and FC714-EB02-081710-SB; field blank FC714-FB-081710- no positive results were exhibited in any of the QC blanks.

DataQual

Worksheets - Perchlorate

Laboratory Control Sample

All criteria were met.

Matrix Spike/Spike Duplicate Samples

An MS/MSD was submitted for samples FC714-SB11-1.5-2.5-10C- %RPD was slightly high however no qualifications were required.

Field Duplicate Sample

A field duplicate sample was submitted for samples FC714-SB01-5-6-10C and FC714-SB09-3-4-10C—no positive results were exhibited in any of these samples.

Specific Comments:

All sample results were reported within the calibration range of the instruments.

Detection limits were acceptable. Raw data and calculations were verified.

We have limited the supporting documentation, found with these worksheets, to those forms that indicate qualifications were required.

Reviewer: _____



Date: 9.29.10

SDG# 1008185
MCB Camp Lejeune, CTO-133
Perchlorate
Page 2

DataQual

Worksheets --Select Metals

This SDG contains metals analysis using SW-846 6010B. Resubmissions were not required.

HOLDING TIMES

Sampling Date: 8/16-17/10

Received Date: 8/19/10

Cooler temps: OK

Prep. Dates: 9/3/10 & 9/7/10 ICP

Analysis Dates: 9/7/10 & 9/9/10 ICP

All holding time requirements were met.

CALIBRATIONS

All initial calibration criteria were met. Single point calibration was analyzed for ICP. Calibration verification criteria were not met for all ICV and CCV standards. See report for qualifications as necessary. The CRI check standards were analyzed and met method criteria for all analytes. Interference check standards were analyzed and met criteria. Raw data was verified.

BLANK SUMMARY

Blank qualification guidelines:

- No action is taken if an analyte is found in the blank but not in the sample.
- Sample weight, volume or dilution factor must be taken into consideration when applying the criteria.
- Apply the same data validation guidelines to any associated calibration, preparation, and field QC blanks and all associated samples.
- Qualification/Action codes:
 - No Action - The sample result is greater than the CRDL and greater than ten times (10X) the blank value.
 - U - The sample result is greater than or equal to the MDL but less than or equal to the CRDL, result is reported as non-detect at the CRDL.
 - R or J+ The blank contaminant concentration was greater than the RL and the sample result is greater than the RL but less than 10X the blank contaminant concentration. The reported results are flagged either as rejected R or biased high J+ based on the professional judgment of the validator.

Blank Contamination and Qualification Summaries

Blank ID	Analyte	Concentration	Action Level	Q Flag
0107004-BLK1	zinc	0.437J mg/Kg	RL	U at RL

The concentration noted for the CCBs is the highest concentration in all the CCBs. However, when qualifying samples for CCB contamination, associated samples are those just prior to or just following a CCB. Therefore, not all analytes in all samples are flagged for noted CCB contamination. See worksheets for associations. Samples are qualified for field QC blank contamination based on QC tracking provided by CH2M HILL. Negative contamination in a prep blank or CCB, if less than the analyte CRDL, is qualified based on professional judgment.

Please note that based on the National Functional Guidelines, for contamination above the CRDL, results in the field samples that are greater than the CRDL up to 10X the blank contamination level should be qualified as estimated J and considered biased high or they should be rejected. Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag	Q Code
all field samples > MDL ≤ RL	zinc	U at RL	MBL

DataQual

Worksheets –Select Metals

MATRIX SPIKE/DUPLICATE SUMMARY

The spike pairs of sample FC714-SB11-1.5-2.5-10C exhibited acceptable recoveries for all target analytes with the exception of antimony (50/51.7). Antimony is qualified as estimated J/UJ in all field samples. LCS recoveries and RPDs were acceptable.

SERIAL DILUTIONS

The serial dilution analysis submitted in this SDG was acceptable.

FIELD DUPLICATE SAMPLE SUMMARY

Note: Field duplicate results are assessed only if both results are above the CRDL.

Sample ID: FC714-SB01-10C Duplicate Sample ID: FC714-SB01D-10C

Analyte	Sample Conc.	Duplicate Conc.	RPD
antimony			#DIV/0!
arsenic	1.32	1.24	6%
copper	0.728	0.68	7%
lead	2.84	2.62	8%
zinc	1.82	2.19	18%

Comments: No qualifications were required

Sample ID: FC714-SB09-3-4-10C dissolved Duplicate Sample ID: FC714-SB09D-3-4-10C dissolved

Analyte	Sample Conc.	Duplicate Conc.	RPD
antimony			#DIV/0!
arsenic			#DIV/0!
copper			#DIV/0!
lead	1.04	1.13	8%
zinc			#DIV/0!

Comments: No qualifications were required

SAMPLE CALCULATION

EPA SAMPLE ID: FC714-SB11-1.5-2.5-10C

COMPOUND: lead

CONCENTRATION: 2.05 mg/Kg

%Solids – 82.99

2.07g to 100 ml

Raw Data result: 35.228 ug/L

$35.228 \text{ ug/L} * 0.100\text{L}/2.07\text{g} * 1/0.8299 * 1\text{mg}/1000\text{ug} * 1000\text{g}/1\text{Kg} = 2.05065 \text{ mg/Kg}$

SAMPLE RESULT VERIFICATION

Specific Comments:

All sample results were reported within the calibration/linear range of the instruments. Detection limits were acceptable. Raw data was verified. All positive results reported at concentrations between the IDL and the CRDL were qualified as estimated, J by the laboratory for the ICP metals.

Reviewer JA Cleveland Date: 10-5-10

Sample Delivery Group Case Narrative

Receipt Information

The samples were received within the preservation guidelines for the associated methods. The information associated with sample receipt and the Sample Delivery Group (SDG) are included within section 4 of this package, which also provides information on the link between the client sample ID listed on the COC and laboratory's assigned unique sample ID or WorkOrder #. The sample is tracked through the laboratory for all analysis via the assigned WorkOrder #.

All samples that were received were analyzed and none of the samples were placed on hold without analyses. There were no subcontracted analyses for this SDG.

The CoC indicated that the sample ID for sample 1008185-14 should be FC714-EB01-081710 but as per the client, should be FC714-EB01-081710-SB and the sample ID for sample 1008185-18 should be FC714-EB02-081710-SB not FC714-EB02-081710 as indicated on the CoC.

Changes to the Revision

This is an original submittal of the final report package.

Analytical Information

All samples were prepped (where applicable) and analyzed within the standard allowed holding times, unless noted within the exceptions listed below. The laboratory analyzed all samples within the program and method guidelines. The following information is provided specific to individual methods:

Chromatographic Flags for Manual Integration:

The following letters are used to denote manual integrations on the laboratory's raw data in association with chromatographic integrations:

- A:** The peak was manually integrated as it was not integrated in the original chromatogram.
- B:** The peak was manually integrated due to resolution or coelution issues in the original chromatogram.
- C:** The peak was manually integrated to correct the baseline from the original chromatogram.
- D:** The peak was manually integrated to identify the correct peak as the wrong peak was identified in the original chromatogram.
- E:** The peak was manually integrated to include the entire peak as the original chromatogram only integrated part of the peak.

SW6850:

The matrix spikes associated to sample 1008185-15 exceeded criteria for the relative percent difference for Perchlorate.

The batch spike 0H24029-BS1 and the matrix spike duplicate for sample 1008185-15

052

are qualified with a Z-01 to indicate that the ion ratio did not meet criteria.

No additional anomalies or deviations are noted and the data is properly qualified.

SW6010B:

The continuing calibration verification 0125303-CCV7 exceeded criteria for Lead with a negative bias. Associated samples 1008185-11, -12, -15, -16, and -17 are qualified.

The digestion blank 0103001-BLK1 had a positive result for Lead and 0107004-BLK1 had a positive result for Zinc.

The matrix spikes associated to sample 1008185-15 exceeded criteria for Antimony.

No additional anomalies or deviations are noted and the data is properly qualified.

053

INITIAL AND CONTINUING CALIBRATION CHECK

SW6010B

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Instrument ID: ME-ICP

Calibration: 0252007

Sequence: 0125303

Lab Sample ID	Analyte	True	Found	%R	Units	Control Limit
0125303-ICV1	Antimony	1000	1008	101	ug/L	+/- 10.00%
	Arsenic	1000	970.6	97.1	ug/L	+/- 10.00%
	Copper	1000	996.3	99.6	ug/L	+/- 10.00%
	Lead	1000	995.4	99.5	ug/L	+/- 10.00%
	Zinc	1000	1017	102	ug/L	+/- 10.00%
0125303-CCV1	Antimony	1000	991.1	99.1	ug/L	+/- 10.00%
	Arsenic	1000	1015	101	ug/L	+/- 10.00%
	Copper	1000	1020	102	ug/L	+/- 10.00%
	Lead	1000	963.8	96.4	ug/L	+/- 10.00%
	Zinc	1000	976.0	97.6	ug/L	+/- 10.00%
0125303-CCV2	Antimony	1000	982.0	98.2	ug/L	+/- 10.00%
	Arsenic	1000	1014	101	ug/L	+/- 10.00%
	Copper	1000	1003	100	ug/L	+/- 10.00%
	Lead	1000	947.9	94.8	ug/L	+/- 10.00%
	Zinc	1000	976.2	97.6	ug/L	+/- 10.00%
0125303-CCV5	Antimony	1000	970.4	97.0	ug/L	+/- 10.00%
	Arsenic	1000	986.7	98.7	ug/L	+/- 10.00%
	Copper	1000	978.4	97.8	ug/L	+/- 10.00%
	Lead	1000	952.3	95.2	ug/L	+/- 10.00%
	Zinc	1000	991.9	99.2	ug/L	+/- 10.00%
0125303-CCV6	Antimony	1000	939.4	93.9	ug/L	+/- 10.00%
	Arsenic	1000	970.3	97.0	ug/L	+/- 10.00%
	Copper	1000	949.9	95.0	ug/L	+/- 10.00%
	Lead	1000	923.1	92.3	ug/L	+/- 10.00%
	Zinc	1000	972.1	97.2	ug/L	+/- 10.00%
0125303-CCV7	Antimony	1000	913.0	91.3	ug/L	+/- 10.00%
	Arsenic	1000	964.3	96.4	ug/L	+/- 10.00%
	Copper	1000	940.5	94.0	ug/L	+/- 10.00%
	Lead	1000	890.6	89.1	ug/L	+/- 10.00%
	Zinc	1000	945.4	94.5	ug/L	+/- 10.00%

NG -
+/- 1

054

**BLANKS
SW6010B**

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Instrument ID: ME-ICP

Project: Lejeune CTO-133

Sequence: 0125117

Calibration: 0252006

Lab Sample ID	Analyte	Found	MDL	MRL	Units	C	Method
0125117-ICB1	Antimony	0.0006400	5.00	15.0	ug/L	U	SW6010B
	Arsenic	1.080	2.00	6.00	ug/L	U	SW6010B
	Copper	0.6896	5.00	24.0	ug/L	U	SW6010B
	Lead	0.1927	1.50	5.00	ug/L	U	SW6010B
	Zinc	0.1876	5.00	20.0	ug/L	U	SW6010B
0125117-CCB1	Antimony	-0.636	5.00	15.0	ug/L	U	SW6010B
	Arsenic	0.678	2.00	6.00	ug/L	U	SW6010B
	Copper	0.604	5.00	24.0	ug/L	U	SW6010B
	Lead	-0.860	1.50	5.00	ug/L	U	SW6010B
	Zinc	0.229	5.00	20.0	ug/L	U	SW6010B
0103001-BLK1	Antimony	-0.150	1.25	3.75	ug/L	U	SW6010B
	Arsenic	0.0870	0.500	1.50	ug/L	U	SW6010B
	Copper	0.436	1.25	6.00	ug/L	U	SW6010B
	Lead	-0.408	0.375	1.25	ug/L	J	SW6010B
	Zinc	0.132	1.25	5.00	ug/L	U	SW6010B
0125117-CCB2	Antimony	-0.219	5.00	15.0	ug/L	U	SW6010B
	Arsenic	0.933	2.00	6.00	ug/L	U	SW6010B
	Copper	0.171	5.00	24.0	ug/L	U	SW6010B
	Lead	-0.610	1.50	5.00	ug/L	U	SW6010B
	Zinc	0.216	5.00	20.0	ug/L	U	SW6010B

NO

**BLANKS
SW6010B**

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Instrument ID: ME-ICP

Project: Lejeune CTO-133

Sequence: 0125303

Calibration: 0252007

Lab Sample ID	Analyte	Found	MDL	MRL	Units	C	Method
0125303-ICB1	Antimony	0.1397	5.00	15.0	ug/L	U	SW6010B
	Arsenic	0.7576	2.00	6.00	ug/L	U	SW6010B
	Copper	0.1813	5.00	24.0	ug/L	U	SW6010B
	Lead	-0.2588	1.50	5.00	ug/L	U	SW6010B
	Zinc	0.08277	5.00	20.0	ug/L	U	SW6010B
0125303-CCB1	Antimony	-0.509	5.00	15.0	ug/L	U	SW6010B
	Arsenic	-0.450	2.00	6.00	ug/L	U	SW6010B
	Copper	-0.118	5.00	24.0	ug/L	U	SW6010B
	Lead	-0.0375	1.50	5.00	ug/L	U	SW6010B
	Zinc	0.0154	5.00	20.0	ug/L	U	SW6010B
0103001-BLK2	Antimony	-0.122	1.25	3.75	ug/L	U	SW6010B
	Arsenic	0.0874	0.500	1.50	ug/L	U	SW6010B
	Copper	0.0208	1.25	6.00	ug/L	U	SW6010B
	Lead	-0.0642	0.375	1.25	ug/L	U	SW6010B
	Zinc	0.0951	1.25	5.00	ug/L	U	SW6010B
0125303-CCB2	Antimony	-0.476	5.00	15.0	ug/L	U	SW6010B
	Arsenic	0.761	2.00	6.00	ug/L	U	SW6010B
	Copper	-0.191	5.00	24.0	ug/L	U	SW6010B
	Lead	-0.480	1.50	5.00	ug/L	U	SW6010B
	Zinc	0.0391	5.00	20.0	ug/L	U	SW6010B
0125303-CCB5	Antimony	-0.778	5.00	15.0	ug/L	U	SW6010B
	Arsenic	0.207	2.00	6.00	ug/L	U	SW6010B
	Copper	-0.214	5.00	24.0	ug/L	U	SW6010B
	Lead	1.11	1.50	5.00	ug/L	U	SW6010B
	Zinc	0.126	5.00	20.0	ug/L	U	SW6010B
0107004-BLK1	Antimony	-0.00169	0.250	0.750	mg/Kg wet	U	SW6010B
	Arsenic	-0.0312	0.150	0.350	mg/Kg wet	U	SW6010B
	Copper	0.00221	0.250	1.00	mg/Kg wet	U	SW6010B
	Lead	-0.0300	0.0750	0.500	mg/Kg wet	U	SW6010B
	Zinc	0.437	0.250	1.00	mg/Kg wet	J	SW6010B
0125303-CCB6	Antimony	-0.690	5.00	15.0	ug/L	U	SW6010B
	Arsenic	0.237	2.00	6.00	ug/L	U	SW6010B
	Copper	-0.358	5.00	24.0	ug/L	U	SW6010B

* U@R

* U@RL all >MDL ≤ RL (field sample)

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY
SW6010B

FC714-SB11-1.5-2.5-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Batch: 0107004
 % Solids: 82.99
 Source Sample Name: 1008185-15

SDG: 1008185
 Project: Lejeune CTO-133

ANALYTE	SPIKE ADDED (mg/Kg dry)	SAMPLE CONCENTRATION (mg/Kg dry)	MS CONCENTRATION (mg/Kg dry)	MS % REC.	Q	QC LIMITS REC.
Antimony	14.99	ND	7.492	50.0	N	80 - 120
Arsenic	14.99	0.3250	13.47	87.7		80 - 120
Copper	14.99	ND	15.35	102		80 - 120
Lead	14.99	2.051	16.10	93.7		80 - 120
Zinc	29.97	0.7033	32.31	105		80 - 120

JWJ

ANALYTE	SPIKE ADDED (mg/Kg dry)	MSD CONCENTRATION (mg/Kg dry)	MSD % REC. #	% RPD	Q	QC LIMITS	
						RPD	REC.
Antimony	14.55	7.525	51.7	0.442	N	20	80 - 120
Arsenic	14.55	13.03	87.3	3.29		20	80 - 120
Copper	14.55	14.85	102	3.32		20	80 - 120
Lead	14.55	15.44	92.0	4.16		20	80 - 120
Zinc	29.10	31.05	104	3.96		20	80 - 120

JWJ

Flag all samples (field)

157

The samples were evaluated based on the following criteria:

- Data Completeness *
- Technical Holding Times *
- HPLC Performance *
- Initial/Continuing Calibrations *
- CRI Standards *
- Interference Check Sample *
- Blanks
- Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Post Digestion Spike Recoveries *
- Serial Dilutions *
- Field Duplicates *
- Identification/Quantitation *
- Reporting Limits *

* - indicates that no qualifications were required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page. Please note that when a compound or analyte is flagged due to blank contamination the BL qualifier code takes precedence over all other qualifier codes except a code that explains rejected data.

Perchlorate

No qualifications were required to the data.

Metals

Blank contamination was noted in the associated preparation blank. One sample required qualification.

The matrix spike recoveries in solid samples were low for one analyte. Qualifications were applied to the data.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/16-17/10 and samples were received at the laboratory 8/19/10. All sample preparation and analysis was performed within method holding time requirements.

Blanks

Contamination was noted in associated blanks and qualification was required in the associated samples. Required action is noted in the following tables.

Blank ID	Analyte	Concentration	Action Level	Q Flag
0107004-BLK1	zinc	0.437J mg/Kg	LOD	U at LOD

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag	Q Code
FC714-SB09-3-4-10C	zinc	U at LOD	MBL

Matrix Spikes

Metals

The matrix spike analyses exhibited non-compliant %Rs. Specific action is noted in the following table.

MS/MSD	Analyte	Samples Affected	%R	Q Flag	Q Code
FC714-SS11-1.5-2.5-10C	antimony	all soil samples	41.5/43.7	J/UJ	MSL

Summary of Data Qualifications

Perchlorate

Sample ID	Compound	Results	Q-Flag	Q Code
No qualifications.				

Select Metals

Sample ID	Analyte	Results	Q-Flag	Q Code
FC714-SB09-3-4-10C	zinc	+J	U at LOD	MBL
all soil samples	antimony	+/-	J/UJ	MSL

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
R	result is rejected; the presence or absence of the analyte cannot be verified
D	result value is based on dilution analysis result
NJ	analyte has been tentatively identified, estimated value
L	analyte present, biased low
UL	not detected, quantitation limit is probably higher
K	analyte present, biased high

Inorganic Field/Lab Blank Qualification Flags (Q-Flags)

NA	The sample result for the blank contaminant is greater than the sample LOD and is greater than 5X the blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.
LOD-U	The sample result for the blank contaminant is less than the sample LOD and the result is raised to the LOD and flagged U.
R or J+	The blank contaminant concentration was greater than the LOD and the sample result is greater than the LOD but less than 10X the blank contaminant concentration. The reported results are flagged either as rejected R or biased high J+ based on the professional judgment of the validator. (see NFG, Rev. date 10/04, p. 17 for extracted blanks (PB))

Organic Field/Lab Blank Qualification Flags (Q-Flags)

NA	The sample result for the blank contaminant is greater than the sample LOD and is greater than 5X (10X for common laboratory contaminants) the blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.
LOD-U	The sample result for the blank contaminant is less than the sample LOD but is less than 5X (10X for common laboratory contaminants) the blank value, so the result is raised to the LOD and flagged U.
U	The sample result for the blank contaminant is greater than the sample LOD but is less than 5X (10X for common laboratory contaminants) the blank value, so the result is flagged U at the reported value.

General Abbreviations

LOQ	level of quantitation
LOD	level of detection
MDL	method detection limit
CRQL/CRDL	contract required quantitation/detection limit
Q Code	qualifier code
+ /-	positive result/non-detect result

ANALYSIS DATA SHEET

FC714-SB13-8-9-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008185-04

Sampled: 08/16/10 16:15

Received: 08/19/10 08:30

% Solids: 95.65

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.256	0.512	0.769	1	U MS	SW6010B	0107004	09/09/10 17:24
7440-38-2	Arsenic		0.154	0.307	0.359	1	U	SW6010B	0107004	09/09/10 17:24
7440-50-8	Copper		0.256	0.410	1.02	1	U	SW6010B	0107004	09/09/10 17:24
7439-92-1	Lead	0.967	0.0769	0.154	0.512	1		SW6010B	0107004	09/09/10 17:24
7440-66-6	Zinc	0.676	0.256	0.512	1.02	1	J	SW6010B	0107004	09/09/10 17:24

JAC
102510

ANALYSIS DATA SHEET

FC714-SB06-7-8-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/16/10 17:05
 % Solids: 91.83

SDG: 1008185
 Project: Lejeune CTO-133
 Laboratory ID: 1008185-05
 Received: 08/19/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.263	0.526	0.789	1	U	SW6010B	0107004	09/09/10 17:29
7440-38-2	Arsenic		0.158	0.316	0.368	1	U	SW6010B	0107004	09/09/10 17:29
7440-50-8	Copper		0.263	0.421	1.05	1	U	SW6010B	0107004	09/09/10 17:29
7439-92-1	Lead	1.64	0.0789	0.158	0.526	1		SW6010B	0107004	09/09/10 17:29
7440-66-6	Zinc	0.859	0.263	0.526	1.05	1	J	SW6010B	0107004	09/09/10 17:29

JAC
102510

ANALYSIS DATA SHEET

FC714-SB11-1.5-2.5-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008185

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008185-15

Sampled: 08/17/10 16:35

Received: 08/19/10 08:30

% Solids: 82.99

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.291	0.582	0.873	1	<i>UN</i>	SW6010B	0107004	09/09/10 18:18
7440-38-2	Arsenic	0.325	0.175	0.349	0.407	1	J	SW6010B	0107004	09/09/10 18:18
7440-50-8	Copper		0.291	0.466	1.16	1	U	SW6010B	0107004	09/09/10 18:18
7439-92-1	Lead	2.05	0.0873	0.175	0.582	1	<i>✓</i>	SW6010B	0107004	09/09/10 18:18
7440-66-6	Zinc	0.703	0.291	0.582	1.16	1	J	SW6010B	0107004	09/09/10 18:18

JAC
102510

ANALYSIS DATA SHEET

FC714-SB09-3-4-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/17/10 16:55
 % Solids: 94.72

SDG: 1008185
 Project: Lejeune CTO-133
 Laboratory ID: 1008185-16
 Received: 08/19/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.256	0.513	0.769	1	UN <i>MSL</i>	SW6010B	0107004	09/09/10 18:41
7440-38-2	Arsenic		0.154	0.308	0.359	1	U	SW6010B	0107004	09/09/10 18:41
7440-50-8	Copper		0.256	0.410	1.03	1	U	SW6010B	0107004	09/09/10 18:41
7439-92-1	Lead	1.04	0.0769	0.154	0.513	1	<i>y</i>	SW6010B	0107004	09/09/10 18:41
7440-66-6	Zinc	0.513-0.452	0.256	0.513	1.03	1	UN <i>MBL</i>	SW6010B	0107004	09/09/10 18:41

JAC
10/25/10

ANALYSIS DATA SHEET

FC714-SB09D-3-4-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/17/10 17:00
 % Solids: 96.76

SDG: 1008185
 Project: Lejeune CTO-133
 Laboratory ID: 1008185-17
 Received: 08/19/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.260	0.519	0.779	1	U <i>UN</i>	SW6010B	0107004	09/09/10 18:46
7440-38-2	Arsenic	0.173	0.156	0.312	0.364	1	J	SW6010B	0107004	09/09/10 18:46
7440-50-8	Copper		0.260	0.415	1.04	1	U	SW6010B	0107004	09/09/10 18:46
7439-92-1	Lead	1.13	0.0779	0.156	0.519	1	Y	SW6010B	0107004	09/09/10 18:46
7440-66-6	Zinc	0.736	0.260	0.519	1.04	1	J	SW6010B	0107004	09/09/10 18:46

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DataQual

Worksheets –Select Metals

This SDG contains metals analysis using SW-846 6010B. Resubmissions were not required.

HOLDING TIMES

Sampling Date: 8/16-17/10
Received Date: 8/19/10 Cooler temps: OK
Prep. Dates: 9/3/10 & 9/7/10 ICP
Analysis Dates: 9/7/10 & 9/9/10 ICP
All holding time requirements were met.

CALIBRATIONS

All initial calibration criteria were met. Single point calibration was analyzed for ICP. Calibration verification criteria were not met for all ICV and CCV standards. See report for qualifications as necessary. The CRI check standards were analyzed and met method criteria for all analytes. Interference check standards were analyzed and met criteria. Raw data was verified.

BLANK SUMMARY

Blank qualification guidelines:

- No action is taken if an analyte is found in the blank but not in the sample.
- Sample weight, volume or dilution factor must be taken into consideration when applying the criteria.
- Apply the same data validation guidelines to any associated calibration, preparation, and field QC blanks and all associated samples.
- Qualification/Action codes:
 - No Action - The sample result is greater than the CRDL and greater than ten times (10X) the blank value.
 - U - The sample result is greater than or equal to the MDL but less than or equal to the CRDL, result is reported as non-detect at the CRDL.
 - R or J+ The blank contaminant concentration was greater than the RL and the sample result is greater than the RL but less than 10X the blank contaminant concentration. The reported results are flagged either as rejected R or biased high J+ based on the professional judgment of the validator.

Blank Contamination and Qualification Summaries

Blank ID	Analyte	Concentration	Action Level	Q Flag
0107004-BLK1	zinc	0.437J mg/Kg	LOD	U at LOD

The concentration noted for the CCBs is the highest concentration in all the CCBs. However, when qualifying samples for CCB contamination, associated samples are those just prior to or just following a CCB. Therefore, not all analytes in all samples are flagged for noted CCB contamination. See worksheets for associations. Samples are qualified for field QC blank contamination based on QC tracking provided by CH2M HILL. Negative contamination in a prep blank or CCB, if less than the analyte CRDL, is qualified based on professional judgment.

Please note that based on the National Functional Guidelines, for contamination above the CRDL, results in the field samples that are greater than the CRDL up to 10X the blank contamination level should be qualified as estimated J and considered biased high or they should be rejected. Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag	Q Code
FC714-SB09-3-4-10C	zinc	U at LOD	MBL

050

DataQual

Environmental Services, LLC

CH2M HILL
5700 Cleveland Street
Suite 101
Virginia Beach, VA 23462

October 5, 2010
SDG# 1008237
Empirical Laboratories
MCB Camp Lejeune, North Carolina – CTO-133

Dear Ms. Shaw,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 1008237. The data validation was performed in accordance with the SW846 methods 6850 for Perchlorate and 6010B for metals. Also used in the validation of these samples were The National Functional Guidelines for Organic Data Review (June, 2008), as applicable, the National Functional Guidelines for Inorganic Data Review (October, 2004), as applicable, and good professional judgment. All areas of concern are discussed in the body of the report and a summary of data qualifications is provided.

Sample ID	Lab ID	Matrix	Perchlorate	Metals	Dissolved Metals
FC714-GW06-10C	1008237-01	water	X	X	X
FC714-GW04-10C	1008237-03	water	X	X	X
FC714-FB-082510	1008237-05	water	X	X	
FC714-GW05-10C	1008237-06	water	X	X	X
FC714-GW08-10C	1008237-08	water	X	X	X
FC714-GW07-10C	1008237-10	water	X	X	X
FC714-GW03-10C	1008237-12	water	X	X	X
FC714-GW01-10C	1008237-14	water	X	X	X
FC714-GW02-10C	1008237-16	water	X	X	X
FC714-GW02D-10C	1008237-18	water	X	X	X
FC714-EB-082510-GW	1008237-20	water	X	X	
FC714-GW06-10C MS	1008237-01MS	water	X	X	X
FC714-GW06-10C MSD	1008237-01MSD	water	X	X	X

The following quality control sample was provided with this SDG: sample FC714-GW02D-10C-field duplicate of sample FC714-GW02-10C; sample FC714-EB-082510-GW-equipment blank; and sample FC714-FB-082510-field blank.

The samples were evaluated based on the following criteria:

- Data Completeness *
- Technical Holding Times *
- HPLC Performance *
- Initial/Continuing Calibrations *
- CRI Standards *
- Interference Check Sample *
- Blanks *
- Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Post Digestion Spike Recoveries *
- Serial Dilutions *
- Field Duplicates *
- Identification/Quantitation *
- Reporting Limits *

* - indicates that no qualifications were required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page. Please note that when a compound or analyte is flagged due to blank contamination the BL qualifier code takes precedence over all other qualifier codes except a code that explains rejected data.

Perchlorate

The matrix spike and matrix spike duplicate pair submitted exhibited low recoveries; therefore native sample result was qualified as estimated.

Total & Dissolved Metals

Continuing calibration standard exhibited non-compliant recoveries for two analytes. Qualifications were required in the samples.

Blank contamination was noted that required qualification in the field samples.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/24-25/10 and samples were received at the laboratory 8/26/10. All sample preparation and analysis was performed within method holding time requirements.

Total & Dissolved Metals

Calibration standards exhibited %Rs that were non-compliant based on the method continuing calibration requirement of +/-10% difference from the true concentration. A summary of these non-compliances and affected samples are noted in the following table. Sample results were qualified as indicated.

Standard ID	Analyte	%R	Samples	Q Flag	Q Code
CCV8/CCV9/CCVA	antimony	88.3/87.4/87.9	all samples	J/UJ	CCL
	lead	88.8/87.5/88.4			

Blanks

Total & Dissolved Metals

Contamination was noted in associated blanks and qualification was required in the associated samples. Required action is noted in the following tables.

Blank ID	Analyte	Concentration	Action Level	Q Flag
FC714-EB-082510-GW	copper	1.60J ug/L	RL	U at RL
	lead	1.21J ug/L	RL	U at RL
	zinc	9.36 ug/L	10X blk level (93.6 ug/L)	J

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag	Q Code
all field samples > MDL ≤ RL	copper	U at RL	EBL
all field samples > MDL ≤ RL	lead	U at RL	EBL
all field samples > RL up to 93.6 ug/L	zinc	J	EBL

Matrix Spikes

Perchlorate

The associated matrix spike pair exhibited non-compliant recoveries as noted below. The sample results were qualified as indicated.

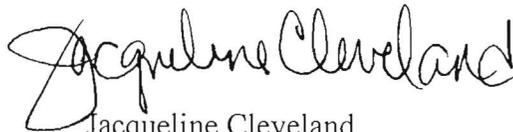
MS/MSD	Compound	MS % Rec	MSD % Rec	% QC Limit	Q Flag	Q Code
FC714-GW06-10C	perchlorate	55.5	55.4	80-120	J/UJ	MSL

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,



Laura Maschhoff
President



Jacqueline Cleveland
Vice-President

Summary of Data Qualifications

Perchlorate

Sample ID	Compound	Results	Q-Flag	Q Code
FC714-GW06-10C	perchlorate	+/-	J/UJ	MSL

Total & Dissolved Metals

Sample ID	Analyte	Results	Q-Flag	Q Code
all samples	antimony lead	+/-	J/UJ	CCL
all field samples > MDL ≤ RL	copper	+J	U at RL	EBL
all field samples > MDL ≤ RL	lead	+J	U at RL	EBL
all field samples > RL up to 93.6 ug/L	zinc	+	J	EBL

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
R	result is rejected; the presence or absence of the analyte cannot be verified
D	result value is based on dilution analysis result
NJ	analyte has been tentatively identified, estimated value
L	analyte present, biased low
UL	not detected, quantitation limit is probably higher
K	analyte present, biased high

Inorganic Field/Lab Blank Qualification Flags (Q-Flags)

NA	The sample result for the blank contaminant is greater than the sample RL and is greater than 5X (10X for common laboratory contaminants) the blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.
RL-U	The sample result for the blank contaminant is less than the sample RL and the result is raised to the RL and flagged U.
R or J+	The blank contaminant concentration was greater than the RL and the sample result is greater than the RL but less than 10X the blank contaminant concentration. The reported results are flagged either as rejected R or biased high J+ based on the professional judgment of the validator. (see NFG, Rev. date 10/04, p. 17 for extracted blanks (PB))

Organic Field/Lab Blank Qualification Flags (Q-Flags)

NA	The sample result for the blank contaminant is greater than the sample RL and is greater than 5X (10X for common laboratory contaminants) the blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.
RL-U	The sample result for the blank contaminant is less than the sample RL but is less than 5X (10X for common laboratory contaminants) the blank value, so the result is raised to the RL and flagged U.
U	The sample result for the blank contaminant is greater than the sample RL but is less than 5X (10X for common laboratory contaminants) the blank value, so the result is flagged U at the reported value.

General Abbreviations

RL	reporting limit
CRQL/CRDL	contract required quantitation/detection limit
Q Code	qualifier code
+	positive result
-	non-detect result

QUALIFIER CODE REFERENCE

Qualifier	Description
TN	Tune
BSL	Blank Spike/LCS - High Recovery
BSH	Blank Spike/LCS - Low Recovery
BD	Blank Spike/Blank Spike Duplicate (LCS/LCSD) Precision
BRL	Below Reporting Limit
ISL	Internal Standard - Low Recovery
ISH	Internal Standard - High Recovery
MSL	Matrix Spike and/or Matrix Spike Duplicate - Low Recovery
MSH	Matrix Spike and/or Matrix Spike Duplicate - High Recovery
MI	Matrix interference obscuring the raw data
MDP	Matrix Spike/Matrix Spike Duplicate Precision
2S	Second Source - Bad reproducibility between tandem detectors
SSL	Spiked Surrogate - Low Recovery
SSH	Spiked Surrogate - High Recovery
SD	Serial Dilution Reproducibility
ICL	Initial Calibration - Low Relative Response Factors (RRF)
ICH	Initial Calibration - High Relative Response Factors (RRF)
ICB	Initial Calibration - Bad Linearity or Curve Function
CCL	Continuing Calibration - Low Recovery or %Difference
CCH	Continuing Calibration - High Recovery or %Difference
LD	Lab Duplicate Reproducibility
HT	Holding Time
PD	Pesticide Degradation
2C	Second Column - Poor Dual Column Reproducibility
LR	Concentration Exceeds Linear Range
BL	Blank Contamination (MBL, TBL, EBL, FBL)
RE	Redundant Result - due to Re-analysis or Re-extraction
DL	Redundant Result - due to Dilution
FD	Field Duplicate
OT	Other - explained in data validation report
%SOL	High moisture content

ANALYSIS DATA SHEET

FC714-GW05-10C

Laboratory: Empirical Laboratories, LLC SDG: 1008237
 Client: CH2M Hill, Inc. Project: Lejeune CTO-133
 Matrix: Ground Water Laboratory ID: 1008237-06 File ID: PERC000048.D
 Sampled: 08/24/10 13:55 Prepared: 08/30/10 06:10 Analyzed: 08/31/10 02:53
 Solids: Preparation: LCMS PREP6850 W Dilution: 1
 Batch: 0H30001 Sequence: 0H24314 Calibration: 0243002 Instrument: LCMS1

CAS NO.	COMPOUND	CONC. (ug/L)	DL	LOD	LOQ	Q
14797-73-0	Perchlorate		0.0660	0.100	0.500	U

MM
100410

ANALYSIS DATA SHEET

FC714-GW06-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-01

Sampled: 08/24/10 16:50

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U <i>JY CCL</i>	SW6010B	0108004	09/10/10 20:42
7440-38-2	Arsenic		0.500	0.25	1.50	1	U	SW6010B	0108004	09/10/10 20:42
7440-50-8	Copper	6.00 <i>U</i>	1.25	2.50	6.00	1	U <i>EBL</i>	SW6010B	0108004	09/10/10 20:42
7439-92-1	Lead	1.89	0.375	0.750	1.25	1	JY CCL	SW6010B	0108004	09/10/10 20:42
7440-66-6	Zinc	9.07	1.25	2.50	5.00	1	JY CCL <i>EBL</i>	SW6010B	0108004	09/10/10 20:42

JAC
10510

ANALYSIS DATA SHEET

FC714-GW06-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-02

Sampled: 08/24/10 16:50

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	<i>YH WU</i>	SW6010B	0108004	09/10/10 21:05
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 21:05
7440-50-8	Copper (dissolved)	<i>6.005</i>	1.25	2.50	6.00	1	<i>JU EBL</i>	SW6010B	0108004	09/10/10 21:05
7439-92-1	Lead (dissolved)	2.05	0.375	0.750	1.25	1	<i>JX CCL</i>	SW6010B	0108004	09/10/10 21:05
7440-66-6	Zinc (dissolved)	8.67	1.25	2.50	5.00	1	<i>JEBL</i>	SW6010B	0108004	09/10/10 21:05

JAC
10570

ANALYSIS DATA SHEET

FC714-GW04-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-03

Sampled: 08/25/10 10:25

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U	SW6010B	0108004	09/10/10 21:29
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 21:29
7440-50-8	Copper	6.00	1.25	2.50	6.00	1	U	SW6010B	0108004	09/10/10 21:29
7439-92-1	Lead	1.25	0.375	0.750	1.25	1	U	SW6010B	0108004	09/10/10 21:29
7440-66-6	Zinc	11.4	1.25	2.50	5.00	1	U	SW6010B	0108004	09/10/10 21:29

JAC
10/5/10

ANALYSIS DATA SHEET

FC714-GW04-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-04

Sampled: 08/25/10 10:25

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	<i>Y U W U</i>	SW6010B	0108004	09/10/10 21:33
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	<i>U</i>	SW6010B	0108004	09/10/10 21:33
7440-50-8	Copper (dissolved)	<i>6.00 L89</i>	1.25	2.50	6.00	1	<i>U EBL</i>	SW6010B	0108004	09/10/10 21:33
7439-92-1	Lead (dissolved)	<i>1.25 0.970</i>	0.375	0.750	1.25	1	<i>U X Y EBL</i>	SW6010B	0108004	09/10/10 21:33
7440-66-6	Zinc (dissolved)	14.4	1.25	2.50	5.00	1	<i>J EBL</i>	SW6010B	0108004	09/10/10 21:33

*JAC
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ANALYSIS DATA SHEET

FC714-FB-082510

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-05

Sampled: 08/25/10 10:20

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	<i>WJ</i>	SW6010B	0108004	09/10/10 21:38
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 21:38
7440-50-8	Copper	1.30	1.25	2.50	6.00	1	J	SW6010B	0108004	09/10/10 21:38
7439-92-1	Lead	0.833	0.375	0.750	1.25	1	<i>WJ</i>	SW6010B	0108004	09/10/10 21:38
7440-66-6	Zinc	7.17	1.25	2.50	5.00	1		SW6010B	0108004	09/10/10 21:38

JAC
10/27/10

ANALYSIS DATA SHEET

FC714-GW05-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-06

Sampled: 08/24/10 13:55

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U x WCL	SW6010B	0108004	09/10/10 21:42
7440-38-2	Arsenic	1.08	0.500	1.25	1.50	1	J	SW6010B	0108004	09/10/10 21:42
7440-50-8	Copper	6.00 1.25	1.25	2.50	6.00	1	U x EBL	SW6010B	0108004	09/10/10 21:42
7439-92-1	Lead	1.25 0.600	0.375	0.750	1.25	1	U x EBL	SW6010B	0108004	09/10/10 21:42
7440-66-6	Zinc	20.0	1.25	2.50	5.00	1	J EBL	SW6010B	0108004	09/10/10 21:42

JAC
10570

ANALYSIS DATA SHEET

FC714-GW05-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-07

Sampled: 08/24/10 13:55

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	WJ <i>CC</i>	SW6010B	0108004	09/10/10 21:47
7440-38-2	Arsenic (dissolved)	1.14	0.500	1.25	1.50	1	J	SW6010B	0108004	09/10/10 21:47
7440-50-8	Copper (dissolved)	<i>6.00</i>	1.25	2.50	6.00	1	<i>U</i> WJ <i>EBL</i>	SW6010B	0108004	09/10/10 21:47
7439-92-1	Lead (dissolved)	<i>1.25</i>	0.375	0.750	1.25	1	WJ <i>EBL</i>	SW6010B	0108004	09/10/10 21:47
7440-66-6	Zinc (dissolved)	14.8	1.25	2.50	5.00	1		SW6010B	0108004	09/10/10 21:47

QAC
10570

ANALYSIS DATA SHEET

FC714-GW08-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Ground Water
 Sampled: 08/24/10 14:45
 % Solids: 0.00

SDG: 1008237
 Project: Lejeune CTO-133
 Laboratory ID: 1008237-08
 Received: 08/26/10 08:45

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U	SW6010B	0108004	09/10/10 21:51
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 21:51
7440-50-8	Copper	6.00	1.25	2.50	6.00	1	U	SW6010B	0108004	09/10/10 21:51
7439-92-1	Lead	1.25	0.375	0.750	1.25	1	U	SW6010B	0108004	09/10/10 21:51
7440-66-6	Zinc	8.03	1.25	2.50	5.00	1	U	SW6010B	0108004	09/10/10 21:51

JAE
10570

ANALYSIS DATA SHEET

FC714-GW08-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-09

Sampled: 08/24/10 14:45

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	Y W CC	SW6010B	0108004	09/10/10 21:56
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 21:56
7440-50-8	Copper (dissolved)	6.00 W	1.25	2.50	6.00	1	W EBL	SW6010B	0108004	09/10/10 21:56
7439-92-1	Lead (dissolved)	1.25 W	0.375	0.750	1.25	1	W EBL	SW6010B	0108004	09/10/10 21:56
7440-66-6	Zinc (dissolved)	9.13	1.25	2.50	5.00	1	J EBL	SW6010B	0108004	09/10/10 21:56

JMC
10570

ANALYSIS DATA SHEET

FC714-GW07-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-10

Sampled: 08/24/10 15:40

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U <i>WJ/EBL</i>	SW6010B	0108004	09/10/10 22:00
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:00
7440-50-8	Copper	<i>6.00</i> 1.87	1.25	2.50	6.00	1	<i>U</i> EBL	SW6010B	0108004	09/10/10 22:00
7439-92-1	Lead	<i>1.25</i> 1.87	0.375	0.750	1.25	1	<i>WJ/EBL</i>	SW6010B	0108004	09/10/10 22:00
7440-66-6	Zinc	10.7	1.25	2.50	5.00	1	<i>J</i> EBL	SW6010B	0108004	09/10/10 22:00

JAC
10510

ANALYSIS DATA SHEET

FC714-GW07-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-11

Sampled: 08/24/10 15:40

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	<i>WJW</i>	SW6010B	0108004	09/10/10 22:18
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:18
7440-50-8	Copper (dissolved)	<i>6.00185</i>	1.25	2.50	6.00	1	<i>WJW</i>	SW6010B	0108004	09/10/10 22:18
7439-92-1	Lead (dissolved)	<i>1.25100</i>	0.375	0.750	1.25	1	<i>WJW</i>	SW6010B	0108004	09/10/10 22:18
7440-66-6	Zinc (dissolved)	8.97	1.25	2.50	5.00	1	<i>JEBL</i>	SW6010B	0108004	09/10/10 22:18

JAC
10/5/10

ANALYSIS DATA SHEET

FC714-GW03-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-12

Sampled: 08/25/10 09:35

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	<i>UJS</i>	SW6010B	0108004	09/10/10 22:22
7440-38-2	Arsenic		0.500	1.25	1.50	1	<i>U</i>	SW6010B	0108004	09/10/10 22:22
7440-50-8	Copper	<i>6.00</i>	1.25	2.50	6.00	1	<i>UJS EBL</i>	SW6010B	0108004	09/10/10 22:22
7439-92-1	Lead	<i>1.25</i>	0.375	0.750	1.25	1	<i>UJS EBL</i>	SW6010B	0108004	09/10/10 22:22
7440-66-6	Zinc	12.1	1.25	2.50	5.00	1	<i>JEBL</i>	SW6010B	0108004	09/10/10 22:22

JAC
10510

ANALYSIS DATA SHEET

FC714-GW03-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-13

Sampled: 08/25/10 09:35

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	<i>YHJ CL</i>	SW6010B	0108004	09/10/10 22:27
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:27
7440-50-8	Copper (dissolved)	<i>6.00205</i>	1.25	2.50	6.00	1	<i>U/EEL</i>	SW6010B	0108004	09/10/10 22:27
7439-92-1	Lead (dissolved)	<i>1.25008</i>	0.375	0.750	1.25	1	<i>U/EEL</i>	SW6010B	0108004	09/10/10 22:27
7440-66-6	Zinc (dissolved)	10.6	1.25	2.50	5.00	1	<i>J EEL</i>	SW6010B	0108004	09/10/10 22:27

JAC
10570

ANALYSIS DATA SHEET

FC714-GW01-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-14

Sampled: 08/25/10 11:20

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U	SW6010B	0108004	09/10/10 22:31
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:31
7440-50-8	Copper		1.25	2.50	6.00	1	U	SW6010B	0108004	09/10/10 22:31
7439-92-1	Lead	1.25 0.872	0.375	0.750	1.25	1	U	SW6010B	0108004	09/10/10 22:31
7440-66-6	Zinc	8.33	1.25	2.50	5.00	1	U	SW6010B	0108004	09/10/10 22:31

JAC
10/5/10

ANALYSIS DATA SHEET

FC714-GW01-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-15

Sampled: 08/25/10 11:20

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	<i>WJW</i>	SW6010B	0108004	09/10/10 22:36
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:36
7440-50-8	Copper (dissolved)	<i>6.00</i>	1.25	2.50	6.00	1	<i>WJW</i>	SW6010B	0108004	09/10/10 22:36
7439-92-1	Lead (dissolved)	<i>1.25</i>	0.375	0.750	1.25	1	<i>WJW</i>	SW6010B	0108004	09/10/10 22:36
7440-66-6	Zinc (dissolved)	8.03	1.25	2.50	5.00	1	<i>JEBL</i>	SW6010B	0108004	09/10/10 22:36

JAC
10570

ANALYSIS DATA SHEET

FC714-GW02-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-16

Sampled: 08/25/10 11:55

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U	SW6010B	0108004	09/10/10 22:40
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:40
7440-50-8	Copper	6.00 1.25	1.25	2.50	6.00	1	U	SW6010B	0108004	09/10/10 22:40
7439-92-1	Lead	1.25 1.00	0.375	0.750	1.25	1	U	SW6010B	0108004	09/10/10 22:40
7440-66-6	Zinc	8.64	1.25	2.50	5.00	1	J	SW6010B	0108004	09/10/10 22:40

JAC
10570

ANALYSIS DATA SHEET

FC714-GW02-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-17

Sampled: 08/25/10 11:55

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	U <i>U</i> CL	SW6010B	0108004	09/10/10 22:45
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:45
7440-50-8	Copper (dissolved)	<i>6.00</i> 2.5	1.25	2.50	6.00	1	U <i>U</i> EBL	SW6010B	0108004	09/10/10 22:45
7439-92-1	Lead (dissolved)	J.34	0.375	0.750	1.25	1	J <i>J</i> CL	SW6010B	0108004	09/10/10 22:45
7440-66-6	Zinc (dissolved)	11.8	1.25	2.50	5.00	1	J <i>J</i> EBL	SW6010B	0108004	09/10/10 22:45

JAC
10/5/10

ANALYSIS DATA SHEET

FC714-GW02D-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-18

Sampled: 08/25/10 12:00

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U W CCL	SW6010B	0108004	09/10/10 22:50
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:50
7440-50-8	Copper	6.00 1.86	1.25	2.50	6.00	1	U W EBL	SW6010B	0108004	09/10/10 22:50
7439-92-1	Lead	1.25 1.05	0.375	0.750	1.25	1	U W EBL	SW6010B	0108004	09/10/10 22:50
7440-66-6	Zinc	8.42	1.25	2.50	5.00	1	J EBL	SW6010B	0108004	09/10/10 22:50

JAC
10/5/10

ANALYSIS DATA SHEET

FC714-GW02D-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-19

Sampled: 08/25/10 12:00

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	U <i>WJ CL</i>	SW6010B	0108004	09/10/10 22:54
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:54
7440-50-8	Copper (dissolved)	<i>6.00 LO</i>	1.25	2.50	6.00	1	<i>U</i> JEBL	SW6010B	0108004	09/10/10 22:54
7439-92-1	Lead (dissolved)	<i>1.25 LO</i>	0.375	0.750	1.25	1	U <i>WJ EBL</i>	SW6010B	0108004	09/10/10 22:54
7440-66-6	Zinc (dissolved)	8.31	1.25	2.50	5.00	1	JEBL	SW6010B	0108004	09/10/10 22:54

*JAC
10570*

ANALYSIS DATA SHEET

FC714-EB-082510-GW

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Ground Water
 Sampled: 08/25/10 12:20
 % Solids: 0.00

SDG: 1008237
 Project: Lejeune CTO-133
 Laboratory ID: 1008237-20
 Received: 08/26/10 08:45

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	<i>YJS</i>	SW6010B	0108004	09/10/10 22:59
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:59
7440-50-8	Copper	1.60	1.25	2.50	6.00	1	J	SW6010B	0108004	09/10/10 22:59
7439-92-1	Lead	1.21	0.375	0.750	1.25	1	<i>YJS</i>	SW6010B	0108004	09/10/10 22:59
7440-66-6	Zinc	9.36	1.25	2.50	5.00	1		SW6010B	0108004	09/10/10 22:59

YJS
10/5/10

CTO-133

EMPIRICAL LABORATORIES, LLC - CHAIN OF CUSTODY RECORD

SHIP TO: 621 Mainstream Drive, Suite 270 ♦ Nashville, TN 37228 ♦ 615-345-1115 ♦ (fax) 615-846-5426

11211

Send Results to:		Send Invoice to:		Analysis Requirements:						Lab Use Only:					
Name <u>Rebekha Shaw/UBO</u>		Name <u>→</u>		Metals (6010B)	Dissolved Metals (600B)	Perchlorate (6850)						VOA Headspace	Y	N	NA
Company <u>5700 Cleveland St.</u>		Company										Field Filtered	Y	N	NA
Address		Address										Correct Containers	Y	N	NA
City <u>VA Beach</u>		City										Discrepancies	Y	N	NA
State, Zip <u>VA, 23462</u>		State, Zip										Cust. Seals Intact	Y	N	NA
Phone <u>(757) 671-6279</u>		Phone										Containers Intact	Y	N	NA
Fax <u>(757) 497-6885</u>		Fax		Airbill #: <u>5409</u>			CAR #: <u>-</u>								
E-mail <u>rebekha.shaw@chem.com</u>		E-mail		Project No./Name: <u>Leisure CTO-133</u>			Sampler's (Signature): <u>[Signature]</u>								

Lab Use Only Lab #	Date/Time Sampled	Sample Description	Sample Matrix										Comments	No. of Bottles	Lab Use Only Containers/Pres.
008237-01-02	8/24/10/1650	" " - GW06-10C	GW	X	X	X								3	1C-11, 1C, 1C-01
		" " - GW06-10C-MS	GW												
		" " - GW06-10C-SD	GW												
-03, -04	8/25/10/1025	" " - GW04-10C	GW												
-05	8/25/10/1020	" " - FB-082510	ER	X		X								2	- 1C-DF
-06, -07	8/24/10/1355	" " - GW05-10C			X									3	
-08, -09	8/24/10/1445	" " - GW08-10C	GW												
-10, -11	8/24/10/1540	" " - GW07-10C	GW												
-12, -13	8/25/10/0935	" " - GW03-10C	GW												
-14, -15	8/25/10/1120	" " - GW01-10C	GW												
-16, -17	8/25/10/1155	" " - GW02-10C	GW												
-18, -19	8/25/10/1200	" " - GW02P-10C	GW												

Sample Kit Prep'd by: (Signature)	Date/Time	Received By: (Signature)
Relinquished by: (Signature)	Date/Time	Received By: (Signature)
Relinquished by: (Signature)	Date/Time	Received By: (Signature)
Received for Laboratory by: (Signature)	Date/Time	Temperature

REMARKS:
 * Dissolved Metals have been field filtered
 * All metals analysis is for select metals per SOW.
 * " " = FC714-

Details:
 Page 1 of 2
 Cooler No. 1 of 2
 Date Shipped 8/25/10
 Shipped By DS/BL
 Turnaround Per SOW

EMPIRICAL LABORATORIES
COOLER RECEIPT FORM

LIMS Number: 1008237 Number of Coolers: 1 of 1
Client: CH2M Hill Project: CTO-133
Date/Time Received: 8/26/10 08:45 Date cooler(s) opened: 8/26/10
Opened By (print): Will Schwab (signature): [Signature]

Circle response below as appropriate

1. How did the samples arrive?: FedEx UPS DHL Hand Delivered
EL Courier Other: _____

If applicable, enter airbill number here: 5404

2. Were custody seals on outside of cooler(s)? Yes No
How many: 1 Seal date: 8/25/10 Seal Initials: ?

3. Were custody seals unbroken and intact at the date and time of arrival? Yes No N/A
4. Were custody papers sealed in a plastic bag included in the sample cooler? Yes No N/A
5. Were custody papers filled out properly (ink, signed, etc.)? Yes No N/A
6. Did you sign custody papers in the appropriate place for acceptance? Yes No N/A
7. Was project identifiable from custody papers? Yes No N/A
8. If required, was enough ice present in the cooler(s)? Yes No N/A

Type of Coolant: WET DRY BLUE NONE Temperature of Samples upon Receipt: 5.5 °C

Dates samples were logged-in: 8/26/10

9. Initial this form to acknowledge login of sample(s): (Name): Will Schwab (Initial): WS

10. Were all bottle lids intact and sealed tightly? Yes No N/A
11. Did all bottles arrive unbroken? Yes No N/A
12. Was all required bottle label information complete? Yes No N/A
13. Did all bottle labels agree with custody papers? Yes No N/A
14. Were correct containers used for the analyses indicated? Yes No N/A
15. Were preservative levels correct in all applicable sample containers? Yes No N/A
16. Was residual chlorine present in any applicable sample containers? Yes No N/A
17. Was sufficient amount of sample sent for the analyses required? Yes No N/A
18. Was headspace present in any included VOA vials? Yes No N/A

pH 2 for
all metals
(to f. & dros)

If Non-Conformance issues were present, list by sample ID: _____

CAR#: _____

Corrections to COCs

TO: Whom It May Concern

COPIES: File
Data Package

FROM: Troy Horn
Environmental Information Specialist
CH2M HILL

DATE: August 23, 2010

This memo is to document corrections made to entries on the Chains of Custodies (COC) and logins for Camp Lejeune CTO-133, Fitness Center, August 2010.

These corrections include updates to sample IDs on Work Order 1008237.

Correct Sample ID	Incorrect Sample ID on COC and login	Date Collected	Time Collected
FC714-EB-082510-GW	FC714-EB-082510	8/25/2010	12:20
FC714-IDW-082510	FC714-IDW-AQ	8/25/2010	16:30

*Please Note: IDW sample has not been placed in a work order yet.

DataQual

Worksheets - Perchlorate

Data Completeness

The data package was received complete and intact. Resubmissions were not required. (Method 6850)

Laboratory: Empirical

Holding Times

Sampling Date: 8/24-25/10

Received Date: 8/26/10

Analysis Dates: 8/31/10

Cooler Temp: 5.5°C

All holding time requirements were met.

Calibrations and Verifications

Mass assignments were verified. The submitted calibrations were within criteria or no qualifications were required.

Internal Standards

All criteria were met.

Blank Summary

Blank qualification guidelines:

- No action is taken if a compound is found in the blank but not in the sample.
- Sample weight, volume or dilution factor must be taken into consideration when applying criteria.
- Qualification/Action codes where applied as stated in table below:
-

Blank Type	Blank Result	Sample Result	Action for Samples
Method, Field	Detects	Not detected	No qualifications
	< RL	< RL	Report RL value with a U
		∃ RL	Use professional judgment
	> RL	< RL	Report RL value with a U
		∃ RL and < blank concentration	Report the concentration for the sample with a U, or qualify the data as unusable R
		∃ RL and ∃ blank concentration	Use professional judgment
	= RL	< RL	Report RL value with a U
		∃ RL	Use professional judgment
Gross contamination	Detects	Qualify results as unusable R	

There was no contamination exhibited in the method blanks. QC blanks associated for these samples were: equipment blank FC714-EB-082510-GW; field blank FC714-FB-082510- no positive results were exhibited in any of the QC blanks.

DataQual

Worksheets - Perchlorate

Laboratory Control Sample

All criteria were met.

Matrix Spike/Spike Duplicate Samples

An MS/MSD was submitted for sample FC714-GW06-10C—the MS and MSD exhibited low recoveries for perchlorate at 47.4% and 72.9% (QC limit 80-120%); therefore the non-detected result in the associated sample was qualified as estimated (UJ).

Field Duplicate Sample

A field duplicate sample was submitted for sample FC714-GW02-10C—no positive results were exhibited in either sample.

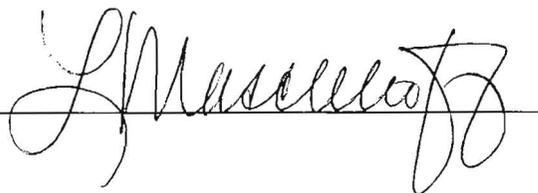
Specific Comments:

All sample results were reported within the calibration range of the instruments.

Detection limits were acceptable. Raw data and calculations were verified.

We have limited the supporting documentation, found with these worksheets, to those forms that indicate qualifications were required.

Reviewer:



Date:

10/4/10

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY
SW6850

FC714-GW06-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Water

Batch: 0H30001

% Solids:

Source Sample Name: 1008237-01

ANALYTE	SPIKE ADDED (ug/L)	SAMPLE CONCENTRATION (ug/L)	MS CONCENTRATION (ug/L)	MS % REC.	Q	QC LIMITS REC.
Perchlorate	0.2000	ND	0.09477	47.4	*	80 - 120

ANALYTE	SPIKE ADDED (ug/L)	MSD CONCENTRATION (ug/L)	MSD % REC. #	% RPD	Q	QC LIMITS	
						RPD	REC.
Perchlorate	0.2000	0.1458	72.9	42.4	* *	15	80 - 120

J/05

DataQual

Worksheets –Select Metals

This SDG contains metals analysis using SW-846 6010B. Resubmissions were not required.

HOLDING TIMES

Sampling Date: 8/24-25/10
Received Date: 8/26/10 Cooler temps: OK
Prep. Dates: 9/08/10 ICP
Analysis Dates: 9/10/10 & 9/13/10 ICP
All holding time requirements were met.

CALIBRATIONS

All initial calibration criteria were met. Single point calibration was analyzed for ICP. Calibration verification criteria were not met for all ICV and CCV standards. See report for qualifications. The CRI check standards were analyzed and met method criteria for all analytes. Interference check standards were analyzed and met criteria. Raw data was verified.

BLANK SUMMARY

Blank qualification guidelines:

- No action is taken if an analyte is found in the blank but not in the sample.
- Sample weight, volume or dilution factor must be taken into consideration when applying the criteria.
- Apply the same data validation guidelines to any associated calibration, preparation, and field QC blanks and all associated samples.
- Qualification/Action codes:
 - No Action - The sample result is greater than the CRDL and greater than ten times (10X) the blank value.
 - U - The sample result is greater than or equal to the MDL but less than or equal to the CRDL, result is reported as non-detect at the CRDL.
 - R or J+ The blank contaminant concentration was greater than the RL and the sample result is greater than the RL but less than 10X the blank contaminant concentration. The reported results are flagged either as rejected R or biased high J+ based on the professional judgment of the validator.

Blank Contamination and Qualification Summaries

Blank ID	Analyte	Concentration	Action Level	Q Flag
FC714-EB-082510-GW	copper	1.60J ug/L	RL	U at RL
	lead	1.21J ug/L	RL	U at RL
	zinc	9.36 ug/L	10X blk level (93.6 ug/L)	J

The concentration noted for the CCBs is the highest concentration in all the CCBs. However, when qualifying samples for CCB contamination, associated samples are those just prior to or just following a CCB. Therefore, not all analytes in all samples are flagged for noted CCB contamination. See worksheets for associations. Samples are qualified for field QC blank contamination based on QC tracking provided by CH2M HILL. Negative contamination in a prep blank or CCB, if less than the analyte CRDL, is qualified based on professional judgment.

Please note that based on the National Functional Guidelines, for contamination above the CRDL, results in the field samples that are greater than the CRDL up to 10X the blank contamination level should be qualified as estimated J and considered biased high or they should be rejected. Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag	Q Code
all samples > MDL ≤ RL	copper	U at RL	EBL
all samples > MDL ≤ RL	lead	U at RL	EBL
all samples > MDL up to 93.6 ug/L	zinc	J	EBL

MATRIX SPIKE/DUPLICATE SUMMARY

The spike pairs of sample FC714-GW06-10C exhibited acceptable recoveries for all target analytes. LCS recoveries and RPDs were acceptable.

SERIAL DILUTIONS

The serial dilution analysis submitted in this SDG was acceptable.

FIELD DUPLICATE SAMPLE SUMMARY

Note: Field duplicate results are assessed only if both results are above the CRDL.

Sample ID: FC714-GW02-10C total Duplicate Sample ID: FC714-GW02D-10C total

Analyte	Sample Conc.	Duplicate Conc.	RPD
antimony			#DIV/0!
arsenic			#DIV/0!
copper	1.35	1.36	1%
lead	1.04	1.05	1%
zinc	8.64	8.42	3%

Comments: No qualifications were required

Sample ID: FC714-GW02-10C dissolved Duplicate Sample ID: FC714-GW02D-10C dissolved

Analyte	Sample Conc.	Duplicate Conc.	RPD
antimony			#DIV/0!
arsenic			#DIV/0!
copper	2.25	1.51	39%
lead	1.34	1.05	24%
zinc	11.8	8.31	35%

Comments: all flagged based on rinse blank contamination!

SAMPLE CALCULATION

EPA SAMPLE ID: FC714-GW06-10C
 COMPOUND: COPPER
 CONCENTRATION: 1.59 ug/L
 %Solids – NA
 100ml to 25 ml
 Raw Data result: 6.3794 ug/L

$6.3794 \text{ ug/L} * 0.025\text{L}/0.125\text{L} = 1.59485 \text{ ug/L}$

SAMPLE RESULT VERIFICATION

Specific Comments:

All sample results were reported within the calibration/linear range of the instruments. Detection limits were acceptable. Raw data was verified. All positive results reported at concentrations between the IDL and the CRDL were qualified as estimated, J by the laboratory for the ICP metals.

Reviewer JA Cleveland Date: 10510

Sample Delivery Group Case Narrative

Receipt Information

The samples were received within the preservation guidelines for the associated methods. The information associated with sample receipt and the Sample Delivery Group (SDG) are included within section 4 of this package, which also provides information on the link between the client sample ID listed on the COC and laboratory's assigned unique sample ID or WorkOrder #. The sample is tracked through the laboratory for all analysis via the assigned WorkOrder #.

All samples that were received were analyzed and none of the samples were placed on hold without analyses. There were no subcontracted analyses for this SDG.

Changes to the Revision

This is an original submittal of the final report package.

Analytical Information

All samples were prepped (where applicable) and analyzed within the standard allowed holding times, unless noted within the exceptions listed below. The laboratory analyzed all samples within the program and method guidelines. The following information is provided specific to individual methods:

Chromatographic Flags for Manual Integration:

The following letters are used to denote manual integrations on the laboratory's raw data in association with chromatographic integrations:

- A:** The peak was manually integrated as it was not integrated in the original chromatogram.
- B:** The peak was manually integrated due to resolution or coelution issues in the original chromatogram.
- C:** The peak was manually integrated to correct the baseline from the original chromatogram.
- D:** The peak was manually integrated to identify the correct peak as the wrong peak was identified in the original chromatogram.
- E:** The peak was manually integrated to include the entire peak as the original chromatogram only integrated part of the peak.

SW6010B:

The continuing calibration verifications exceeded criteria in 0125603-CCV8, -CCV9 and -CCVA for Antimony and Lead.

No additional anomalies or deviations are noted and the data is properly qualified.

SW6850:

The matrix spikes associated to sample 1008237-01 exceeded criteria for Perchlorate.

The matrix spikes for sample 1008237-01 are qualified with a Z-01 to indicate that the

ion ratio did no meet criteria.

No additional anomalies or deviations are noted and the data is properly qualified.

INITIAL AND CONTINUING CALIBRATION CHECK

SW6010B

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Instrument ID: ME-ICP

Calibration: 0256001

Sequence: 0125603

Lab Sample ID	Analyte	True	Found	%R	Units	Control Limit
0125603-ICV1	Antimony	1000	1021	102	ug/L	+/- 10.00%
	Arsenic	1000	974.0	97.4	ug/L	+/- 10.00%
	Copper	1000	979.3	97.9	ug/L	+/- 10.00%
	Lead	1000	1011	101	ug/L	+/- 10.00%
	Zinc	1000	1032	103	ug/L	+/- 10.00%
0125603-CCV1	Antimony	1000	1017	102	ug/L	+/- 10.00%
	Arsenic	1000	1017	102	ug/L	+/- 10.00%
	Copper	1000	988.3	98.8	ug/L	+/- 10.00%
	Lead	1000	999.6	100	ug/L	+/- 10.00%
	Zinc	1000	1016	102	ug/L	+/- 10.00%
0125603-CCV8	Antimony	1000	882.6	88.3	ug/L	+/- 10.00%
	Arsenic	1000	946.7	94.7	ug/L	+/- 10.00%
	Copper	1000	904.4	90.4	ug/L	+/- 10.00%
	Lead	1000	888.4	88.8	ug/L	+/- 10.00%
	Zinc	1000	978.4	97.8	ug/L	+/- 10.00%
0125603-CCV9	Antimony	1000	873.7	87.4	ug/L	+/- 10.00%
	Arsenic	1000	934.5	93.5	ug/L	+/- 10.00%
	Copper	1000	903.6	90.4	ug/L	+/- 10.00%
	Lead	1000	874.7	87.5	ug/L	+/- 10.00%
	Zinc	1000	949.5	95.0	ug/L	+/- 10.00%
0125603-CCVA	Antimony	1000	879.3	87.9	ug/L	+/- 10.00%
	Arsenic	1000	931.7	93.2	ug/L	+/- 10.00%
	Copper	1000	901.0	90.1	ug/L	+/- 10.00%
	Lead	1000	884.2	88.4	ug/L	+/- 10.00%
	Zinc	1000	961.6	96.2	ug/L	+/- 10.00%

JWJ
JWJ
JWJ
JWJ
JWJ
JWJ
JWJ

*all samples associated
Flag all Sb & Pb JWJ in
samples*

The samples were evaluated based on the following criteria:

- Data Completeness *
- Technical Holding Times *
- HPLC Performance *
- Initial/Continuing Calibrations
- CRI Standards *
- Interference Check Sample *
- Blanks
- Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Post Digestion Spike Recoveries *
- Serial Dilutions *
- Field Duplicates *
- Identification/Quantitation *
- Reporting Limits *

* - indicates that no qualifications were required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page. Please note that when a compound or analyte is flagged due to blank contamination the BL qualifier code takes precedence over all other qualifier codes except a code that explains rejected data.

Perchlorate

The matrix spike and matrix spike duplicate pair submitted exhibited low recoveries; therefore native sample result was qualified as estimated.

Total & Dissolved Metals

Continuing calibration standard exhibited non-compliant recoveries for two analytes. Qualifications were required in the samples.

Blank contamination was noted that required qualification in the field samples.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/24-25/10 and samples were received at the laboratory 8/26/10. All sample preparation and analysis was performed within method holding time requirements.

Calibrations

Total & Dissolved Metals

Calibration standards exhibited %Rs that were non-compliant based on the method continuing calibration requirement of +/-10% difference from the true concentration. A summary of these non-compliances and affected samples are noted in the following table. Sample results were qualified as indicated.

Standard ID	Analyte	%R	Samples	Q Flag	Q Code
CCV8/CCV9/CCVA	antimony	88.3/87.4/87.9	all samples	J/UJ	CCL
	lead	88.8/87.5/88.4			

Blanks

Total & Dissolved Metals

Contamination was noted in associated blanks and qualification was required in the associated samples. Required action is noted in the following tables.

Blank ID	Analyte	Concentration	Action Level	Q Flag
FC714-EB-082510-GW	copper	1.60J ug/L	LOD	U at LOD
	lead	1.21J ug/L	LOD	U at LOD
	zinc	9.36 ug/L	10X blk level (93.6 ug/L)	J

Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag	Q Code
all field samples > DL ≤ LOD	copper	U at LOD	EBL
all field samples > DL ≤ LOD	lead	U at LOD	EBL
all field samples > LOD up to 93.6 ug/L	zinc	J	EBL

Summary of Data Qualifications

Perchlorate

Sample ID	Compound	Results	Q-Flag	Q Code
FC714-GW06-10C	perchlorate	+/-	J/UJ	MSL

Total & Dissolved Metals

Sample ID	Analyte	Results	Q-Flag	Q Code
all samples	antimony lead	+/-	J/UJ	*CCL
all field samples > DL ≤ LOD	copper	+J	U at LOD	EBL
all field samples > DL ≤ LOD	lead	+J	U at LOD	EBL
all field samples > LOD up to 93.6 ug/L	zinc	+	J	EBL

*Please note that some lead results were also flagged for blank contamination. These results were flagged U for blank contamination then J for calibration issues with a final qualifier code of EBL to indicate why the detect was changed to a non-detect.

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
R	result is rejected; the presence or absence of the analyte cannot be verified
D	result value is based on dilution analysis result
NJ	analyte has been tentatively identified, estimated value
L	analyte present, biased low
UL	not detected, quantitation limit is probably higher
K	analyte present, biased high

Inorganic Field/Lab Blank Qualification Flags (Q-Flags)

NA	The sample result for the blank contaminant is greater than the sample LOD and is greater than 5X the blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.
LOD-U	The sample result for the blank contaminant is less than the sample LOD and the result is raised to the LOD and flagged U.
R or J+	The blank contaminant concentration was greater than the LOD and the sample result is greater than the LOD but less than 10X the blank contaminant concentration. The reported results are flagged either as rejected R or biased high J+ based on the professional judgment of the validator. (see NFG, Rev. date 10/04, p. 17 for extracted blanks (PB))

Organic Field/Lab Blank Qualification Flags (Q-Flags)

NA	The sample result for the blank contaminant is greater than the sample LOD and is greater than 5X (10X for common laboratory contaminants) the blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.
LOD-U	The sample result for the blank contaminant is less than the sample LOD but is less than 5X (10X for common laboratory contaminants) the blank value, so the result is raised to the LOD and flagged U.
U	The sample result for the blank contaminant is greater than the sample LOD but is less than 5X (10X for common laboratory contaminants) the blank value, so the result is flagged U at the reported value.

General Abbreviations

LOQ	level of quantitation
LOD	level of detection
MDL	method detection limit
CRQL/CRDL	contract required quantitation/detection limit
Q Code	qualifier code
+/-	positive result/non-detect result

ANALYSIS DATA SHEET

FC714-GW06-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-01

Sampled: 08/24/10 16:50

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	<i>U X CL</i>	SW6010B	0108004	09/10/10 20:42
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 20:42
7440-50-8	Copper	<i>2.50 LSS</i>	1.25	2.50	6.00	1	<i>U X EBL</i>	SW6010B	0108004	09/10/10 20:42
7439-92-1	Lead	1.89	0.375	0.750	1.25	1	<i>J X CL</i>	SW6010B	0108004	09/10/10 20:42
7440-66-6	Zinc	9.07	1.25	2.50	5.00	1	<i>J EBL</i>	SW6010B	0108004	09/10/10 20:42

JAC
102510

ANALYSIS DATA SHEET

FC714-GW06-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Ground Water
 Sampled: 08/24/10 16:50
 % Solids: 0.00

SDG: 1008237
 Project: Lejeune CTO-133
 Laboratory ID: 1008237-02
 Received: 08/26/10 08:45

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	U + CC	SW6010B	0108004	09/10/10 21:05
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 21:05
7440-50-8	Copper (dissolved)	2.50 ug/L	1.25	2.50	6.00	1	U + EBL	SW6010B	0108004	09/10/10 21:05
7439-92-1	Lead (dissolved)	2.05	0.375	0.750	1.25	1	J + CC	SW6010B	0108004	09/10/10 21:05
7440-66-6	Zinc (dissolved)	8.67	1.25	2.50	5.00	1	J EBL	SW6010B	0108004	09/10/10 21:05

QAC
10/25/10

ANALYSIS DATA SHEET

FC714-GW04-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-03

Sampled: 08/25/10 10:25

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U	SW6010B	0108004	09/10/10 21:29
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 21:29
7440-50-8	Copper	2.50 <i>lab</i>	1.25	2.50	6.00	1	U	SW6010B	0108004	09/10/10 21:29
7439-92-1	Lead	0.906	0.375	0.750	1.25	1	J	SW6010B	0108004	09/10/10 21:29
7440-66-6	Zinc	11.4	1.25	2.50	5.00	1	J	SW6010B	0108004	09/10/10 21:29

JAC
102570

ANALYSIS DATA SHEET

FC714-GW04-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-04

Sampled: 08/25/10 10:25

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	U <i>JAC</i>	SW6010B	0108004	09/10/10 21:33
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 21:33
7440-50-8	Copper (dissolved)	<i>2.50</i>	1.25	2.50	6.00	1	U <i>JAC</i>	SW6010B	0108004	09/10/10 21:33
7439-92-1	Lead (dissolved)	0.970	0.375	0.750	1.25	1	J <i>JAC</i>	SW6010B	0108004	09/10/10 21:33
7440-66-6	Zinc (dissolved)	14.4	1.25	2.50	5.00	1	J <i>EBL</i>	SW6010B	0108004	09/10/10 21:33

JAC
102516

ANALYSIS DATA SHEET

FC714-GW05-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-06

Sampled: 08/24/10 13:55

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	USL+ZLL	SW6010B	0108004	09/10/10 21:42
7440-38-2	Arsenic	1.08	0.500	1.25	1.50	1	J	SW6010B	0108004	09/10/10 21:42
7440-50-8	Copper	2.50 1.25	1.25	2.50	6.00	1	U + EBL	SW6010B	0108004	09/10/10 21:42
7439-92-1	Lead	0.750 0.600	0.375	0.750	1.25	1	US+TBL	SW6010B	0108004	09/10/10 21:42
7440-66-6	Zinc	20.0	1.25	2.50	5.00	1	J EBL	SW6010B	0108004	09/10/10 21:42

JAC
102510

ANALYSIS DATA SHEET

FC714-GW05-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-07

Sampled: 08/24/10 13:55

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	US + EBL	SW6010B	0108004	09/10/10 21:47
7440-38-2	Arsenic (dissolved)	1.14	0.500	1.25	1.50	1	J	SW6010B	0108004	09/10/10 21:47
7440-50-8	Copper (dissolved)	2.50 1.42	1.25	2.50	6.00	1	U + EBL	SW6010B	0108004	09/10/10 21:47
7439-92-1	Lead (dissolved)	0.750 0.52	0.375	0.750	1.25	1	US + EBL	SW6010B	0108004	09/10/10 21:47
7440-66-6	Zinc (dissolved)	14.8	1.25	2.50	5.00	1	J EBL	SW6010B	0108004	09/10/10 21:47

JAC
102570

ANALYSIS DATA SHEET

FC714-GW08-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-08

Sampled: 08/24/10 14:45

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U <i>JEBL</i>	SW6010B	0108004	09/10/10 21:51
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 21:51
7440-50-8	Copper	<i>2.50 L36</i>	1.25	2.50	6.00	1	U <i>JEBL</i>	SW6010B	0108004	09/10/10 21:51
7439-92-1	Lead	1.05	0.375	0.750	1.25	1	J <i>JEBL</i>	SW6010B	0108004	09/10/10 21:51
7440-66-6	Zinc	8.03	1.25	2.50	5.00	1	J <i>JEBL</i>	SW6010B	0108004	09/10/10 21:51

JAC
102510

ANALYSIS DATA SHEET

FC714-GW08-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Leieune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-09

Sampled: 08/24/10 14:45

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	UJH/CL	SW6010B	0108004	09/10/10 21:56
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 21:56
7440-50-8	Copper (dissolved)	2.50 JH	1.25	2.50	6.00	1	U JEBL	SW6010B	0108004	09/10/10 21:56
7439-92-1	Lead (dissolved)	1.18	0.375	0.750	1.25	1	JH/CL	SW6010B	0108004	09/10/10 21:56
7440-66-6	Zinc (dissolved)	9.13	1.25	2.50	5.00	1	JEBL	SW6010B	0108004	09/10/10 21:56

JAC
1008237

ANALYSIS DATA SHEET

FC714-GW07-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-10

Sampled: 08/24/10 15:40

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	<i>U</i>	SW6010B	0108004	09/10/10 22:00
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:00
7440-50-8	Copper	<i>2.50 ug/L</i>	1.25	2.50	6.00	1	<i>U + EBL</i>	SW6010B	0108004	09/10/10 22:00
7439-92-1	Lead	0.987	0.375	0.750	1.25	1	<i>J + EBL</i>	SW6010B	0108004	09/10/10 22:00
7440-66-6	Zinc	10.7	1.25	2.50	5.00	1	<i>J EBL</i>	SW6010B	0108004	09/10/10 22:00

JAC
102510

ANALYSIS DATA SHEET

FC714-GW07-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-11

Sampled: 08/24/10 15:40

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	U FECL	SW6010B	0108004	09/10/10 22:18
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:18
7440-50-8	Copper (dissolved)	250.83	1.25	2.50	6.00	1	U FECL	SW6010B	0108004	09/10/10 22:18
7439-92-1	Lead (dissolved)	1.00	0.375	0.750	1.25	1	J FECL	SW6010B	0108004	09/10/10 22:18
7440-66-6	Zinc (dissolved)	8.97	1.25	2.50	5.00	1	J FECL	SW6010B	0108004	09/10/10 22:18

JAC
10/25/10

ANALYSIS DATA SHEET

FC714-GW03-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-12

Sampled: 08/25/10 09:35

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	W+U	SW6010B	0108004	09/10/10 22:22
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:22
7440-50-8	Copper	2.50 L 2	1.25	2.50	6.00	1	U JEBL	SW6010B	0108004	09/10/10 22:22
7439-92-1	Lead	0.750 L 698	0.375	0.750	1.25	1	W+U JEBL	SW6010B	0108004	09/10/10 22:22
7440-66-6	Zinc	12.1	1.25	2.50	5.00	1	JEBL	SW6010B	0108004	09/10/10 22:22

JAC
1008237

ANALYSIS DATA SHEET

FC714-GW03-10C

 Laboratory: Empirical Laboratories, LLC

 SDG: 1008237

 Client: CH2M Hill, Inc.

 Project: Lejeune CTO-133

 Matrix: Ground Water

 Laboratory ID: 1008237-13

 Sampled: 08/25/10 09:35

 Received: 08/26/10 08:45

 % Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	<i>U</i>	SW6010B	0108004	09/10/10 22:27
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:27
7440-50-8	Copper (dissolved)	<i>2.50</i>	1.25	2.50	6.00	1	<i>U</i>	SW6010B	0108004	09/10/10 22:27
7439-92-1	Lead (dissolved)	0.968	0.375	0.750	1.25	1	<i>J</i>	SW6010B	0108004	09/10/10 22:27
7440-66-6	Zinc (dissolved)	10.6	1.25	2.50	5.00	1	<i>J</i>	SW6010B	0108004	09/10/10 22:27

JAC
10/25/10

ANALYSIS DATA SHEET

FC714-GW01-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-14

Sampled: 08/25/10 11:20

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	<i>WYCEL</i>	SW6010B	0108004	09/10/10 22:31
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:31
7440-50-8	Copper		1.25	2.50	6.00	1	U	SW6010B	0108004	09/10/10 22:31
7439-92-1	Lead	0.872	0.375	0.750	1.25	1	<i>JYCEL</i>	SW6010B	0108004	09/10/10 22:31
7440-66-6	Zinc	8.33	1.25	2.50	5.00	1	<i>JEBL</i>	SW6010B	0108004	09/10/10 22:31

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102510

ANALYSIS DATA SHEET

FC714-GW01-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-15

Sampled: 08/25/10 11:20

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	U W J EBL	SW6010B	0108004	09/10/10 22:36
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:36
7440-50-8	Copper (dissolved)	2.50 1.52	1.25	2.50	6.00	1	U W J EBL	SW6010B	0108004	09/10/10 22:36
7439-92-1	Lead (dissolved)	0.755	0.375	0.750	1.25	1	J W J EBL	SW6010B	0108004	09/10/10 22:36
7440-66-6	Zinc (dissolved)	8.03	1.25	2.50	5.00	1	J W J EBL	SW6010B	0108004	09/10/10 22:36

JAC
10/25/10

ANALYSIS DATA SHEET

FC714-GW02-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-16

Sampled: 08/25/10 11:55

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U JEBL	SW6010B	0108004	09/10/10 22:40
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:40
7440-50-8	Copper	2.50 3.5	1.25	2.50	6.00	1	U JEBL	SW6010B	0108004	09/10/10 22:40
7439-92-1	Lead	1.04	0.375	0.750	1.25	1	J JEBL	SW6010B	0108004	09/10/10 22:40
7440-66-6	Zinc	8.64	1.25	2.50	5.00	1	JEBL	SW6010B	0108004	09/10/10 22:40

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ANALYSIS DATA SHEET

FC714-GW02-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-17

Sampled: 08/25/10 11:55

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	<i>U JEBL</i>	SW6010B	0108004	09/10/10 22:45
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:45
7440-50-8	Copper (dissolved)	<i>2.50 225</i>	1.25	2.50	6.00	1	<i>U JEBL</i>	SW6010B	0108004	09/10/10 22:45
7439-92-1	Lead (dissolved)	1.34	0.375	0.750	1.25	1	<i>JEBL</i>	SW6010B	0108004	09/10/10 22:45
7440-66-6	Zinc (dissolved)	11.8	1.25	2.50	5.00	1	<i>JEBL</i>	SW6010B	0108004	09/10/10 22:45

JAC
100570

ANALYSIS DATA SHEET

FC714-GW02D-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Leicune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-18

Sampled: 08/25/10 12:00

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U + JCL	SW6010B	0108004	09/10/10 22:50
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0108004	09/10/10 22:50
7440-50-8	Copper	2.50 ^{1.36}	1.25	2.50	6.00	1	U + JCL	SW6010B	0108004	09/10/10 22:50
7439-92-1	Lead	1.05	0.375	0.750	1.25	1	J + JCL	SW6010B	0108004	09/10/10 22:50
7440-66-6	Zinc	8.42	1.25	2.50	5.00	1	J EBL	SW6010B	0108004	09/10/10 22:50

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1008237

ANALYSIS DATA SHEET

FC714-GW02D-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008237

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Ground Water

Laboratory ID: 1008237-19

Sampled: 08/25/10 12:00

Received: 08/26/10 08:45

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	<i>U</i>	SW6010B	0108004	09/10/10 22:54
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	<i>U</i>	SW6010B	0108004	09/10/10 22:54
7440-50-8	Copper (dissolved)	<i>2.50 ± 0.1</i>	1.25	2.50	6.00	1	<i>U</i>	SW6010B	0108004	09/10/10 22:54
7439-92-1	Lead (dissolved)	1.05	0.375	0.750	1.25	1	<i>J</i>	SW6010B	0108004	09/10/10 22:54
7440-66-6	Zinc (dissolved)	8.31	1.25	2.50	5.00	1	<i>J</i>	SW6010B	0108004	09/10/10 22:54

JC
1008237

DataQual**Worksheets –Select Metals**

This SDG contains metals analysis using SW-846 6010B. Resubmissions were not required.

HOLDING TIMES

Sampling Date: 8/24-25/10

Received Date: 8/26/10

Cooler temps: OK

Prep. Dates: 9/08/10 ICP

Analysis Dates: 9/10/10 & 9/13/10 ICP

All holding time requirements were met.

CALIBRATIONS

All initial calibration criteria were met. Single point calibration was analyzed for ICP. Calibration verification criteria were not met for all ICV and CCV standards. See report for qualifications. The CRI check standards were analyzed and met method criteria for all analytes. Interference check standards were analyzed and met criteria. Raw data was verified.

BLANK SUMMARY

Blank qualification guidelines:

- No action is taken if an analyte is found in the blank but not in the sample.
- Sample weight, volume or dilution factor must be taken into consideration when applying the criteria.
- Apply the same data validation guidelines to any associated calibration, preparation, and field QC blanks and all associated samples.
- Qualification/Action codes:
 - No Action - The sample result is greater than the LOD and greater than ten times (10X) the blank value.
 - U - The sample result is greater than or equal to the MDL but less than or equal to the LOD-result is reported as non-detect at the LOD.
 - R or J₊ The blank contaminant concentration was greater than the LOD and the sample result is greater than the LOD but less than 10X the blank contaminant concentration. The reported results are flagged either as rejected R or biased high J₊ based on the professional judgment of the validator.

Blank Contamination and Qualification Summaries

Blank ID	Analyte	Concentration	Action Level	Q Flag
FC714-EB-082510-GW	copper	1.60J ug/L	LOD	U at LOD
	lead	1.21J ug/L	LOD	U at LOD
	zinc	9.36 ug/L	10X blk level (93.6 ug/L)	J

The concentration noted for the CCBs is the highest concentration in all the CCBs. However, when qualifying samples for CCB contamination, associated samples are those just prior to or just following a CCB. Therefore, not all analytes in all samples are flagged for noted CCB contamination. See worksheets for associations. Samples are qualified for field QC blank contamination based on QC tracking provided by CH2M HILL. Negative contamination in a prep blank or CCB, if less than the analyte CRDL, is qualified based on professional judgment.

Please note that based on the National Functional Guidelines, for contamination above the CRDL, results in the field samples that are greater than the CRDL up to 10X the blank contamination level should be qualified as estimated J and considered biased high or they should be rejected. Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag	Q Code
all samples > MDL ≤ RL	copper	U at LOD	EBL
all samples > MDL ≤ RL	lead	U at LOD	EBL
all samples > MDL up to 93.6 ug/L	zinc	J	EBL

SDG# 1008237
 MCB Camp Lejeune, CTO-133
 Select Metals
 Page 1

046

DataQual

Environmental Services, LLC

CH2M HILL
 5700 Cleveland Street
 Suite 101
 Virginia Beach, VA 23462

September 27, 2010
 SDG# 1008049
 Empirical Laboratories
 MCB Camp Lejeune, North Carolina – CTO-133

Dear Ms. Shaw,

The following Data Validation report is provided as requested for the parameters noted in the table below for SDG # 1008049. The data validation was performed in accordance with the SW846 methods 6850 for Perchlorate and 6010B for metals. Also used in the validation of these samples were The National Functional Guidelines for Organic Data Review (June, 2008), as applicable, the National Functional Guidelines for Inorganic Data Review (October, 2004), as applicable, and good professional judgment. All areas of concern are discussed in the body of the report and a summary of data qualifications is provided.

Sample ID	Lab ID	Matrix	Perchlorate	Metals	Dissolved Metals
FC714-SS04-10C	1008049-01	soil	X	X	
FC714-SS03-10C	1008049-02	soil	X	X	
FC714-SS07-10C	1008049-03	soil	X	X	
FC714-SS15-10C	1008049-04	soil	X	X	
FC714-SS08-10C	1008049-05	soil	X	X	
FC714-SS03D-10C	1008049-06	soil	X	X	
FC714-SS12-10C	1008049-07	soil	X	X	
FC714-SS16-10C	1008049-08	soil	X	X	
FC714-SS01-10C	1008049-09	soil	X	X	
FC714-SS02-10C	1008049-10	soil	X	X	
FC714-SS05-10C	1008049-11	soil	X	X	
FC714-SS11-10C	1008049-12	soil	X	X	
FC714-SS25-10C	1008049-13	soil	X	X	
FC714-SS17-10C	1008049-14	soil	X	X	
FC714-SS10-10C	1008049-15	soil	X	X	
FC714-SS06-10C	1008049-16	soil	X	X	
FC714-SS28-10C	1008049-17	soil	X	X	
FC714-SS31-D-10C	1008049-18	soil	X	X	
FC714-SS30-10C	1008049-19	soil	X	X	
FC714-SS21-10C	1008049-20	soil	X	X	
FC714-SS27-D-10C	1008049-21	soil	X	X	
FC714-SS27-10C	1008049-22	soil	X	X	
FC714-SS26-10C	1008049-23	soil	X	X	
FC714-SS32-10C	1008049-24	soil	X	X	
FC714-SS31-10C	1008049-25	soil	X	X	
FC714-SS14-10C	1008049-26	soil	X	X	
FC714-SS18-10C	1008049-27	soil	X	X	

Sample ID	Lab ID	Matrix	Perchlorate	Metals	Dissolved Metals
FC714-SS14-D-10C	1008049-28	soil	X	X	
FC714-SS29-10C	1008049-29	soil	X	X	
FC714-SS13-10C	1008049-30	soil	X	X	
FC714-FB-080310	1008049-31/-43	water	X	X	X
FC714-EB-080210-SS	1008049-32	water	X	X	
FC714-EB-080310-SS	1008049-33	water	X	X	
FC714-EB-080310-SD	1008049-34	water	X	X	
FC714-EB-080310-SW	1008049-35/-44	water	X	X	X
FC714-EB-080410-SS	1008049-36	water	X	X	
FC714-SD02-10C	1008049-37	soil	X	X	
FC714-SD02-D-10C	1008049-38	soil	X	X	
FC714-SD04-10C	1008049-39	soil	X	X	
FC714-SD05-10C	1008049-40	soil	X	X	
FC714-SD01-10C	1008049-41	soil	X	X	
FC714-SS24-10C	1008049-42	soil	X	X	
FC714-SS23-10C	1008049-45	soil	X	X	
FC714-SS09-10C	1008049-46	soil	X	X	
FC714-SS19-10C	1008049-47	soil	X	X	
FC714-SS22-10C	1008049-48	soil	X	X	
FC714-SS20-10C	1008049-49	soil	X	X	
FC714-SD06-10C	1008049-50	soil	X	X	
FC714-SD03-10C	1008049-51	soil	X	X	
FC714-SW01-10C	1008049-52/-53	water	X	X	X
FC714-SW05-10C	1008049-54/-55	water	X	X	X
FC714-SW03-10C	1008049-56/-57	water	X	X	X
FC714-SW01-D-10C	1008049-58/-59	water	X	X	X
FC714-SW02-10C	1008049-60/-61	water	X	X	X
FC714-SW06-10C	1008049-62/-63	water	X	X	X
FC714-SW04-10C	1008049-64/-65	water	X	X	X
FC714-SW06-10C MS	1008049-62/63-MS	water	X	X	X
FC714-SW06-10C MSD	1008049-62/-63MSD	water	X	X	X
FC714-SS01-10C MS	1008049-09MS	soil	X	X	
FC714-SS01-10C MSD	1008049-09MSD	soil	X	X	
FC714-SS21-10C MS	1008049-20MS	soil	X	X	
FC714-SS21-10C MSD	1008049-20MSD	soil	X	X	
FC714-SS27-10C MS	1008049-22MS	soil	X		
FC714-SS27-10C MSD	1008049-22MSD	soil	X		
FC714-SD06-10C MS	1008049-50MS	soil	X	X	
FC714-SD06-10C MSD	1008049-50MSD	soil	X	X	

The following quality control sample was provided with this SDG: sample FC714-SS03D-10C -field duplicate of sample FC714-SS03-10C; sample FC714-SS31-D-10-C - field duplicate of sample FC714-SS31-10-C; sample FC714-SS27D-10C- field duplicate of sample FC714-SS27D-10C; sample FC714-SS14-D-10C- filed duplicate of sample FC714-SS14-10C; sample FC714-SD02-D-10C- field duplicate of sample FC714-SD02-10C; sample FC714-SW01-D-10C- field duplicate of sample FC714-SW01-10C; samples FC714-EB-080210-SS, FC714-EB-080310-SS, FC714-EB-080310-SD, FC714-EB-080310-SW, and FC714-EB-080410-SS- equipment blanks; sample FC714-FB-080310- field blank.

The samples were evaluated based on the following criteria:

- Data Completeness *
- Technical Holding Times *
- HPLC Performance *
- Initial/Continuing Calibrations *
- CRI Standards *
- Interference Check Sample *
- Blanks *
- Internal Standards *
- Laboratory Control Samples *
- Matrix Spike Recoveries
- Matrix Duplicate RPDs *
- Post Digestion Spike Recoveries *
- Serial Dilutions *
- Field Duplicates
- Identification/Quantitation *
- Reporting Limits *

* - indicates that no qualifications were required based on this criteria

Overall Evaluation of Data/Potential Usability Issues

A summary of qualifications applied to the sample results are noted below for the fractions validated. Specific details regarding qualification of the data are addressed in the Specific Evaluation section of this narrative. If an issue is not addressed there were no actions required based on unmet quality criteria. When more than one qualifier is associated with a compound/analyte the validator has chosen the qualifier that best indicates possible bias in the results and flagged the data accordingly. However, information regarding all quality control issues is provided in the body of the report and on the qualification summary page. Please note that when a compound or analyte is flagged due to blank contamination the BL qualifier code takes precedence over all other qualifier codes except a code that explains rejected data.

Perchlorate

Two of the matrix spike and matrix spike duplicate pairs submitted exhibited low results; therefore native sample results were qualified as estimated.

Metals

The matrix spike recoveries in solid samples were low for one analyte. Qualifications were applied to the data.

One of the field duplicate pairs exhibited one non-compliant RPD and the analyte was qualified as estimated in the pair.

Specific Evaluation of Data

Data Completeness

The SDG was received complete and intact. Resubmissions were not required.

Technical Holding Times

According to chain of custody records, sampling was performed on 8/2-4/10 and samples were received at the laboratory 8/5/10. All sample preparation and analysis was performed within method holding time requirements.

Matrix Spikes

Perchlorate

The associated matrix spike pair exhibited non-compliant recoveries as noted below. The sample results were qualified as indicated.

MS/MSD	Compound	MS % Rec	MSD % Rec	% QC Limit	Q Flag	Q Code
FC714-SW06-10C	perchlorate	55.5	55.4	80-120	J/UJ	MSL
FC714-SD06-10C	perchlorate	61.1	61.6	80-120	J/UJ	MSL

Metals

The matrix spike analyses exhibited non-compliant %Rs. Specific action is noted in the following table.

MS/MSD	Analyte	Samples Affected	%R	Q Flag	Q Code
FC714-SS01-10C	antimony	all soil samples	41.5/43.7	J/UJ	MSL
FC714-SS21-10C	antimony		78.3/77.8		
FC714-SD06-10C	antimony		51.8/52.4		

Field Duplicates

Metals

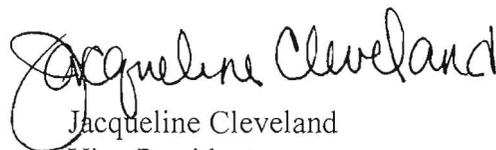
The field duplicate pair of samples FC714-SS27-10C and FC714-SS27D-10C exhibited one analyte with a non-compliant RPD, copper at 109%. Therefore copper was qualified as estimated J in the field duplicate pair with a qualifier code of FD.

A summary of qualifications required is provided on the following page. Please do not hesitate to contact DataQual ES with any questions regarding this validation report.

Sincerely,



Laura Maschhoff
President



Jacqueline Cleveland
Vice-President

Summary of Data Qualifications

Perchlorate

Sample ID	Compound	Results	Q-Flag	Q Code
FC714-SW06-10C	perchlorate	+/-	J/UJ	MSL
FC714-SD06-10C	perchlorate	+/-	J/UJ	MSL

Metals

Sample ID	Analyte	Results	Q-Flag	Q Code
all soil and sediment samples	antimony	+/-	J/UJ	MSL
FC714-SS27-10C and FC714-SS27D-10C	copper	+	J	FD

Glossary of Qualification Flags and Abbreviations

Qualification Flags (Q-Flags)

U	not detected above the reported sample quantitation limit
J	estimated value
UJ	reported quantitation limit is qualified as estimated
R	result is rejected; the presence or absence of the analyte cannot be verified
D	result value is based on dilution analysis result
NJ	analyte has been tentatively identified, estimated value
L	analyte present, biased low
UL	not detected, quantitation limit is probably higher
K	analyte present, biased high

Inorganic Field/Lab Blank Qualification Flags (Q-Flags)

NA	The sample result for the blank contaminant is greater than the sample RL and is greater than 5X (10X for common laboratory contaminants) the blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.
RL-U	The sample result for the blank contaminant is less than the sample RL and the result is raised to the RL and flagged U.
R or J+	The blank contaminant concentration was greater than the RL and the sample result is greater than the RL but less than 10X the blank contaminant concentration. The reported results are flagged either as rejected R or biased high J+ based on the professional judgment of the validator. (see NFG, Rev. date 10/04, p. 17 for extracted blanks (PB))

Organic Field/Lab Blank Qualification Flags (Q-Flags)

NA	The sample result for the blank contaminant is greater than the sample RL and is greater than 5X (10X for common laboratory contaminants) the blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.
RL-U	The sample result for the blank contaminant is less than the sample RL but is less than 5X (10X for common laboratory contaminants) the blank value, so the result is raised to the RL and flagged U.
U	The sample result for the blank contaminant is greater than the sample RL but is less than 5X (10X for common laboratory contaminants) the blank value, so the result is flagged U at the reported value.

General Abbreviations

RL	reporting limit
CRQL/CRDL	contract required quantitation/detection limit
Q Code	qualifier code
+	positive result
-	non-detect result

QUALIFIER CODE REFERENCE

Qualifier	Description
TN	Tune
BSL	Blank Spike/LCS - High Recovery
BSH	Blank Spike/LCS - Low Recovery
BD	Blank Spike/Blank Spike Duplicate (LCS/LCSD) Precision
BRL	Below Reporting Limit
ISL	Internal Standard - Low Recovery
ISH	Internal Standard - High Recovery
MSL	Matrix Spike and/or Matrix Spike Duplicate - Low Recovery
MSH	Matrix Spike and/or Matrix Spike Duplicate - High Recovery
MI	Matrix interference obscuring the raw data
MDP	Matrix Spike/Matrix Spike Duplicate Precision
2S	Second Source - Bad reproducibility between tandem detectors
SSL	Spiked Surrogate - Low Recovery
SSH	Spiked Surrogate - High Recovery
SD	Serial Dilution Reproducibility
ICL	Initial Calibration - Low Relative Response Factors (RRF)
ICH	Initial Calibration - High Relative Response Factors (RRF)
ICB	Initial Calibration - Bad Linearity or Curve Function
CCL	Continuing Calibration - Low Recovery or %Difference
CCH	Continuing Calibration - High Recovery or %Difference
LD	Lab Duplicate Reproducibility
HT	Holding Time
PD	Pesticide Degradation
2C	Second Column - Poor Dual Column Reproducibility
LR	Concentration Exceeds Linear Range
BL	Blank Contamination (MBL, TBL, EBL, FBL)
RE	Redundant Result - due to Re-analysis or Re-extraction
DL	Redundant Result - due to Dilution
FD	Field Duplicate
OT	Other - explained in data validation report
%SOL	High moisture content

ANALYSIS DATA SHEET

FC714-SS08-10C

Laboratory: Empirical Laboratories, LLC SDG: 1008049
 Client: CH2M Hill, Inc. Project: Lejeune CTO-133
 Matrix: Solid Laboratory ID: 1008049-05 File ID: PERC000072.D
 Sampled: 08/04/10 11:10 Prepared: 08/17/10 08:55 Analyzed: 08/25/10 12:37
 Solids: 71.15 Preparation: LCMS_PERC6850_S Dilution: 1
 Batch: 0H17011 Sequence: 0H23718 Calibration: 0235003 Instrument: LCMS1

CAS NO.	COMPOUND	CONC. (ug/Kg dry)	DL	LOD	LOQ	Q
14797-73-0	Perchlorate		0.843	1.41	2.81	U

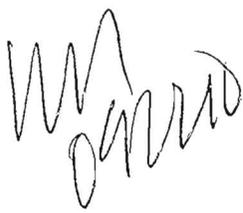
MM
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ANALYSIS DATA SHEET

FC714-SS18-10C

Laboratory:	<u>Empirical Laboratories, LLC</u>	SDG:	<u>1008049</u>
Client:	<u>CH2M Hill, Inc.</u>	Project:	<u>Lejeune CTO-133</u>
Matrix:	<u>Solid</u>	Laboratory ID:	<u>1008049-27</u>
Sampled:	<u>08/03/10 14:55</u>	Prepared:	<u>08/17/10 09:00</u>
Solids:	<u>78.05</u>	Preparation:	<u>LCMS PERC6850_S</u>
Batch:	<u>0H17012</u>	Sequence:	<u>0H23820</u>
		Calibration:	<u>0235003</u>
		Instrument:	<u>LCMS1</u>
		File ID:	<u>PERC000043.D</u>
		Analyzed:	<u>08/26/10 08:09</u>
		Dilution:	<u>1</u>

CAS NO.	COMPOUND	CONC. (ug/Kg dry)	DL	LOD	LOQ	Q
14797-73-0	Perchlorate		0.769	1.28	2.56	U



ANALYSIS DATA SHEET

FC714-SD02-10C

Laboratory: <u>Empirical Laboratories, LLC</u>	SDG: <u>1008049</u>	
Client: <u>CH2M Hill, Inc.</u>	Project: <u>Lejeune CTO-133</u>	
Matrix: <u>Solid</u>	Laboratory ID: <u>1008049-37</u>	File ID: <u>PERC000052.D</u>
Sampled: <u>08/03/10 11:30</u>	Prepared: <u>08/17/10 09:00</u>	Analyzed: <u>08/26/10 10:49</u>
Solids: <u>75.01</u>	Preparation: <u>LCMS_PERC6850_S</u>	Dilution: <u>1</u>
Batch: <u>0H17012</u>	Sequence: <u>0H23820</u>	Calibration: <u>0235003</u>
		Instrument: <u>LCMS1</u>

CAS NO.	COMPOUND	CONC. (ug/Kg dry)	DL	LOD	LOQ	Q
14797-73-0	Perchlorate		0.800	1.33	2.67	U

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045

ANALYSIS DATA SHEET

FC714-SS04-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-01

Sampled: 08/04/10 11:15

Received: 08/05/10 08:30

% Solids: 74.39

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.338	0.675	1.01	1	WJL MSL	SW6010B	0H18004	08/23/10 19:06
7440-38-2	Arsenic	0.395	0.203	0.405	0.473	1	J	SW6010B	0H18004	08/23/10 19:06
7440-50-8	Copper	1.10	0.338	0.540	1.35	1	J	SW6010B	0H18004	08/23/10 19:06
7439-92-1	Lead	7.83	0.101	0.203	0.675	1		SW6010B	0H18004	08/23/10 19:06
7440-66-6	Zinc	1.91	0.338	0.675	1.35	1		SW6010B	0H18004	08/23/10 19:06

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SS03-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/04/10 11:25
 % Solids: 76.08

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-02
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.332	0.664	0.996	1	<i>USM MEL</i>	SW6010B	0H18004	08/23/10 19:11
7440-38-2	Arsenic	0.874	0.199	0.398	0.465	1		SW6010B	0H18004	08/23/10 19:11
7440-50-8	Copper	0.780	0.332	0.531	1.33	1	J	SW6010B	0H18004	08/23/10 19:11
7439-92-1	Lead	11.9	0.0996	0.199	0.664	1		SW6010B	0H18004	08/23/10 19:11
7440-66-6	Zinc	5.12	0.332	0.664	1.33	1		SW6010B	0H18004	08/23/10 19:11

*QC
8/22/10*

ANALYSIS DATA SHEET

FC714-SS07-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/04/10 11:30
 % Solids: 76.82

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-03
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.329	0.657	0.986	1	<i>WJN MSL</i>	SW6010B	0H18004	08/23/10 19:15
7440-38-2	Arsenic	0.553	0.197	0.394	0.460	1		SW6010B	0H18004	08/23/10 19:15
7440-50-8	Copper	0.832	0.329	0.526	1.31	1	J	SW6010B	0H18004	08/23/10 19:15
7439-92-1	Lead	10.1	0.0986	0.197	0.657	1		SW6010B	0H18004	08/23/10 19:15
7440-66-6	Zinc	2.64	0.329	0.657	1.31	1		SW6010B	0H18004	08/23/10 19:15

WJN MSL
8/23/10

ANALYSIS DATA SHEET

FC714-SS15-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-04

Sampled: 08/04/10 10:35

Received: 08/05/10 08:30

% Solids: 88.34

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.280	0.560	0.841	1	<i>MSL</i>	SW6010B	0H18004	08/23/10 19:20
7440-38-2	Arsenic	0.851	0.168	0.336	0.392	1		SW6010B	0H18004	08/23/10 19:20
7440-50-8	Copper	0.848	0.280	0.448	1.12	1	J	SW6010B	0H18004	08/23/10 19:20
7439-92-1	Lead	9.09	0.0841	0.168	0.560	1		SW6010B	0H18004	08/23/10 19:20
7440-66-6	Zinc	2.42	0.280	0.560	1.12	1		SW6010B	0H18004	08/23/10 19:20

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ANALYSIS DATA SHEET

FC714-SS08-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/04/10 11:10
 % Solids: 71.15

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-05
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.353	0.706	1.06	1	<i>WJL+MSL</i>	SW6010B	0H18004	08/23/10 19:24
7440-38-2	Arsenic	0.535	0.212	0.424	0.494	1		SW6010B	0H18004	08/23/10 19:24
7440-50-8	Copper	1.66	0.353	0.565	1.41	1		SW6010B	0H18004	08/23/10 19:24
7439-92-1	Lead	8.96	0.106	0.212	0.706	1		SW6010B	0H18004	08/23/10 19:24
7440-66-6	Zinc	5.30	0.353	0.706	1.41	1		SW6010B	0H18004	08/23/10 19:24

JLC
9/22/10

ANALYSIS DATA SHEET

FC714-SS03D-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Leieune CTO-133

Matrix: Solid

Laboratory ID: 1008049-06

Sampled: 08/04/10 11:30

Received: 08/05/10 08:30

% Solids: 76.53

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.332	0.663	0.995	1	<i>WJL+MBL</i>	SW6010B	0H18004	08/23/10 19:29
7440-38-2	Arsenic	0.660	0.199	0.398	0.464	1		SW6010B	0H18004	08/23/10 19:29
7440-50-8	Copper	0.573	0.332	0.531	1.33	1	J	SW6010B	0H18004	08/23/10 19:29
7439-92-1	Lead	13.2	0.0995	0.199	0.663	1		SW6010B	0H18004	08/23/10 19:29
7440-66-6	Zinc	4.32	0.332	0.663	1.33	1		SW6010B	0H18004	08/23/10 19:29

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SS12-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-07

Sampled: 08/04/10 11:40

Received: 08/05/10 08:30

% Solids: 76.58

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.328	0.656	0.984	1	WITH MEL	SW6010B	0H18004	08/23/10 19:33
7440-38-2	Arsenic	0.732	0.197	0.394	0.459	1		SW6010B	0H18004	08/23/10 19:33
7440-50-8	Copper	0.655	0.328	0.525	1.31	1	J	SW6010B	0H18004	08/23/10 19:33
7439-92-1	Lead	8.73	0.0984	0.197	0.656	1		SW6010B	0H18004	08/23/10 19:33
7440-66-6	Zinc	3.08	0.328	0.656	1.31	1		SW6010B	0H18004	08/23/10 19:33

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SS16-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/04/10 10:45
 % Solids: 81.54

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-08
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.308	0.616	0.924	1	<i>USL MSL</i>	SW6010B	0H18004	08/23/10 19:38
7440-38-2	Arsenic	0.537	0.185	0.370	0.431	1		SW6010B	0H18004	08/23/10 19:38
7440-50-8	Copper	0.439	0.308	0.493	1.23	1	J	SW6010B	0H18004	08/23/10 19:38
7439-92-1	Lead	6.27	0.0924	0.185	0.616	1		SW6010B	0H18004	08/23/10 19:38
7440-66-6	Zinc	1.52	0.308	0.616	1.23	1		SW6010B	0H18004	08/23/10 19:38

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SS01-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-09

Sampled: 08/04/10 08:45

Received: 08/05/10 08:30

% Solids: 68.07

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.371	0.742	1.11	1	<i>WJL+ML</i>	SW6010B	0H18004	08/23/10 19:42
7440-38-2	Arsenic	1.62	0.223	0.445	0.519	1		SW6010B	0H18004	08/23/10 19:42
7440-50-8	Copper	252	0.371	0.594	1.48	1		SW6010B	0H18004	08/23/10 19:42
7439-92-1	Lead	24.0	0.111	0.223	0.742	1		SW6010B	0H18004	08/23/10 19:42
7440-66-6	Zinc	11.4	0.371	0.742	1.48	1		SW6010B	0H18004	08/23/10 19:42

*WJL
8/22/10*

ANALYSIS DATA SHEET

FC714-SS02-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/04/10 09:05
 % Solids: 85.95

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-10
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.292	0.585	0.877	1	<i>WJW mb</i>	SW6010B	0H18004	08/23/10 20:06
7440-38-2	Arsenic	0.298	0.175	0.351	0.409	1	J	SW6010B	0H18004	08/23/10 20:06
7440-50-8	Copper	0.731	0.292	0.468	1.17	1	J	SW6010B	0H18004	08/23/10 20:06
7439-92-1	Lead	6.09	0.0877	0.175	0.585	1		SW6010B	0H18004	08/23/10 20:06
7440-66-6	Zinc	3.24	0.292	0.585	1.17	1		SW6010B	0H18004	08/23/10 20:06

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SS05-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/04/10 09:00
 % Solids: 60.79

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-11
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.409	0.818	1.23	1	<i>WJN mbl</i>	SW6010B	0H18004	08/23/10 20:23
7440-38-2	Arsenic	0.847	0.246	0.491	0.573	1		SW6010B	0H18004	08/23/10 20:23
7440-50-8	Copper	4.38	0.409	0.655	1.64	1		SW6010B	0H18004	08/23/10 20:23
7439-92-1	Lead	16.5	0.123	0.246	0.818	1		SW6010B	0H18004	08/23/10 20:23
7440-66-6	Zinc	5.54	0.409	0.818	1.64	1		SW6010B	0H18004	08/23/10 20:23

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SS11-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/04/10 09:45
 % Solids: 75.65

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-12
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.332	0.664	0.996	1	<i>WJLH MBL</i>	SW6010B	0H18004	08/23/10 20:28
7440-38-2	Arsenic	1.01	0.199	0.399	0.465	1		SW6010B	0H18004	08/23/10 20:28
7440-50-8	Copper	1.82	0.332	0.531	1.33	1		SW6010B	0H18004	08/23/10 20:28
7439-92-1	Lead	13.4	0.0996	0.199	0.664	1		SW6010B	0H18004	08/23/10 20:28
7440-66-6	Zinc	7.69	0.332	0.664	1.33	1		SW6010B	0H18004	08/23/10 20:28

*QAC
9/22/10*

076

ANALYSIS DATA SHEET

FC714-SS25-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/04/10 07:50
 % Solids: 87.61

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-13
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.291	0.582	0.874	1	<i>USL + MBL</i>	SW6010B	0H18004	08/23/10 20:32
7440-38-2	Arsenic	0.359	0.175	0.349	0.408	1	J	SW6010B	0H18004	08/23/10 20:32
7440-50-8	Copper	1.10	0.291	0.466	1.16	1	J	SW6010B	0H18004	08/23/10 20:32
7439-92-1	Lead	5.71	0.0874	0.175	0.582	1		SW6010B	0H18004	08/23/10 20:32
7440-66-6	Zinc	3.20	0.291	0.582	1.16	1		SW6010B	0H18004	08/23/10 20:32

*JAC
9/22/10*

ANALYSIS DATA SHEET

FC714-SS17-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/04/10 08:00
 % Solids: 94.49

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-14
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.267	0.535	0.802	1	WJL <i>MSL</i>	SW6010B	0H18004	08/23/10 20:37
7440-38-2	Arsenic	0.377	0.160	0.321	0.374	1		SW6010B	0H18004	08/23/10 20:37
7440-50-8	Copper	0.839	0.267	0.428	1.07	1	J	SW6010B	0H18004	08/23/10 20:37
7439-92-1	Lead	15.2	0.0802	0.160	0.535	1		SW6010B	0H18004	08/23/10 20:37
7440-66-6	Zinc	2.87	0.267	0.535	1.07	1		SW6010B	0H18004	08/23/10 20:37

JAC
8/22/10

ANALYSIS DATA SHEET

FC714-SS10-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-15

Sampled: 08/04/10 09:20

Received: 08/05/10 08:30

% Solids: 65.76

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony	0.918	0.376	0.753	1.13	1	<i>JLA ml</i>	SW6010B	0H18004	08/23/10 20:41
7440-38-2	Arsenic	0.485	0.226	0.452	0.527	1	J	SW6010B	0H18004	08/23/10 20:41
7440-50-8	Copper	1.19	0.376	0.602	1.51	1	J	SW6010B	0H18004	08/23/10 20:41
7439-92-1	Lead	6.34	0.113	0.226	0.753	1		SW6010B	0H18004	08/23/10 20:41
7440-66-6	Zinc	9.52	0.376	0.753	1.51	1		SW6010B	0H18004	08/23/10 20:41

*JLA
9/22/10*

ANALYSIS DATA SHEET

FC714-SS06-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/04/10 09:30
 % Solids: 89.60

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-16
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.278	0.555	0.833	1	<i>WJN MEL</i>	SW6010B	0H18004	08/23/10 20:46
7440-38-2	Arsenic	0.372	0.167	0.333	0.389	1	J	SW6010B	0H18004	08/23/10 20:46
7440-50-8	Copper	0.780	0.278	0.444	1.11	1	J	SW6010B	0H18004	08/23/10 20:46
7439-92-1	Lead	7.65	0.0833	0.167	0.555	1		SW6010B	0H18004	08/23/10 20:46
7440-66-6	Zinc	2.46	0.278	0.555	1.11	1		SW6010B	0H18004	08/23/10 20:46

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SS28-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-17

Sampled: 08/02/10 15:25

Received: 08/05/10 08:30

% Solids: 64.05

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.398	0.797	1.19	1	<i>WJL msl</i>	SW6010B	0H18004	08/23/10 20:50
7440-38-2	Arsenic	0.640	0.239	0.478	0.558	1		SW6010B	0H18004	08/23/10 20:50
7440-50-8	Copper	3.38	0.398	0.637	1.59	1		SW6010B	0H18004	08/23/10 20:50
7439-92-1	Lead	8.77	0.119	0.239	0.797	1		SW6010B	0H18004	08/23/10 20:50
7440-66-6	Zinc	10.5	0.398	0.797	1.59	1		SW6010B	0H18004	08/23/10 20:50

JAC
9/22/10

081

ANALYSIS DATA SHEET

FC714-SS31-D-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-18

Sampled: 08/03/10 14:10

Received: 08/05/10 08:30

% Solids: 88.00

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.277	0.554	0.831	1	<i>WJL msl</i>	SW6010B	0H18004	08/23/10 20:55
7440-38-2	Arsenic	0.487	0.166	0.333	0.388	1		SW6010B	0H18004	08/23/10 20:55
7440-50-8	Copper	1.30	0.277	0.443	1.11	1		SW6010B	0H18004	08/23/10 20:55
7439-92-1	Lead	8.99	0.0831	0.166	0.554	1		SW6010B	0H18004	08/23/10 20:55
7440-66-6	Zinc	4.34	0.277	0.554	1.11	1		SW6010B	0H18004	08/23/10 20:55

JLC
9/22/10

ANALYSIS DATA SHEET

FC714-SS30-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-19

Sampled: 08/03/10 14:30

Received: 08/05/10 08:30

% Solids: 84.18

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.296	0.591	0.887	1	<i>WJL MSL</i>	SW6010B	0H18004	08/23/10 20:59
7440-38-2	Arsenic	0.295	0.177	0.355	0.414	1	J	SW6010B	0H18004	08/23/10 20:59
7440-50-8	Copper	0.620	0.296	0.473	1.18	1	J	SW6010B	0H18004	08/23/10 20:59
7439-92-1	Lead	5.10	0.0887	0.177	0.591	1		SW6010B	0H18004	08/23/10 20:59
7440-66-6	Zinc	2.83	0.296	0.591	1.18	1		SW6010B	0H18004	08/23/10 20:59

JMC
8/23/10

ANALYSIS DATA SHEET

FC714-SS21-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/03/10 15:05
 % Solids: 71.09

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-20
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.355	0.710	1.07	1	<i>WJW msl</i>	SW6010B	0H18005	08/23/10 21:32
7440-38-2	Arsenic	0.679	0.213	0.426	0.497	1		SW6010B	0H18005	08/23/10 21:32
7440-50-8	Copper	2.48	0.355	0.568	1.42	1		SW6010B	0H18005	08/23/10 21:32
7439-92-1	Lead	14.3	0.107	0.213	0.710	1		SW6010B	0H18005	08/23/10 21:32
7440-66-6	Zinc	5.49	0.355	0.710	1.42	1		SW6010B	0H18005	08/23/10 21:32

*JMC
9/22/10*

ANALYSIS DATA SHEET

FC714-SS27-D-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-21

Sampled: 08/03/10 14:10

Received: 08/05/10 08:30

% Solids: 71.85

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.341	0.682	1.02	1	WLM SL	SW6010B	0H18004	08/23/10 21:04
7440-38-2	Arsenic	0.300	0.205	0.409	0.478	1	J	SW6010B	0H18004	08/23/10 21:04
7440-50-8	Copper	2.52	0.341	0.546	1.36	1	JFD	SW6010B	0H18004	08/23/10 21:04
7439-92-1	Lead	4.38	0.102	0.205	0.682	1		SW6010B	0H18004	08/23/10 21:04
7440-66-6	Zinc	4.21	0.341	0.682	1.36	1		SW6010B	0H18004	08/23/10 21:04

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SS27-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-22

Sampled: 08/03/10 14:05

Received: 08/05/10 08:30

% Solids: 89.59

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.274	0.547	0.821	1	WJH MSL	SW6010B	0H18005	08/23/10 21:55
7440-38-2	Arsenic	0.298	0.164	0.328	0.383	1	J	SW6010B	0H18005	08/23/10 21:55
7440-50-8	Copper	8.50	0.274	0.438	1.09	1	JFD	SW6010B	0H18005	08/23/10 21:55
7439-92-1	Lead	3.75	0.0821	0.164	0.547	1		SW6010B	0H18005	08/23/10 21:55
7440-66-6	Zinc	3.37	0.274	0.547	1.09	1		SW6010B	0H18005	08/23/10 21:55

JAC
8/22/10

ANALYSIS DATA SHEET

FC714-SS26-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-23

Sampled: 08/03/10 14:40

Received: 08/05/10 08:30

% Solids: 86.39

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.294	0.588	0.881	1	WJH MSL	SW6010B	0H18005	08/23/10 22:00
7440-38-2	Arsenic	0.397	0.176	0.353	0.411	1	J	SW6010B	0H18005	08/23/10 22:00
7440-50-8	Copper	1.41	0.294	0.470	1.18	1		SW6010B	0H18005	08/23/10 22:00
7439-92-1	Lead	11.8	0.0881	0.176	0.588	1		SW6010B	0H18005	08/23/10 22:00
7440-66-6	Zinc	4.22	0.294	0.588	1.18	1		SW6010B	0H18005	08/23/10 22:00

JAC
9/22/10

087

ANALYSIS DATA SHEET

FC714-SS32-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-24

Sampled: 08/03/10 14:25

Received: 08/05/10 08:30

% Solids: 83.69

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.294	0.589	0.883	1	USL MSL	SW6010B	0H18005	08/23/10 22:05
7440-38-2	Arsenic	0.631	0.177	0.353	0.412	1		SW6010B	0H18005	08/23/10 22:05
7440-50-8	Copper	2.47	0.294	0.471	1.18	1		SW6010B	0H18005	08/23/10 22:05
7439-92-1	Lead	9.72	0.0883	0.177	0.589	1		SW6010B	0H18005	08/23/10 22:05
7440-66-6	Zinc	4.52	0.294	0.589	1.18	1		SW6010B	0H18005	08/23/10 22:05

MSL
8/22/10

ANALYSIS DATA SHEET

FC714-SS31-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/03/10 14:05
 % Solids: 86.42

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-25
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.286	0.573	0.859	1	<i>WJH MBL</i>	SW6010B	0H18005	08/23/10 22:09
7440-38-2	Arsenic	0.545	0.172	0.344	0.401	1		SW6010B	0H18005	08/23/10 22:09
7440-50-8	Copper	1.24	0.286	0.458	1.15	1		SW6010B	0H18005	08/23/10 22:09
7439-92-1	Lead	8.02	0.0859	0.172	0.573	1		SW6010B	0H18005	08/23/10 22:09
7440-66-6	Zinc	4.12	0.286	0.573	1.15	1		SW6010B	0H18005	08/23/10 22:09

JAC
8/22/10

ANALYSIS DATA SHEET

FC714-SS14-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/04/10 09:45
 % Solids: 91.84

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-26
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.271	0.542	0.813	1	<i>WJMSL</i>	SW6010B	0H18005	08/23/10 22:14
7440-38-2	Arsenic	0.544	0.163	0.325	0.379	1		SW6010B	0H18005	08/23/10 22:14
7440-50-8	Copper	0.418	0.271	0.433	1.08	1	J	SW6010B	0H18005	08/23/10 22:14
7439-92-1	Lead	5.46	0.0813	0.163	0.542	1		SW6010B	0H18005	08/23/10 22:14
7440-66-6	Zinc	2.18	0.271	0.542	1.08	1		SW6010B	0H18005	08/23/10 22:14

WJMSL
9/22/10

ANALYSIS DATA SHEET

FC714-SS18-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-27

Sampled: 08/03/10 14:55

Received: 08/05/10 08:30

% Solids: 78.05

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.320	0.641	0.961	1	<i>WJL/MBL</i>	SW6010B	0H18005	08/23/10 22:18
7440-38-2	Arsenic	0.360	0.192	0.384	0.448	1	J	SW6010B	0H18005	08/23/10 22:18
7440-50-8	Copper	2.00	0.320	0.513	1.28	1		SW6010B	0H18005	08/23/10 22:18
7439-92-1	Lead	7.46	0.0961	0.192	0.641	1		SW6010B	0H18005	08/23/10 22:18
7440-66-6	Zinc	3.78	0.320	0.641	1.28	1		SW6010B	0H18005	08/23/10 22:18

JJC
9/22/10

ANALYSIS DATA SHEET

FC714-SS14-D-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/04/10 09:50
 % Solids: 91.98

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-28
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.272	0.544	0.815	1	<i>Just MSL</i>	SW6010B	0H18005	08/23/10 22:23
7440-38-2	Arsenic	0.512	0.163	0.326	0.381	1		SW6010B	0H18005	08/23/10 22:23
7440-50-8	Copper	0.472	0.272	0.435	1.09	1	J	SW6010B	0H18005	08/23/10 22:23
7439-92-1	Lead	5.28	0.0815	0.163	0.544	1		SW6010B	0H18005	08/23/10 22:23
7440-66-6	Zinc	2.14	0.272	0.544	1.09	1		SW6010B	0H18005	08/23/10 22:23

JLC
9/22/10

ANALYSIS DATA SHEET

FC714-SS29-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-29

Sampled: 08/04/10 07:50

Received: 08/05/10 08:30

% Solids: 73.99

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.330	0.659	0.989	1	<i>WJMSL</i>	SW6010B	0H18005	08/23/10 22:27
7440-38-2	Arsenic	0.641	0.198	0.396	0.461	1		SW6010B	0H18005	08/23/10 22:27
7440-50-8	Copper	0.493	0.330	0.527	1.32	1	J	SW6010B	0H18005	08/23/10 22:27
7439-92-1	Lead	6.90	0.0989	0.198	0.659	1		SW6010B	0H18005	08/23/10 22:27
7440-66-6	Zinc	2.52	0.330	0.659	1.32	1		SW6010B	0H18005	08/23/10 22:27

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SS13-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/04/10 08:05
 % Solids: 79.19

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-30
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.322	0.644	0.966	1	<i>WJH MBL</i>	SW6010B	0H18005	08/23/10 22:32
7440-38-2	Arsenic	0.293	0.193	0.387	0.451	1	J	SW6010B	0H18005	08/23/10 22:32
7440-50-8	Copper	1.77	0.322	0.515	1.29	1		SW6010B	0H18005	08/23/10 22:32
7439-92-1	Lead	7.49	0.0966	0.193	0.644	1		SW6010B	0H18005	08/23/10 22:32
7440-66-6	Zinc	4.34	0.322	0.644	1.29	1		SW6010B	0H18005	08/23/10 22:32

*JAC
9/22/10*

ANALYSIS DATA SHEET

FC714-FB-080310

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Water
 Sampled: 08/03/10 15:35
 % Solids: 0.00

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-31
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U	SW6010B	0H16019	08/23/10 15:47
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0H16019	08/23/10 15:47
7440-50-8	Copper		1.25	2.50	6.00	1	U	SW6010B	0H16019	08/23/10 15:47
7439-92-1	Lead		0.375	0.750	1.25	1	U	SW6010B	0H16019	08/23/10 15:47
7440-66-6	Zinc		1.25	2.50	5.00	1	U	SW6010B	0H16019	08/23/10 15:47

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-EB-080210-SS

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Water
 Sampled: 08/02/10 16:40
 % Solids: 0.00

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-32
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U	SW6010B	0H16019	08/23/10 15:52
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0H16019	08/23/10 15:52
7440-50-8	Copper		1.25	2.50	6.00	1	U	SW6010B	0H16019	08/23/10 15:52
7439-92-1	Lead		0.375	0.750	1.25	1	U	SW6010B	0H16019	08/23/10 15:52
7440-66-6	Zinc	1.63	1.25	2.50	5.00	1	J	SW6010B	0H16019	08/23/10 15:52

JJC
92210

ANALYSIS DATA SHEET

FC714-EB-080310-SS

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Water

Laboratory ID: 1008049-33

Sampled: 08/03/10 15:50

Received: 08/05/10 08:30

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U	SW6010B	0H16019	08/23/10 15:57
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0H16019	08/23/10 15:57
7440-50-8	Copper		1.25	2.50	6.00	1	U	SW6010B	0H16019	08/23/10 15:57
7439-92-1	Lead		0.375	0.750	1.25	1	U	SW6010B	0H16019	08/23/10 15:57
7440-66-6	Zinc	2.22	1.25	2.50	5.00	1	J	SW6010B	0H16019	08/23/10 15:57

JAC
92210

097

ANALYSIS DATA SHEET

FC714-EB-080310-SD

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Water

Laboratory ID: 1008049-34

Sampled: 08/03/10 15:55

Received: 08/05/10 08:30

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	I	U	SW6010B	0H16019	08/23/10 16:01
7440-38-2	Arsenic		0.500	1.25	1.50	I	U	SW6010B	0H16019	08/23/10 16:01
7440-50-8	Copper		1.25	2.50	6.00	I	U	SW6010B	0H16019	08/23/10 16:01
7439-92-1	Lead		0.375	0.750	1.25	I	U	SW6010B	0H16019	08/23/10 16:01
7440-66-6	Zinc	3.66	1.25	2.50	5.00	I	J	SW6010B	0H16019	08/23/10 16:01

Handwritten signature and date:
JAC
8/23/10

ANALYSIS DATA SHEET

FC714-EB-080310-SW

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Water

Laboratory ID: 1008049-35

Sampled: 08/03/10 15:40

Received: 08/05/10 08:30

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U	SW6010B	0H16019	08/23/10 16:06
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0H16019	08/23/10 16:06
7440-50-8	Copper		1.25	2.50	6.00	1	U	SW6010B	0H16019	08/23/10 16:06
7439-92-1	Lead		0.375	0.750	1.25	1	U	SW6010B	0H16019	08/23/10 16:06
7440-66-6	Zinc		1.25	2.50	5.00	1	U	SW6010B	0H16019	08/23/10 16:06

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-EB-080410-SS

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Water
 Sampled: 08/04/10 14:00
 % Solids: 0.00

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-36
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U	SW6010B	0H16019	08/23/10 16:11
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0H16019	08/23/10 16:11
7440-50-8	Copper		1.25	2.50	6.00	1	U	SW6010B	0H16019	08/23/10 16:11
7439-92-1	Lead		0.375	0.750	1.25	1	U	SW6010B	0H16019	08/23/10 16:11
7440-66-6	Zinc	1.56	1.25	2.50	5.00	1	J	SW6010B	0H16019	08/23/10 16:11

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SD02-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-37

Sampled: 08/03/10 11:30

Received: 08/05/10 08:30

% Solids: 75.01

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.320	0.641	0.961	1	<i>WJLH MSL</i>	SW6010B	0H18005	08/23/10 22:49
7440-38-2	Arsenic	0.303	0.192	0.385	0.449	1	J	SW6010B	0H18005	08/23/10 22:49
7440-50-8	Copper	1.43	0.320	0.513	1.28	1		SW6010B	0H18005	08/23/10 22:49
7439-92-1	Lead	8.24	0.0961	0.192	0.641	1		SW6010B	0H18005	08/23/10 22:49
7440-66-6	Zinc	1.86	0.320	0.641	1.28	1		SW6010B	0H18005	08/23/10 22:49

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SD02-D-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-38

Sampled: 08/03/10 11:35

Received: 08/05/10 08:30

% Solids: 73.03

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.337	0.675	1.01	1	WJLN MSL	SW6010B	0H18005	08/23/10 22:54
7440-38-2	Arsenic	0.412	0.202	0.405	0.472	1	J	SW6010B	0H18005	08/23/10 22:54
7440-50-8	Copper	1.60	0.337	0.540	1.35	1		SW6010B	0H18005	08/23/10 22:54
7439-92-1	Lead	10.4	0.101	0.202	0.675	1		SW6010B	0H18005	08/23/10 22:54
7440-66-6	Zinc	2.64	0.337	0.675	1.35	1		SW6010B	0H18005	08/23/10 22:54

JAC
08/23/10

ANALYSIS DATA SHEET

FC714-SD04-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-39

Sampled: 08/03/10 09:35

Received: 08/05/10 08:30

% Solids: 32.76

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.727	1.45	2.18	1	MSL MSL	SW6010B	0H18005	08/23/10 22:58
7440-38-2	Arsenic	9.32	0.436	0.872	1.02	1		SW6010B	0H18005	08/23/10 22:58
7440-50-8	Copper	3.33	0.727	1.16	2.91	1		SW6010B	0H18005	08/23/10 22:58
7439-92-1	Lead	4.87	0.218	0.436	1.45	1		SW6010B	0H18005	08/23/10 22:58
7440-66-6	Zinc	121	0.727	1.45	2.91	1		SW6010B	0H18005	08/23/10 22:58

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SD05-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-40

Sampled: 08/03/10 09:50

Received: 08/05/10 08:30

% Solids: 10.92

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		2.26	4.51	6.77	1	<i>WJMSL</i>	SW6010B	0H18005	08/23/10 23:03
7440-38-2	Arsenic	18.6	1.35	2.71	3.16	1		SW6010B	0H18005	08/23/10 23:03
7440-50-8	Copper	14.6	2.26	3.61	9.02	1		SW6010B	0H18005	08/23/10 23:03
7439-92-1	Lead	20.6	0.677	1.35	4.51	1		SW6010B	0H18005	08/23/10 23:03
7440-66-6	Zinc	366	2.26	4.51	9.02	1		SW6010B	0H18005	08/23/10 23:03

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SD01-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Laboratory ID: 1008049-41

Sampled: 08/03/10 10:55

Received: 08/05/10 08:30

% Solids: 75.23

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.329	0.658	0.987	1	<i>WJL msl</i>	SW6010B	0H18005	08/23/10 23:07
7440-38-2	Arsenic	0.338	0.197	0.395	0.461	1	J	SW6010B	0H18005	08/23/10 23:07
7440-50-8	Copper	2.54	0.329	0.526	1.32	1		SW6010B	0H18005	08/23/10 23:07
7439-92-1	Lead	5.81	0.0987	0.197	0.658	1		SW6010B	0H18005	08/23/10 23:07
7440-66-6	Zinc	3.51	0.329	0.658	1.32	1		SW6010B	0H18005	08/23/10 23:07

*JAC
9/22/10*

ANALYSIS DATA SHEET

FC714-SS24-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/02/10 15:36
 % Solids: 84.33

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-42
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.284	0.567	0.851	1	<i>UJLHMSL</i>	SW6010B	0H18005	08/23/10 23:12
7440-38-2	Arsenic	0.280	0.170	0.340	0.397	1	J	SW6010B	0H18005	08/23/10 23:12
7440-50-8	Copper	0.574	0.284	0.454	1.13	1	J	SW6010B	0H18005	08/23/10 23:12
7439-92-1	Lead	5.75	0.0851	0.170	0.567	1		SW6010B	0H18005	08/23/10 23:12
7440-66-6	Zinc	4.22	0.284	0.567	1.13	1		SW6010B	0H18005	08/23/10 23:12

JAC
92210

ANALYSIS DATA SHEET

FC714-FB-080310

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Water

Laboratory ID: 1008049-43

Sampled: 08/03/10 15:35

Received: 08/05/10 08:30

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	U	SW6010B	0H16019	08/23/10 16:15
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0H16019	08/23/10 16:15
7440-50-8	Copper (dissolved)		1.25	2.50	6.00	1	U	SW6010B	0H16019	08/23/10 16:15
7439-92-1	Lead (dissolved)		0.375	0.750	1.25	1	U	SW6010B	0H16019	08/23/10 16:15
7440-66-6	Zinc (dissolved)		1.25	2.50	5.00	1	U	SW6010B	0H16019	08/23/10 16:15

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-EB-080310-SW

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Water

Laboratory ID: 1008049-44

Sampled: 08/03/10 15:40

Received: 08/05/10 08:30

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	U	SW6010B	0H16019	08/23/10 16:20
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0H16019	08/23/10 16:20
7440-50-8	Copper (dissolved)		1.25	2.50	6.00	1	U	SW6010B	0H16019	08/23/10 16:20
7439-92-1	Lead (dissolved)		0.375	0.750	1.25	1	U	SW6010B	0H16019	08/23/10 16:20
7440-66-6	Zinc (dissolved)		1.25	2.50	5.00	1	U	SW6010B	0H16019	08/23/10 16:20

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08/21/10

ANALYSIS DATA SHEET

FC714-SS23-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/02/10 15:35
 % Solids: 86.18

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-45
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.295	0.589	0.884	1	<i>UJ + MSL</i>	SW6010B	0H18005	08/23/10 23:16
7440-38-2	Arsenic	0.352	0.177	0.353	0.412	1	J	SW6010B	0H18005	08/23/10 23:16
7440-50-8	Copper	0.789	0.295	0.471	1.18	1	J	SW6010B	0H18005	08/23/10 23:16
7439-92-1	Lead	13.7	0.0884	0.177	0.589	1		SW6010B	0H18005	08/23/10 23:16
7440-66-6	Zinc	5.67	0.295	0.589	1.18	1		SW6010B	0H18005	08/23/10 23:16

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SS09-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/04/10 08:30
 % Solids: 84.76

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-46
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.296	0.593	0.889	1	<i>UJLMSL</i>	SW6010B	0H18005	08/23/10 23:21
7440-38-2	Arsenic	0.344	0.178	0.356	0.415	1	J	SW6010B	0H18005	08/23/10 23:21
7440-50-8	Copper	0.738	0.296	0.474	1.19	1	J	SW6010B	0H18005	08/23/10 23:21
7439-92-1	Lead	6.99	0.0889	0.178	0.593	1		SW6010B	0H18005	08/23/10 23:21
7440-66-6	Zinc	2.81	0.296	0.593	1.19	1		SW6010B	0H18005	08/23/10 23:21

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SS19-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/02/10 15:45
 % Solids: 61.29

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-47
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.418	0.837	1.26	1	UJL+MSL	SW6010B	0H18005	08/23/10 23:25
7440-38-2	Arsenic	0.439	0.251	0.502	0.586	1	J	SW6010B	0H18005	08/23/10 23:25
7440-50-8	Copper	3.77	0.418	0.669	1.67	1		SW6010B	0H18005	08/23/10 23:25
7439-92-1	Lead	11.5	0.126	0.251	0.837	1		SW6010B	0H18005	08/23/10 23:25
7440-66-6	Zinc	8.46	0.418	0.837	1.67	1		SW6010B	0H18005	08/23/10 23:25

JAC
92210

ANALYSIS DATA SHEET

FC714-SS22-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/03/10 14:45
 % Solids: 85.79

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-48
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.293	0.586	0.879	1	UJL MSL	SW6010B	0H18005	08/23/10 23:30
7440-38-2	Arsenic	0.229	0.176	0.351	0.410	1	J	SW6010B	0H18005	08/23/10 23:30
7440-50-8	Copper	2.81	0.293	0.469	1.17	1		SW6010B	0H18005	08/23/10 23:30
7439-92-1	Lead	5.01	0.0879	0.176	0.586	1		SW6010B	0H18005	08/23/10 23:30
7440-66-6	Zinc	3.94	0.293	0.586	1.17	1		SW6010B	0H18005	08/23/10 23:30

JLC
92210

ANALYSIS DATA SHEET

FC714-SS20-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/02/10 15:50
 % Solids: 88.18

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-49
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.289	0.579	0.868	1	UJH MSL	SW6010B	0H18006	08/23/10 23:58
7440-38-2	Arsenic	0.634	0.174	0.347	0.405	1		SW6010B	0H18006	08/23/10 23:58
7440-50-8	Copper	0.544	0.289	0.463	1.16	1	J	SW6010B	0H18006	08/23/10 23:58
7439-92-1	Lead	7.47	0.0868	0.174	0.579	1		SW6010B	0H18006	08/23/10 23:58
7440-66-6	Zinc	3.01	0.289	0.579	1.16	1		SW6010B	0H18006	08/23/10 23:58

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SD06-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/03/10 10:10
 % Solids: 13.29

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-50
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.92	3.84	5.76	1	UJLMSL	SW6010B	0H18006	08/24/10 00:03
7440-38-2	Arsenic	8.80	1.15	2.30	2.69	1		SW6010B	0H18006	08/24/10 00:03
7440-50-8	Copper	10.2	1.92	3.07	7.68	1		SW6010B	0H18006	08/24/10 00:03
7439-92-1	Lead	21.9	0.576	1.15	3.84	1		SW6010B	0H18006	08/24/10 00:03
7440-66-6	Zinc	238	1.92	3.84	7.68	1		SW6010B	0H18006	08/24/10 00:03

JAC
08210

ANALYSIS DATA SHEET

FC714-SD03-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Sampled: 08/03/10 11:55
 % Solids: 69.89

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-51
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (mg/Kg dry)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		0.341	0.681	1.02	1	<i>WJH MSL</i>	SW6010B	0H18006	08/24/10 00:26
7440-38-2	Arsenic	0.485	0.204	0.409	0.477	1		SW6010B	0H18006	08/24/10 00:26
7440-50-8	Copper	2.38	0.341	0.545	1.36	1		SW6010B	0H18006	08/24/10 00:26
7439-92-1	Lead	10.8	0.102	0.204	0.681	1		SW6010B	0H18006	08/24/10 00:26
7440-66-6	Zinc	4.90	0.341	0.681	1.36	1		SW6010B	0H18006	08/24/10 00:26

JAC
92210

ANALYSIS DATA SHEET

FC714-SW01-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Water
 Sampled: 08/03/10 11:00
 % Solids: 0.00

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-52
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U	SW6010B	0H16019	08/23/10 16:24
7440-38-2	Arsenic	0.639	0.500	1.25	1.50	1	J	SW6010B	0H16019	08/23/10 16:24
7440-50-8	Copper		1.25	2.50	6.00	1	U	SW6010B	0H16019	08/23/10 16:24
7439-92-1	Lead	1.15	0.375	0.750	1.25	1	J	SW6010B	0H16019	08/23/10 16:24
7440-66-6	Zinc		1.25	2.50	5.00	1	U	SW6010B	0H16019	08/23/10 16:24

JAC
08/23/10

ANALYSIS DATA SHEET

FC714-SW01-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Water
 Sampled: 08/03/10 11:00
 % Solids: 0.00

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-53
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	U	SW6010B	0H16019	08/23/10 16:29
7440-38-2	Arsenic (dissolved)	0.509	0.500	1.25	1.50	1	J	SW6010B	0H16019	08/23/10 16:29
7440-50-8	Copper (dissolved)		1.25	2.50	6.00	1	U	SW6010B	0H16019	08/23/10 16:29
7439-92-1	Lead (dissolved)	0.386	0.375	0.750	1.25	1	J	SW6010B	0H16019	08/23/10 16:29
7440-66-6	Zinc (dissolved)		1.25	2.50	5.00	1	U	SW6010B	0H16019	08/23/10 16:29

JAC
92210

ANALYSIS DATA SHEET

FC714-SW05-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Water

Laboratory ID: 1008049-54

Sampled: 08/03/10 09:55

Received: 08/05/10 08:30

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U	SW6010B	0H16019	08/23/10 16:46
7440-38-2	Arsenic	14.5	0.500	1.25	1.50	1		SW6010B	0H16019	08/23/10 16:46
7440-50-8	Copper	6.54	1.25	2.50	6.00	1		SW6010B	0H16019	08/23/10 16:46
7439-92-1	Lead	8.87	0.375	0.750	1.25	1		SW6010B	0H16019	08/23/10 16:46
7440-66-6	Zinc	179	1.25	2.50	5.00	1		SW6010B	0H16019	08/23/10 16:46

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SW05-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Water
 Sampled: 08/03/10 09:55
 % Solids: 0.00

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-55
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	I	U	SW6010B	0H16019	08/23/10 16:51
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	I	U	SW6010B	0H16019	08/23/10 16:51
7440-50-8	Copper (dissolved)		1.25	2.50	6.00	I	U	SW6010B	0H16019	08/23/10 16:51
7439-92-1	Lead (dissolved)		0.375	0.750	1.25	I	U	SW6010B	0H16019	08/23/10 16:51
7440-66-6	Zinc (dissolved)	1.48	1.25	2.50	5.00	I	J	SW6010B	0H16019	08/23/10 16:51

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SW03-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Water
 Sampled: 08/03/10 12:00
 % Solids: 0.00

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-56
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U	SW6010B	0H16019	08/23/10 16:55
7440-38-2	Arsenic	0.718	0.500	1.25	1.50	1	J	SW6010B	0H16019	08/23/10 16:55
7440-50-8	Copper		1.25	2.50	6.00	1	U	SW6010B	0H16019	08/23/10 16:55
7439-92-1	Lead	0.617	0.375	0.750	1.25	1	J	SW6010B	0H16019	08/23/10 16:55
7440-66-6	Zinc		1.25	2.50	5.00	1	U	SW6010B	0H16019	08/23/10 16:55

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SW03-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Water

Laboratory ID: 1008049-57

Sampled: 08/03/10 12:00

Received: 08/05/10 08:30

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	U	SW6010B	0H16019	08/23/10 17:00
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0H16019	08/23/10 17:00
7440-50-8	Copper (dissolved)		1.25	2.50	6.00	1	U	SW6010B	0H16019	08/23/10 17:00
7439-92-1	Lead (dissolved)	0.508	0.375	0.750	1.25	1	J	SW6010B	0H16019	08/23/10 17:00
7440-66-6	Zinc (dissolved)		1.25	2.50	5.00	1	U	SW6010B	0H16019	08/23/10 17:00

JAC
9/22/10

ANALYSIS DATA SHEET

FC714-SW01-D-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Water
 Sampled: 08/03/10 11:05
 % Solids: 0.00

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-58
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	I	U	SW6010B	0H16019	08/23/10 17:05
7440-38-2	Arsenic	1.19	0.500	1.25	1.50	I	J	SW6010B	0H16019	08/23/10 17:05
7440-50-8	Copper	1.63	1.25	2.50	6.00	I	J	SW6010B	0H16019	08/23/10 17:05
7439-92-1	Lead	1.93	0.375	0.750	1.25	I		SW6010B	0H16019	08/23/10 17:05
7440-66-6	Zinc	4.63	1.25	2.50	5.00	I	J	SW6010B	0H16019	08/23/10 17:05

JAC
9/2/10

ANALYSIS DATA SHEET

FC714-SW01-D-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Water
 Sampled: 08/03/10 11:05
 % Solids: 0.00

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-59
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	U	SW6010B	0H16019	08/23/10 17:09
7440-38-2	Arsenic (dissolved)	0.817	0.500	1.25	1.50	1	J	SW6010B	0H16019	08/23/10 17:09
7440-50-8	Copper (dissolved)		1.25	2.50	6.00	1	U	SW6010B	0H16019	08/23/10 17:09
7439-92-1	Lead (dissolved)	0.421	0.375	0.750	1.25	1	J	SW6010B	0H16019	08/23/10 17:09
7440-66-6	Zinc (dissolved)	1.45	1.25	2.50	5.00	1	J	SW6010B	0H16019	08/23/10 17:09

JAC
08/23/10

ANALYSIS DATA SHEET

FC714-SW02-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Water
 Sampled: 08/03/10 11:45
 % Solids: 0.00

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-60
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U	SW6010B	0H16019	08/23/10 17:14
7440-38-2	Arsenic		0.500	1.25	1.50	1	U	SW6010B	0H16019	08/23/10 17:14
7440-50-8	Copper		1.25	2.50	6.00	1	U	SW6010B	0H16019	08/23/10 17:14
7439-92-1	Lead	0.913	0.375	0.750	1.25	1	J	SW6010B	0H16019	08/23/10 17:14
7440-66-6	Zinc		1.25	2.50	5.00	1	U	SW6010B	0H16019	08/23/10 17:14

JAC
08/22/10

ANALYSIS DATA SHEET

FC714-SW02-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Water

Laboratory ID: 1008049-61

Sampled: 08/03/10 11:45

Received: 08/05/10 08:30

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	U	SW6010B	0H16019	08/23/10 17:18
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0H16019	08/23/10 17:18
7440-50-8	Copper (dissolved)		1.25	2.50	6.00	1	U	SW6010B	0H16019	08/23/10 17:18
7439-92-1	Lead (dissolved)	0.499	0.375	0.750	1.25	1	J	SW6010B	0H16019	08/23/10 17:18
7440-66-6	Zinc (dissolved)		1.25	2.50	5.00	1	U	SW6010B	0H16019	08/23/10 17:18

*QAC
8/22/10*

ANALYSIS DATA SHEET

FC714-SW06-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Water
 Sampled: 08/03/10 10:15
 % Solids: 0.00

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-62
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U	SW6010B	0H16019	08/23/10 17:23
7440-38-2	Arsenic	0.908	0.500	1.25	1.50	1	J	SW6010B	0H16019	08/23/10 17:23
7440-50-8	Copper		1.25	2.50	6.00	1	U	SW6010B	0H16019	08/23/10 17:23
7439-92-1	Lead	0.393	0.375	0.750	1.25	1	J	SW6010B	0H16019	08/23/10 17:23
7440-66-6	Zinc	1.89	1.25	2.50	5.00	1	J	SW6010B	0H16019	08/23/10 17:23

QC
9/22/10

ANALYSIS DATA SHEET

FC714-SW06-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Water

Laboratory ID: 1008049-63

Sampled: 08/03/10 10:15

Received: 08/05/10 08:30

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	I	U	SW6010B	0H16022	08/23/10 18:10
7440-38-2	Arsenic (dissolved)	0.700	0.500	1.25	1.50	I	J	SW6010B	0H16022	08/23/10 18:10
7440-50-8	Copper (dissolved)		1.25	2.50	6.00	I	U	SW6010B	0H16022	08/23/10 18:10
7439-92-1	Lead (dissolved)		0.375	0.750	1.25	I	U	SW6010B	0H16022	08/23/10 18:10
7440-66-6	Zinc (dissolved)		1.25	2.50	5.00	I	U	SW6010B	0H16022	08/23/10 18:10

JJC
9/2/10

ANALYSIS DATA SHEET

FC714-SW04-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Water
 Sampled: 08/03/10 09:30
 % Solids: 0.00

SDG: 1008049
 Project: Lejeune CTO-133
 Laboratory ID: 1008049-64
 Received: 08/05/10 08:30

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony		1.25	2.00	3.75	1	U	SW6010B	0H16022	08/23/10 18:33
7440-38-2	Arsenic	0.640	0.500	1.25	1.50	1	J	SW6010B	0H16022	08/23/10 18:33
7440-50-8	Copper		1.25	2.50	6.00	1	U	SW6010B	0H16022	08/23/10 18:33
7439-92-1	Lead	0.484	0.375	0.750	1.25	1	J	SW6010B	0H16022	08/23/10 18:33
7440-66-6	Zinc	4.80	1.25	2.50	5.00	1	J	SW6010B	0H16022	08/23/10 18:33

JAC
 92210

ANALYSIS DATA SHEET

FC714-SW04-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Water

Laboratory ID: 1008049-65

Sampled: 08/03/10 09:30

Received: 08/05/10 08:30

% Solids: 0.00

CAS NO.	Analyte	Conc. (ug/L)	DL	LOD	LOQ	D.F.	Q	Method	Batch	Analyzed
7440-36-0	Antimony (dissolved)		1.25	2.00	3.75	1	U	SW6010B	0H16022	08/23/10 18:38
7440-38-2	Arsenic (dissolved)		0.500	1.25	1.50	1	U	SW6010B	0H16022	08/23/10 18:38
7440-50-8	Copper (dissolved)		1.25	2.50	6.00	1	U	SW6010B	0H16022	08/23/10 18:38
7439-92-1	Lead (dissolved)		0.375	0.750	1.25	1	U	SW6010B	0H16022	08/23/10 18:38
7440-66-6	Zinc (dissolved)	1.74	1.25	2.50	5.00	1	J	SW6010B	0H16022	08/23/10 18:38

JAC
9/22/10

Sample Delivery Group Case Narrative

Receipt Information

The samples were received within the preservation guidelines for the associated methods. The information associated with sample receipt and the Sample Delivery Group (SDG) are included within section 4 of this package, which also provides information on the link between the client sample ID listed on the COC and laboratory's assigned unique sample ID or WorkOrder #. The sample is tracked through the laboratory for all analysis via the assigned WorkOrder #.

All samples that were received were analyzed and none of the samples were placed on hold without analyses. There were no subcontracted analyses for this SDG.

The sample time for sample FC714-SW04-10C was incorrect on the CoC at 09:40 and was changed, per the client's request, to 09:30. ✓

Changes to the Revision

This is an original submittal of the final report package.

Analytical Information

All samples were prepped (where applicable) and analyzed within the standard allowed holding times, unless noted within the exceptions listed below. The laboratory analyzed all samples within the program and method guidelines. The following information is provided specific to individual methods:

Chromatographic Flags for Manual Integration:

The following letters are used to denote manual integrations on the laboratory's raw data in association with chromatographic integrations:

- A:** The peak was manually integrated as it was not integrated in the original chromatogram.
- B:** The peak was manually integrated due to resolution or coelution issues in the original chromatogram.
- C:** The peak was manually integrated to correct the baseline from the original chromatogram.
- D:** The peak was manually integrated to identify the correct peak as the wrong peak was identified in the original chromatogram.
- E:** The peak was manually integrated to include the entire peak as the original chromatogram only integrated part of the peak.

SW6850:

The matrix spikes associated to samples 1008049-50 and -62 exceeded criteria for Perchlorate.

Matrix spikes for samples 1008049-09 and -62 and the matrix spike duplicate for sample 1008049-50 are qualified with a Z-01 to indicate that the ion ratio did not meet criteria.

No additional anomalies or deviations were noted and the data was properly qualified.

SW6010B:

The digestion blanks associated to batches 0H18004, 0H18005, and 0H18006 had positive results for Zinc.

The matrix spikes associated to samples 1008049-09 and -50 exceeded criteria for Antimony.

No additional anomalies or deviations were noted and the data was properly qualified.

EMPIRICAL LABORATORIES, LLC - CHAIN OF CUSTODY RECORD

SHIP TO: 621 Mainstream Drive, Suite 270 ♦ Nashville, TN 37228 ♦ 615-345-1115 ♦ (fax) 615-846-5426

10995

132

Send Results to:		Send Invoice to:		Analysis Requirements:						Lab Use Only:				
Name <u>Rebekka Shaw</u>		Name <u>Dave Hubell</u>								VOA Headspace	Y	N	<input checked="" type="radio"/> NA	
Company <u>CH2M HILL</u>		Company <u>CH2M HILL</u>								Field Filtered	<input checked="" type="radio"/> Y	N	<input checked="" type="radio"/> NA	
Address <u>5700 Cleveland St</u>		Address <u>3201 Birchleaf Ct</u>								Correct Containers	<input checked="" type="radio"/> Y	N	<input checked="" type="radio"/> NA	
City <u>Ste 101, Virginia Beach</u>		City <u>Ste 302, Raleigh</u>								Discrepancies	<input checked="" type="radio"/> Y	N	<input checked="" type="radio"/> NA	
State, Zip <u>VA 23462</u>		State, Zip <u>NC 27604</u>								Cust. Seals Intact	<input checked="" type="radio"/> Y	N	<input checked="" type="radio"/> NA	
Phone <u>757-671-6279</u>		Phone <u>919-875-4311</u>		Containers Intact	<input checked="" type="radio"/> Y	N	<input checked="" type="radio"/> NA	Airbill #: <u>2381</u>						
Fax <u>757-497-6885</u>		Fax <u>919-875-8491</u>								CAR #: <u> </u>				
E-mail <u>rebekka.shaw@ch2m.com</u>		E-mail <u>david.hubell@ch2m.com</u>												
Project No./Name: <u>403741. F.I.T.S</u>				Sampler's (Signature): <u>[Signature]</u>										
Lab Use Only Lab #	Date/Time Sampled	Sample Description	Sample Matrix								Comments	No. of Bottles	Lab Use Only Containers/Pres.	
<u>1008049-01</u>	<u>8/4/10 1115</u>	<u>FC714-SS04-10C</u>	<u>SS</u>	<u>X</u>	<u>X</u>							<u>2M</u>		
<u>-02</u>	<u>8/4/10 1125</u>	<u>FC714-SS03-10C</u>	<u>SS</u>	<u>X</u>	<u>X</u>									
<u>-03</u>	<u>8/4/10 1130</u>	<u>FC714-SS07-10C</u>	<u>SS</u>	<u>X</u>	<u>X</u>									
<u>-04</u>	<u>8/4/10 1035</u>	<u>FC714-SS15-10C</u>	<u>SS</u>	<u>X</u>	<u>X</u>									
<u>-05</u>	<u>8/4/10 1110</u>	<u>FC714-SS08-10C</u>	<u>SS</u>	<u>X</u>	<u>X</u>									
<u>-06</u>	<u>8/4/10 1130</u>	<u>FC714-SS03D-10C</u>	<u>SS</u>	<u>X</u>	<u>X</u>									
<u>-07</u>	<u>8/4/10 1140</u>	<u>FC714-SS12-10C</u>	<u>SS</u>	<u>X</u>	<u>X</u>									
<u>-08</u>	<u>8/4/10 1045</u>	<u>FC714-SS16-10C</u>	<u>SS</u>	<u>X</u>	<u>X</u>									
Sample Kit Prep'd by: (Signature) <u>[Signature]</u>		Date/Time <u>8/4/10 1525</u>	Received By: (Signature) <u>Fedex</u>		REMARKS:						Details:			
Relinquished by: (Signature)		Date/Time	Received By: (Signature)								Page <u>1</u> of <u>1</u>			
Relinquished by: (Signature)		Date/Time	Received By: (Signature)								Cooler No. <u>5</u> of <u>5</u>			
Received for Laboratory by: (Signature) <u>[Signature]</u>		Date/Time <u>8/5/10 08:30</u>	Temperature <u>3-8°C</u>								Date Shipped <u>8/4</u>			
											Shipped By <u>[Signature]</u>			
											Turnaround <u>See contract</u>			

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers.

1008049 Summary Package

9

C70-133

EMPIRICAL LABORATORIES, LLC - CHAIN OF CUSTODY RECORD

SHIP TO: 621 Mainstream Drive, Suite 270 ♦ Nashville, TN 37228 ♦ 615-345-1115 ♦ (fax) 615-846-5426

10994

133

Send Results to:		Send Invoice to:		Analysis Requirements:										Lab Use Only:			
Name <u>REBECCA SHAW</u>		Name <u>DAVE LOBELL</u>												VOA Headspace <u>Y</u> <u>N</u> <u>NA</u>			
Company <u>CHIM HILL</u>		Company <u>CHIM HILL</u>												Field Filtered <u>Y</u> <u>N</u> <u>NA</u>			
Address <u>3700 CLEVELAND ST. SUITE 101</u>		Address <u>3101 BEECHLEAF CT. SUITE 300</u>												Correct Containers <u>Y</u> <u>N</u> <u>NA</u>			
City <u>VIRGINIA BEACH</u>		City <u>RALEIGH</u>												Discrepancies <u>Y</u> <u>N</u> <u>NA</u>			
State, Zip <u>VA, 23462</u>		State, Zip <u>NC, 27604</u>												Cust. Seals Intact <u>Y</u> <u>N</u> <u>NA</u>			
Phone <u>(757) 671-6279</u>		Phone <u>(919) 875-4211</u>												Containers Intact <u>Y</u> <u>N</u> <u>NA</u>			
Fax <u>(757) 497-6885</u>		Fax <u>(919) 875 8441</u>												Airbill #: <u>2381</u>			
E-mail <u>REBECCA.SHAW@CHIM.COM</u>		E-mail <u>DAVID.LABELL@CHIM.COM</u>												CAR #: <u>-</u>			
Project No./Name: <u>103741.FI.FS</u>		Sampler's (Signature): <u>[Signature]</u>															
Lab Use Only Lab #	Date/Time Sampled	Sample Description	Sample Matrix												Comments	No. of Bottles	Lab Use Only Containers/Pres.
1008049-09	8/4/10 0845	FC714-SS01-10C	SS	X	X											2	2M
-10	8/4/10 0905	FC714-SS02-10C	SS	X	X											2	
-11	8/4/10 0900	FC714-SS05-10C	SS	X	X											2	
-12	8/4/10 0945	FC714-SS11-10C	SS	X	X											2	
-13	8/4/10 0750	FC714-SS25-10C	SS	X	X											2	
-14	8/4/10 0800	FC714-SS17-10C	SS	X	X											2	
-15	8/4/10 0920	FC714-SS10-10C	SS	X	X											2	
-16	8/4/10 0930	FC714-SS06-10C	SS	X	X											2	
-17	8/2/10 1525	FC714-SS28-10C	SS	X	X											2	
-09	8/5/10 0845	FC714-SS01-10C-SD	SS	X	X											2	
	WS 8/5/10															2	✓
Sample Kit Prep'd by: (Signature) <u>[Signature]</u>		Date/Time <u>8/4/10 1415</u>	Received By: (Signature)		REMARKS:										Details:		
Relinquished by: (Signature)		Date/Time	Received By: (Signature)												Page <u>1</u> of <u>1</u>		
Relinquished by: (Signature)		Date/Time	Received By: (Signature)												Cooler No. <u>3</u> of <u>4</u>		
Received for Laboratory by: (Signature) <u>[Signature]</u>		Date/Time <u>8/5/10 08:30</u>	Temperature <u>3.8°C</u>												Date Shipped <u>8/4/10</u>		
															Shipped By <u>JD/MR</u>		
															Turnaround <u>PER CONTRACT</u>		

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers.

1008049 Summary Dashboard

CTO-133

EMPIRICAL LABORATORIES, LLC - CHAIN OF CUSTODY RECORD

SHIP TO: 621 Mainstream Drive, Suite 270 ♦ Nashville, TN 37228 ♦ 615-345-1115 ♦ (fax) 615-846-5426

8641

135

Send Results to:		Send Invoice to:		Analysis Requirements:								Lab Use Only:			
Name <u>REBEKAH SHAW</u>		Name <u>DAVE LUBELL</u>		<small>(5000) LEAD, ANTIMONY COPPER, MERCURY, ARSENIC (6750) PERCHLORATE</small>								VOA Headspace	Y	N	<input checked="" type="radio"/> NA
Company <u>CHEM HILL</u>		Company <u>CHEM HILL</u>										Field Filtered	Y	N	<input checked="" type="radio"/> NA
Address <u>5700 CLEVELAND ST. SUITE 101</u>		Address <u>2701 GREENTREE ST. SUITE 300 RALEIGH</u>										Correct Containers	<input checked="" type="radio"/> Y	N	NA
City <u>VIRGINIA BEACH</u>		City <u>RALEIGH</u>										Discrepancies	Y	<input checked="" type="radio"/> N	NA
State, Zip <u>VA, 23462</u>		State, Zip <u>NC, 27604</u>										Cust. Seals Intact	<input checked="" type="radio"/> Y	N	NA
Phone <u>(757) 671-6279</u>		Phone <u>(919) 875-4300</u>		Containers Intact	<input checked="" type="radio"/> Y	N	NA								
Fax <u>(757) 497-6885</u>		Fax <u>(919) 875-8408</u>		Airbill #: <u>2381</u>				CAR #: <u>-</u>							
E-mail <u>REBEKAH.SHAW@CHEM.COM</u>		E-mail <u>DAVE.LUBELL@CHEM.COM</u>		Project No./Name: <u>403 MI.FL.FS</u>											
Sampler's (Signature): 		Sample Description		Sample Matrix		Comments		No. of Bottles		Lab Use Only Containers/Pres.					
Lab Use Only Lab #		Date/Time Sampled		Sample Matrix		Comments		No. of Bottles		Lab Use Only Containers/Pres.					
<u>1062049 -09</u>		<u>8/4/10 0945</u>		<u>FC714-SS01-10C-MS</u>		<u>SS</u>		<u>X X</u>		<u>2 2IM</u>					
<u>-28</u>		<u>8/4/10 0950</u>		<u>FC714-SSM-D-10C</u>		<u>SS</u>		<u>X X</u>		<u>2</u>					
<u>-29</u>		<u>8/4/10 0750</u>		<u>FC714-SS29-10C</u>		<u>SS</u>		<u>X X</u>		<u>2</u>					
<u>-30</u>		<u>8/4/10 0805</u>		<u>FC714-SS13-10C</u>		<u>SS</u>		<u>X X</u>		<u>2</u>					
Sample Kit Prep'd by: (Signature) 		Date/Time <u>8/4/10 1330</u>		Received By: (Signature)				REMARKS:							
Relinquished by: (Signature)		Date/Time		Received By: (Signature)											
Relinquished by: (Signature)		Date/Time		Received By: (Signature)											
Received for Laboratory by: (Signature) 		Date/Time <u>8/5/10 08130</u>		Temperature <u>3-8°C</u>									Details: Page <u>2</u> of <u>2</u> Cooler No. <u>1</u> of <u>24</u> Date Shipped <u>8/4/10</u> Shipped By <u>JD/MR</u> Turnaround <u>PER CONTRACT</u>		

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers.

12

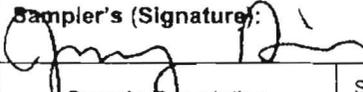
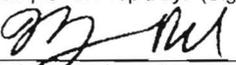
1008010 Summary Package

CTD-133

EMPIRICAL LABORATORIES, LLC - CHAIN OF CUSTODY RECORD
 SHIP TO: 621 Mainstream Drive, Suite 270 ♦ Nashville, TN 37228 ♦ 615-345-1115 ♦ (fax) 615-846-5426

10992

136

Send Results to: Name <u>REBEKA SHAW</u> Company <u>CH2M HILL</u> Address <u>5700 CLEVELAND ST</u> City <u>SUITE 101 VITIGUANA BEACH</u> State, Zip <u>VA, 23402</u> Phone <u>(757) 671-0279</u> Fax <u>(757) 497-6885</u> E-mail <u>REBEKA.SHAW@CH2M.COM</u>		Send Invoice to: Name <u>DAVE LUBEL</u> Company <u>CH2M HILL</u> Address <u>319 BEECHLEAF CT</u> City <u>RALEIGH</u> State, Zip <u>NC, 27604</u> Phone <u>(919) 878-3311</u> Fax <u>(919) 875-8141</u> E-mail <u>DAVID.LUBEL@CH2M.COM</u>		Analysis Requirements: (6016) LEAD, ANTIMONY, COPPER ZINC, ARSENIC (6850) PERCHLORATE (6005) DISSOLVED LEAD, ANTIMONY COPPER, ZINC, ARSENIC						Lab Use Only: VOA Headspace <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> NA Field Filtered <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> NA Correct Containers <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> NA Discrepancies <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> NA Cust. Seals Intact <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> NA Containers Intact <input checked="" type="checkbox"/> Y <input type="checkbox"/> N <input type="checkbox"/> NA Airbill #: <u>2381</u> CAR #: <u>—</u>				
Project No./Name: <u>403741.FI.FS</u>		Sampler's (Signature): 												
Lab Use Only Lab #	Date/Time Sampled	Sample Description	Sample Matrix								Comments	No. of Bottles	Lab Use Only Containers/Pres.	
1008049-31	8/31/10 1535	FCT14-FB-080310	W	X	X	X					also-L13	3	2C-Ni, IC	
-32	8/2/10 1640	FCTM-FB-080210-SS	W	X	X							2	1C-Ni, IC	
-33	8/31/10 1550	FCT14-FB-080310-SS	W	X	X							2		
-34	8/31/10 1555	FCTM-FB-080310-SD	W	X	X							2		
-35	8/31/10 1540	FCTM-FB-080310-SW	W	X	X	X					also-L44	3	↓ +1C-MF	
-36	8/21/10 1406	FCT14-FB-080410-SS	W	X	X							2	↓	
-37	8/31/10 1130	FCT14-SD02-10C	SD	X	X							2	2M	
-38	8/31/10 1135	FCT14-SD02-R-10C	SD	X	X							2		
-39	8/31/10 0935	FCT14-SD04-10C	SD	X	X							2		
-40	8/31/10 0950	FCT14-SD05-10C	SD	X	X							2		
-41	8/31/10 1055	FCT14-SD01-10C	SD	X	X							2		
-42	8/2/10 1536	FCT14-SS24-10C	SD	X	X							2	↓	
Sample Kit Prep'd by: (Signature) 		Date/Time <u>8/14/10</u> <u>1410</u>		Received By: (Signature)		REMARKS:						Details: Page <u>1</u> of <u>2</u> Cooler No. <u>2</u> of <u>741</u> Date Shipped <u>8/14/10</u> Shipped By <u>SD/MR</u> Turnaround <u>PER CONTRACT</u>		
Relinquished by: (Signature)		Date/Time		Received By: (Signature)										
Relinquished by: (Signature)		Date/Time		Received By: (Signature)										
Received for Laboratory by: (Signature) 		Date/Time <u>8/5/10</u> <u>08:30</u>		Temperature <u>3.80C</u>										

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers.

13

1008049 Summary Package

CTO-133

EMPIRICAL LABORATORIES, LLC - CHAIN OF CUSTODY RECORD
 SHIP TO: 621 Mainstream Drive, Suite 270 ♦ Nashville, TN 37228 ♦ 615-345-1115 ♦ (fax) 615-846-5426

8971

138

Send Results to:		Send Invoice to:		Analysis Requirements:												Lab Use Only:				
Name <u>REBERHA SHAW</u> Company <u>CH2M HILL</u> Address <u>5700 CLEVELAND ST.</u> City <u>SUITE 101 VIRGINIA BRANCH</u> State, Zip <u>VA, 23462</u> Phone <u>(757) 671-6279</u> Fax <u>(757) 497-6585</u> E-mail <u>REBERHA.SHAW@CH2M.COM</u>		Name <u>DAVE WISELL</u> Company <u>CH2M HILL</u> Address <u>3701 BEECHLEAF CT</u> City <u>SUITE 300 RALEIGH, NC</u> State, Zip <u>NC, 27604</u> Phone <u>(919) 875-4311</u> Fax <u>(919) 875-8491</u> E-mail <u>DAVID.WISELL@CH2M.COM</u>		(6003) LEAD, ANTIMONY, COPPER (6004) ZINC, ARSENIC (6050) MERCURY (6005) DISSOLVED LEAD, ANTIMONY, COPPER, ZINC, ARSENIC												VOA Headspace <u>Y</u> <u>N</u> <u>NA</u> Field Filtered <u>Y</u> <u>N</u> <u>NA</u> Correct Containers <u>Y</u> <u>N</u> <u>NA</u> Discrepancies <u>Y</u> <u>N</u> <u>NA</u> Cust. Seals Intact <u>Y</u> <u>N</u> <u>NA</u> Containers Intact <u>Y</u> <u>N</u> <u>NA</u> Airbill #: <u>2381</u> CAR #: <u>-</u>				
Project No./Name: <u>403741, F.I.L.K.S</u>		Sampler's (Signature): 																		
Lab Use Only Lab #	Date/Time Sampled	Sample Description	Sample Matrix															Comments	No. of Bottles	Lab Use Only Containers/Pres.
<u>1008049-50</u>	<u>8/3/10 10:10</u>	<u>FL7M-SD06-10C</u>	<u>SD</u>	<u>X</u>	<u>X</u>														<u>2</u>	<u>214</u>
	<u>8/3/10 10:10</u>	<u>FL7M-SD06-10C-MS</u>	<u>SD</u>	<u>X</u>	<u>X</u>														<u>2</u>	
	<u>8/3/10 10:10</u>	<u>FL7M-SD06-10C-SD</u>	<u>SD</u>	<u>X</u>	<u>X</u>														<u>2</u>	
<u>-51</u>	<u>8/3/10 11:55</u>	<u>FL7M-SD03-10C</u>	<u>SD</u>	<u>X</u>	<u>X</u>														<u>2</u>	
	<u>8/3/10 11:50</u>	<u>FL7M-SD03-10C</u>	<u>SD</u>	<u>X</u>	<u>X</u>														<u>2</u>	
	<u>8/3/10 09:45</u>	<u>FL7M-SD04-10C</u>	<u>SD</u>	<u>X</u>	<u>X</u>														<u>2</u>	
	<u>8/3/10 10:55</u>	<u>FL7M-SD01-10C</u>	<u>SD</u>	<u>X</u>	<u>X</u>														<u>2</u>	
	<u>8/3/10</u>	<u>FL7M-SD05-10C</u>	<u>SD</u>	<u>X</u>	<u>X</u>														<u>2</u>	
	<u>8/3/10 11:25</u>	<u>FL7M-SD02-B-10C</u>	<u>SD</u>	<u>X</u>	<u>X</u>														<u>2</u>	
<u>-52-53</u>	<u>8/3/10 11:00</u>	<u>FL7M-SW01-10C</u>	<u>SW</u>	<u>X</u>	<u>X</u>	<u>X</u>													<u>3</u>	<u>1C, 1C-M, K-WF</u>
<u>-54-55</u>	<u>8/3/10 09:55</u>	<u>FL7M-SW05-10C</u>	<u>SW</u>	<u>X</u>	<u>X</u>	<u>X</u>													<u>3</u>	
<u>-56-57</u>	<u>8/3/10 12:00</u>	<u>FL7M-SW03-10C</u>	<u>SW</u>	<u>X</u>	<u>X</u>	<u>X</u>													<u>3</u>	
Sample Kit Prep'd by: (Signature) 		Date/Time <u>8/4/10 13:45</u>	Received By: (Signature)		REMARKS:												Details:			
Relinquished by: (Signature)		Date/Time	Received By: (Signature)														Page <u>1</u> of <u>2</u>			
Relinquished by: (Signature)		Date/Time	Received By: (Signature)														Cooler No. <u>4</u> of <u>4</u>			
Received for Laboratory by: (Signature) 		Date/Time <u>8/3/10 08:30</u>	Temperature <u>3.80C</u>														Date Shipped <u>8/4/10</u>			
																	Shipped By <u>JD/MR</u>			
																	Turnaround <u>PER CONTRACT</u>			

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers.

15

1008040 Summary Parkane

CTO-133

EMPIRICAL LABORATORIES, LLC - CHAIN OF CUSTODY RECORD
 SHIP TO: 621 Mainstream Drive, Suite 270 ♦ Nashville, TN 37228 ♦ 615-345-1115 ♦ (fax) 615-846-5426

10991

139

Send Results to:		Send Invoice to:		Analysis Requirements:										Lab Use Only:			
Name <u>REBECCA SHAW</u>		Name <u>DAVE LUBELL</u>		(60105) LEAD, ANTIMONY, COPPER BIL, MERCURY (2750) PELLETHREATE (60105) DISSOLVED LEAD ANTIMONY COPPER, BIL, MERCURY										VOA Headspace	Y	N	NA
Company <u>CH2M HILL</u>		Company <u>CH2M HILL</u>												Field Filtered	<input checked="" type="radio"/>	<input type="radio"/>	NA
Address <u>5700 CLEVELAND ST.</u>		Address <u>3201 BERCHLGAFF CT.</u>												Correct Containers	<input checked="" type="radio"/>	<input type="radio"/>	NA
City <u>SUITE 101 VIRGINIA BEACH</u>		City <u>SUITE 300 RALEIGH</u>												Discrepancies	<input type="radio"/>	<input checked="" type="radio"/>	NA
State, Zip <u>VA, 23462</u>		State, Zip <u>NC, 27604</u>												Cust. Seals Intact	<input checked="" type="radio"/>	<input type="radio"/>	NA
Phone <u>(757) 671-6279</u>		Phone <u>(919) 875-4311</u>		Containers Intact	<input checked="" type="radio"/>	<input type="radio"/>	NA										
Fax <u>(757) 497-6885</u>		Fax <u>(919) 875-8441</u>		Airbill #: <u>2381</u>			CAR #: <u>—</u>										
E-mail <u>REBECCA.SHAW@CH2M.COM</u>		E-mail <u>PAV.D.LUBELL@CH2M.COM</u>															
Project No./Name: <u>40374.FI.FS</u>		Sampler's (Signature) 															
Lab Use Only Lab #	Date/Time Sampled	Sample Description	Sample Matrix												Comments	No. of Bottles	Lab Use Only Containers/Pres.
1008049-58-59	8/3/10 1105	FC714-SW001-D-10C	SW	X	X	X										3	1C, 1C-N, 1C-D
-60-61	8/3/10 1115	FC714-SW02-10C	SW	X	X	X										3	
-62-63	8/3/10 1015	FC714-SW06-10C	SW	X	X	X										3	
↓	8/3/10 1015	FC714-SW06-10C-MS	SW	X	X	X										3	
-64-65	8/3/10 0940	FC714-SW04-10C	SW	X	X	X										3	
-62-63	8/3/10 1015	FC714-SW06-10C-S9	SW	X	X	X										3	✓
Sample Kit Prep'd by: (Signature) 		Date/Time 8/4/10 1345	Received By: (Signature)		REMARKS:										Details:		
Relinquished by: (Signature)		Date/Time	Received By: (Signature)												Page <u>2</u> of <u>2</u>		
Relinquished by: (Signature)		Date/Time	Received By: (Signature)												Cooler No. <u>4</u> of <u>4</u>		
Received for Laboratory by: (Signature) 		Date/Time 8/5/10 08:30	Temperature 3.80C												Date Shipped <u>8/4/10</u>		
															Shipped By <u>JD/MR</u>		
															Turnaround <u>CONTRACT</u>		

Distribution: Original and yellow copies accompany sample shipment to laboratory; Pink retained by samplers.

16

1008040 Summary Package

**EMPIRICAL LABORATORIES
COOLER RECEIPT FORM**

LIMS Number: 1008049 Number of Coolers: 1 of 5
 Client: CH2M Hill Project: 402741-FI-F3
 Date/Time Received: 8/05/10 08:30 Date cooler(s) opened: 8/05/10
 Opened By (print): Will Schwab (signature): [Signature]

Circle response below as appropriate

1. How did the samples arrive?: FedEx UPS DHL Hand Delivered
 EL Courier Other: _____

If applicable, enter airbill number here: 5651

2. Were custody seals on outside of cooler(s)? Yes No
 How many: 1 Seal date: 8/4/10 Seal Initials: ?

3. Were custody seals unbroken and intact at the date and time of arrival? Yes No N/A
 4. Were custody papers sealed in a plastic bag included in the sample cooler? Yes No N/A
 5. Were custody papers filled out properly (ink, signed, etc.)? Yes No N/A
 6. Did you sign custody papers in the appropriate place for acceptance? Yes No N/A
 7. Was project identifiable from custody papers? Yes No N/A
 8. If required, was enough ice present in the cooler(s)? Yes No N/A

Type of Coolant: WET DRY BLUE NONE Temperature of Samples upon Receipt: 4.0 °C

Dates samples were logged-in: 8/05/10

9. Initial this form to acknowledge login of sample(s): (Name): Will Schwab (Initial): WS

10. Were all bottle lids intact and sealed tightly? Yes No N/A
 11. Did all bottles arrive unbroken? Yes No N/A
 12. Was all required bottle label information complete? Yes No N/A
 13. Did all bottle labels agree with custody papers? Yes No N/A
 14. Were correct containers used for the analyses indicated? Yes No N/A
 15. Were preservative levels correct in all applicable sample containers? Yes No N/A
 16. Was residual chlorine present in any applicable sample containers? Yes No N/A
 17. Was sufficient amount of sample sent for the analyses required? Yes No N/A
 18. Was headspace present in any included VOA vials? Yes No N/A

*pt/c2 for
all
metals
(tot. & day)*

If Non-Conformance issues were present, list by sample ID: _____

CAR#: _____

**EMPIRICAL LABORATORIES
COOLER RECEIPT FORM**

LIMS Number: 1008049 Number of Coolers: 2 of 5
 Client: CH2M Hill Project: 402741-FI-F3
 Date/Time Received: 8/05/10 08:30 Date cooler(s) opened: 8/05/10
 Opened By (print): Willis Schwal (signature): [Signature]

Circle response below as appropriate

1. How did the samples arrive?: FedEx UPS DHL Hand Delivered
 EL Courier Other: _____

If applicable, enter airbill number here: 5651

2. Were custody seals on outside of cooler(s)? Yes No
 How many: 1 Seal date: 8/4/10 Seal Initials: ?

3. Were custody seals unbroken and intact at the date and time of arrival? Yes No N/A
 4. Were custody papers sealed in a plastic bag included in the sample cooler? Yes No N/A
 5. Were custody papers filled out properly (ink, signed, etc.)? Yes No N/A
 6. Did you sign custody papers in the appropriate place for acceptance? Yes No N/A
 7. Was project identifiable from custody papers? Yes No N/A
 8. If required, was enough ice present in the cooler(s)? Yes No N/A

Type of Coolant: WET DRY BLUE NONE Temperature of Samples upon Receipt: 3.3 °C

~~Dates samples were logged-in: 8/05/10~~

9. Initial this form to acknowledge login of sample(s): (Name): _____ (Initial): _____
 10. Were all bottle lids intact and sealed tightly? Yes No N/A
 11. Did all bottles arrive unbroken? Yes No N/A
 12. Was all required bottle label information complete? Yes No N/A
 13. Did all bottle labels agree with custody papers? Yes No N/A
 14. Were correct containers used for the analyses indicated? Yes No N/A
 15. Were preservative levels correct in all applicable sample containers? Yes No N/A
 16. Was residual chlorine present in any applicable sample containers? Yes No N/A
 17. Was sufficient amount of sample sent for the analyses required? Yes No N/A
 18. Was headspace present in any included VOA vials? Yes No N/A

If Non-Conformance issues were present, list by sample ID: _____
 CAR#: _____

*See
Page
1 of 5*

EMPIRICAL LABORATORIES
COOLER RECEIPT FORM

LIMS Number: 1008049 Number of Coolers: 3 of 5
Client: CH2M Hill Project: 4102741-FI-F3
Date/Time Received: 8/05/10 08:30 Date cooler(s) opened: 8/05/10
Opened By (print): Will Schwab (signature): [Signature]

Circle response below as appropriate

1. How did the samples arrive?: FedEx UPS DHL Hand Delivered
 EL Courier Other: _____

If applicable, enter airbill number here: 5651

2. Were custody seals on outside of cooler(s)? Yes No
How many: 1 Seal date: 8/4/10 Seal Initials: ?

3. Were custody seals unbroken and intact at the date and time of arrival? Yes No N/A
4. Were custody papers sealed in a plastic bag included in the sample cooler? Yes No N/A
5. Were custody papers filled out properly (ink, signed, etc.)? Yes No N/A
6. Did you sign custody papers in the appropriate place for acceptance? Yes No N/A
7. Was project identifiable from custody papers? Yes No N/A
8. If required, was enough ice present in the cooler(s)? Yes No N/A

Type of Coolant: WET DRY BLUE NONE Temperature of Samples upon Receipt: 2.2 °C

~~Dates samples were logged-in: 8/05/10~~

9. Initial this form to acknowledge logn of sample(s): (Name): _____ (Initial): _____
10. Were all bottle lids intact and sealed tightly? Yes No N/A
11. Did all bottles arrive unbroken? Yes No N/A
12. Was all required bottle label information complete? Yes No N/A
13. Did all bottle labels agree with custody papers? Yes No N/A
14. Were correct containers used for the analyses indicated? Yes No N/A
15. Were preservative levels correct in all applicable sample containers? Yes No N/A
16. Was residual chlorine present in any applicable sample containers? Yes No N/A
17. Was sufficient amount of sample sent for the analyses required? Yes No N/A
18. Was headspace present in any included VOA vials? Yes No N/A

If Non-Conformance issues were present, list by sample ID: _____

CAR#: _____

see
Page
1 of 5

EMPIRICAL LABORATORIES
COOLER RECEIPT FORM

LIMS Number: 1008049 Number of Coolers: 6 of 5

Client: CH2M Hill Project: 4102741-FI-F3

Date/Time Received: 8/05/10 08:30 Date cooler(s) opened: 8/05/10

Opened By (print): Will Schwab (signature): [Signature]

Circle response below as appropriate

1. How did the samples arrive?: FedEx UPS DHL Hand Delivered
 EL Courier Other: _____

If applicable, enter airbill number here: 2392

2. Were custody seals on outside of cooler(s)? Yes No
How many: 1 Seal date: 8/4/10 Seal Initials: ?

- 3. Were custody seals unbroken and intact at the date and time of arrival? Yes No N/A
- 4. Were custody papers sealed in a plastic bag included in the sample cooler? Yes No N/A
- 5. Were custody papers filled out properly (ink, signed, etc.)? Yes No N/A
- 6. Did you sign custody papers in the appropriate place for acceptance? Yes No N/A
- 7. Was project identifiable from custody papers? Yes No N/A
- 8. If required, was enough ice present in the cooler(s)? Yes No N/A

Type of Coolant: WET DRY BLUE NONE Temperature of Samples upon Receipt: 4.2 °C

~~Dates samples were logged-in: 8/05/10~~

9. Initial this form to acknowledge login of sample(s): (Name): _____ (Initial): _____

- 10. Were all bottle lids intact and sealed tightly? Yes No N/A
- 11. Did all bottles arrive unbroken? Yes No N/A
- 12. Was all required bottle label information complete? Yes No N/A
- 13. Did all bottle labels agree with custody papers? Yes No N/A
- 14. Were correct containers used for the analyses indicated? Yes No N/A
- 15. Were preservative levels correct in all applicable sample containers? Yes No N/A
- 16. Was residual chlorine present in any applicable sample containers? Yes No N/A
- 17. Was sufficient amount of sample sent for the analyses required? Yes No N/A
- 18. Was headspace present in any included VOA vials? Yes No N/A

If Non-Conformance issues were present, list by sample ID: _____

CAR#: _____

see
Page
1 of 5

EMPIRICAL LABORATORIES
COOLER RECEIPT FORM

LIMS Number: 1008049 Number of Coolers: 5 of 5
Client: CH2M Hill Project: 4103741-FI-F3
Date/Time Received: 8/05/10 08:30 Date cooler(s) opened: 8/05/10
Opened By (print): Will Schwarz (signature): [Signature]

Circle response below as appropriate

1. How did the samples arrive?: FedEx UPS DHL Hand Delivered
 EL Courier Other: _____

If applicable, enter airbill number here: 2381

2. Were custody seals on outside of cooler(s)? Yes No
How many: 1 Seal date: 8/4/10 Seal Initials: ?

3. Were custody seals unbroken and intact at the date and time of arrival? Yes No N/A
4. Were custody papers sealed in a plastic bag included in the sample cooler? Yes No N/A
5. Were custody papers filled out properly (ink, signed, etc.)? Yes No N/A
6. Did you sign custody papers in the appropriate place for acceptance? Yes No N/A
7. Was project identifiable from custody papers? Yes No N/A
8. If required, was enough ice present in the cooler(s)? Yes No N/A

Type of Coolant: WET DRY BLUE NONE Temperature of Samples upon Receipt: 3-8 °C

~~Dates samples were logged-in: 8/05/10~~

~~9. Initial this form to acknowledge login of sample(s): (Name): _____ (Initial): _____~~

- ~~10. Were all bottle lids intact and sealed tightly? Yes No N/A
11. Did all bottles arrive unbroken? Yes No N/A
12. Was all required bottle label information complete? Yes No N/A
13. Did all bottle labels agree with custody papers? Yes No N/A
14. Were correct containers used for the analyses indicated? Yes No N/A
15. Were preservative levels correct in all applicable sample containers? Yes No N/A
16. Was residual chlorine present in any applicable sample containers? Yes No N/A
17. Was sufficient amount of sample sent for the analyses required? Yes No N/A
18. Was headspace present in any included VOA vials? Yes No N/A~~

~~If Non-Conformance issues were present, list by sample ID: _____~~

~~CAR#: _____~~

see
Page
1 of 5

DataQual

Worksheets - ~~40A~~ Perchlorate

Data Completeness

The data package was received complete and intact. Resubmissions were not required. (Method 6850)

Laboratory: Empirical

Holding Times

Sampling Date: 8/2-4/10
Received Date: 8/5/10
Analysis Dates: 8/24-26/10

Cooler Temp: 3.8°C

All holding time requirements were met.

Calibrations and Verifications

Mass assignments were verified. The submitted calibrations were within criteria or no qualifications were required.

Internal Standards

All criteria were met.

Blank Summary

Blank qualification guidelines:

- No action is taken if a compound is found in the blank but not in the sample.
- Sample weight, volume or dilution factor must be taken into consideration when applying criteria.
- Qualification/Action codes were applied as stated in table below:
-

Blank Type	Blank Result	Sample Result	Action for Samples
Method, Field	Detects	Not detected	No qualifications
	< RL	< RL	Report RL value with a U
		≥ RL	Use professional judgment
	> RL	< RL	Report RL value with a U
		≥ RL and < blank concentration	Report the concentration for the sample with a U, or qualify the data as unusable R
		≥ RL and ≥ blank concentration	Use professional judgment
	= RL	< RL	Report RL value with a U
		≥ RL	Use professional judgment
Gross contamination	Detects	Qualify results as unusable R	

There was no contamination exhibited in the method blanks. QC blanks associated for these samples were: equipment blanks FC714-EB-080210-SS, FC714-EB-080310-SS, FC714-EB-080310-SD, FC714-EB-080310-SW, and FC714-EB-080410-SS; field blank FC714-FB-080310- no positive results were exhibited.

SDG# 0910140
MCB Camp Lejeune, CTO-8133
~~VOA~~ Perchlorate
Page 1

DataQual

Worksheets - Perchlorate

Laboratory Control Sample

All criteria were met.

Matrix Spike/Spike Duplicate Samples

An MS/MSD was submitted for samples FC714-SS01-10C, FC714-SS21-10C and FC714-SS227-10C- all criteria were met; the MS/MSD submitted for samples FC714-SW06-10C exhibited low recoveries for perchlorate at 55.5% and 55.4% (QC limit 80-120%) and FC714-SD06-10C exhibited low recoveries for perchlorate at 61.1% and 61.6% (QC limit 80-120%)—therefore results for these samples were qualified as estimated (J/UJ).

Field Duplicate Sample

A field duplicate sample was submitted for samples FC714-SS03-10C, FC714-SS31-10C, FC714-SS27-10CFC714-SS14-10C, FC714-SD02-10C and FC714-SW01-10C—no positive results were exhibited in any of these samples.

Specific Comments:

All sample results were reported within the calibration range of the instruments.

Detection limits were acceptable. Raw data and calculations were verified.

We have limited the supporting documentation, found with these worksheets, to those forms that indicate qualifications were required.

Reviewer:



Date: 9/22/10

SDG#1008049
Camp Lejeune, CTO-133
Perchlorate
Page 2

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY
SW6850

FC714-SW06-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Water

Batch: 0H17009

% Solids:

Source Sample Name: 1008049-62

ANALYTE	SPIKE ADDED (ug/L)	SAMPLE CONCENTRATION (ug/L)	MS CONCENTRATION (ug/L)	MS % REC.	Q	QC LIMITS REC.
Perchlorate	0.2000	0.2769	0.3878	55.5	*	80 - 120

ANALYTE	SPIKE ADDED (ug/L)	MSD CONCENTRATION (ug/L)	MSD % REC. #	% RPD	Q	QC LIMITS	
						RPD	REC.
Perchlorate	0.2000	0.3877	55.4	0.0348	*	15	80 - 120

J/05

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY
SW6850

FC714-SD06-10C

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Project: Lejeune CTO-133

Matrix: Solid

Batch: 0H18013

% Solids: 13.29

Source Sample Name: 1008049-50

ANALYTE	SPIKE ADDED (ug/Kg dry)	SAMPLE CONCENTRATION (ug/Kg dry)	MS CONCENTRATION (ug/Kg dry)	MS % REC.	Q	QC LIMITS REC.
Perchlorate	9.966	ND	6.089	61.1	*	80 - 120

ANALYTE	SPIKE ADDED (ug/Kg dry)	MSD CONCENTRATION (ug/Kg dry)	MSD % REC. #	% RPD	Q	QC LIMITS	
						RPD	REC.
Perchlorate	10.03	6.182	61.6	1.50	*	15	80 - 120

J/05

DataQual

Worksheets –Select Metals

This SDG contains metals analysis using SW-846 6010B. Resubmissions were not required.

HOLDING TIMES

Sampling Date: 8/2-8/4
Received Date: 8/5 Cooler temps: OK
Prep. Dates: 8/16 & 8/18 ICP
Analysis Dates: 8/23-8/24 ICP

All holding time requirements were met.

CALIBRATIONS

All initial calibration criteria were met. Single point calibration was analyzed for ICP. Calibration verification criteria were not met for all ICV and CCV standards. See report for qualifications. The CRI check standards were analyzed and met method criteria for all analytes. Interference check standards were analyzed and met criteria. Raw data was verified.

BLANK SUMMARY

Blank qualification guidelines:

- No action is taken if an analyte is found in the blank but not in the sample.
- Sample weight, volume or dilution factor must be taken into consideration when applying the criteria.
- Apply the same data validation guidelines to any associated calibration, preparation, and field QC blanks and all associated samples.
- Qualification/Action codes:
 - No Action - The sample result is greater than the CRDL and greater than ten times (10X) the blank value.
 - U - The sample result is greater than or equal to the MDL but less than or equal to the CRDL, result is reported as non-detect at the CRDL.
 - R or J+ The blank contaminant concentration was greater than the RL and the sample result is greater than the RL but less than 10X the blank contaminant concentration. The reported results are flagged either as rejected R or biased high J+ based on the professional judgment of the validator.

Blank Contamination and Qualification Summaries

Blank ID	Analyte	Concentration	Action Level	Q Flag	Q Code
Some low-level contamination was noted but all reported results for contaminants were above the action limit of the RL.					

The concentration noted for the CCBs is the highest concentration in all the CCBs. However, when qualifying samples for CCB contamination, associated samples are those just prior to or just following a CCB. Therefore, not all analytes in all samples are flagged for noted CCB contamination. See worksheets for associations. Samples are qualified for field QC blank contamination based on QC tracking provided by CH2M HILL. Negative contamination in a prep blank or CCB, if less than the analyte CRDL, is qualified based on professional judgment.

Please note that based on the National Functional Guidelines, for contamination above the CRDL, results in the field samples that are greater than the CRDL up to 10X the blank contamination level should be qualified as estimated J and considered biased high or they should be rejected. Associated samples and required qualifications are noted in the following table.

Sample ID	Analyte	Q Flag	Q Code
no qualifications were required			

SDG# 1008049
MCB Camp Lejeune, CTO-133
Select Metals
Page 1

MATRIX SPIKE/DUPLICATE SUMMARY

The spike pairs analyzed for the solid matrices exhibited low recoveries for antimony. All positive and non-detect results for antimony in the solid matrix samples were flagged J/UJ. LCS recoveries and RPDs were acceptable.

SERIAL DILUTIONS

The serial dilution analysis submitted in this SDG was acceptable.

FIELD DUPLICATE SAMPLE SUMMARY

Note: Field duplicate results are assessed only if both results are above the CRDL.

Sample ID: FC714-SS03-10C Duplicate Sample ID: FC714-SS03D-10C

Analyte	Sample Conc.	Duplicate Conc.	RPD
antimony			#DIV/0!
arsenic	0.874	0.66	28%
copper	0.78	0.573	31%
lead	11.9	13.2	10%
zinc	5.12	4.32	17%

Comments: No qualifications were required

Sample ID: FC714-SS14-10C Duplicate Sample ID: FC714-SS14D-10C

Analyte	Sample Conc.	Duplicate Conc.	RPD
antimony			#DIV/0!
arsenic	0.544	0.512	6%
copper	0.418	0.472	12%
lead	5.46	5.28	3%
zinc	2.18	2.14	2%

Comments: No qualifications were required

Sample ID: FC714-SS27-10C Duplicate Sample ID: FC714-SS27D-10C

Analyte	Sample Conc.	Duplicate Conc.	RPD
antimony			#DIV/0!
arsenic	0.298	0.3	1%
copper	8.5	2.52	109%
lead	3.75	4.38	15%
zinc	3.37	4.21	22%

Comments: J copper in both samples

Sample ID: FC714-SS31-10C Duplicate Sample ID: FC714-SS31D-10C

Analyte	Sample Conc.	Duplicate Conc.	RPD
antimony			#DIV/0!
arsenic	0.545	0.487	11%
copper	1.24	1.3	5%
lead	8.02	8.99	11%
zinc	4.12	4.34	5%

Comments: No qualifications were required

DataQual**Worksheets –Select Metals**

Sample ID: FC714-SD02-10C Duplicate Sample ID: FC714-SD02D-10C

Analyte	Sample Conc.	Duplicate Conc.	RPD
antimony			#DIV/0!
arsenic	0.303	0.412	30%
copper	1.43	1.6	11%
lead	8.24	10.4	23%
zinc	1.86	2.64	35%

Comments: No qualifications were required

Sample ID: FC714-SW01-10C Total Duplicate Sample ID: FC714-SW01D-10C Total

Analyte	Sample Conc.	Duplicate Conc.	RPD
antimony			#DIV/0!
arsenic	0.639	1.19	60%
copper		1.63	100%
lead	1.15	1.93	51%
zinc		4.63	100%

Comments: No qualifications were required-all less than RL except Pb in duplicate

Sample ID: FC714-SW01-10C Dissolved Duplicate Sample ID: FC714-SW01D-10C Dissolved

Analyte	Sample Conc.	Duplicate Conc.	RPD
antimony			#DIV/0!
arsenic	0.509	0.817	46%
copper			#DIV/0!
lead	0.386	0.421	9%
zinc		1.45	100%

Comments: No qualifications were required- all less than RL

SAMPLE CALCULATION

EPA SAMPLE ID: FC714-SS05-10C
 COMPOUND: COPPER
 CONCENTRATION: 4.38 mg/Kg dry
 %Solids – 60.79
 2.01g to 100 ml
 Raw Data result: 53.487 ug/L

$$53.487 \text{ ug/L} * 0.100\text{L}/2.01\text{g} * 1/0.6079 * 1\text{mg}/1000\text{ug} * 1000\text{g}/1\text{Kg} = 4.37744 \text{ mg/Kg}$$

EPA SAMPLE ID: FC714-SW03-10C
 COMPOUND: ARSENIC
 CONCENTRATION: 0.718 ug/L
 %Solids – NA
 100ml to 25ml
 Raw Data result: 2.8728 ug/L

$$2.8728 \text{ ug/L} * 0.025\text{L}/0.100\text{L} = 0.7182 \text{ ug/L}$$

DataQual

SAMPLE RESULT VERIFICATION

Worksheets –Select Metals

Specific Comments:

All sample results were reported within the calibration/linear range of the instruments. Detection limits were acceptable. Raw data was verified. All positive results reported at concentrations between the IDL and the CRDL were qualified as estimated, J by the laboratory for the ICP metals.

Reviewer JA Cleveland Date: 92710

SDG# 1008049
MCB Camp Lejeune, CTO-133
Select Metals
Page 4

**BLANKS
SW6010B**

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Instrument ID: ME-ICP

Project: Lejeune CTO-133

Sequence: 0H23604

Calibration: 0237008

Lab Sample ID	Analyte	Found	MDL	MRL	Units	C	Method
0H23604-ICB1	Antimony	0.1631	5.00	15.0	ug/L	U	SW6010B
	Arsenic	0.8518	2.00	6.00	ug/L	U	SW6010B
	Copper	0.4647	5.00	24.0	ug/L	U	SW6010B
	Lead	-0.3384	1.50	5.00	ug/L	U	SW6010B
	Zinc	-0.01195	5.00	20.0	ug/L	U	SW6010B
0H23604-CCB1	Antimony	-0.203	5.00	15.0	ug/L	U	SW6010B
	Arsenic	1.48	2.00	6.00	ug/L	U	SW6010B
	Copper	0.364	5.00	24.0	ug/L	U	SW6010B
	Lead	0.678	1.50	5.00	ug/L	U	SW6010B
	Zinc	-0.146	5.00	20.0	ug/L	U	SW6010B
0H23604-CCB2	Antimony	0.590	5.00	15.0	ug/L	U	SW6010B
	Arsenic	1.11	2.00	6.00	ug/L	U	SW6010B
	Copper	0.639	5.00	24.0	ug/L	U	SW6010B
	Lead	-0.0890	1.50	5.00	ug/L	U	SW6010B
	Zinc	0.156	5.00	20.0	ug/L	U	SW6010B
0H16019-BLK1	Antimony	0.0345	1.25	3.75	ug/L	U	SW6010B
	Antimony (dissolved)	0.0345	1.25	3.75	ug/L	U	SW6010B
	Arsenic	0.138	0.500	1.50	ug/L	U	SW6010B
	Arsenic (dissolved)	0.138	0.500	1.50	ug/L	U	SW6010B
	Copper	0.167	1.25	6.00	ug/L	U	SW6010B
	Copper (dissolved)	0.167	1.25	6.00	ug/L	U	SW6010B
	Lead	0.0646	0.375	1.25	ug/L	U	SW6010B
	Lead (dissolved)	0.0646	0.375	1.25	ug/L	U	SW6010B
	Zinc	0.0693	1.25	5.00	ug/L	U	SW6010B
	Zinc (dissolved)	0.0693	1.25	5.00	ug/L	U	SW6010B
0H23604-CCB3	Antimony	-0.580	5.00	15.0	ug/L	U	SW6010B
	Arsenic	0.174	2.00	6.00	ug/L	U	SW6010B
	Copper	-0.0522	5.00	24.0	ug/L	U	SW6010B
	Lead	0.323	1.50	5.00	ug/L	U	SW6010B
	Zinc	-0.0743	5.00	20.0	ug/L	U	SW6010B
0H23604-CCB4	Antimony	-0.585	5.00	15.0	ug/L	U	SW6010B
	Arsenic	0.506	2.00	6.00	ug/L	U	SW6010B
	Copper	0.0779	5.00	24.0	ug/L	U	SW6010B

**BLANKS
SW6010B**

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Instrument ID: ME-ICP

Project: Lejeune CTO-133

Sequence: 0H23604

Calibration: 0237008

Lab Sample ID	Analyte	Found	MDL	MRL	Units	C	Method
0H23604-CCB4	Lead	0.648	1.50	5.00	ug/L	U	SW6010B
	Zinc	0.0592	5.00	20.0	ug/L	U	SW6010B
0H16022-BLK1	Antimony	-0.157	1.25	3.75	ug/L	U	SW6010B
	Antimony (dissolved)	-0.157	1.25	3.75	ug/L	U	SW6010B
	Arsenic	0.358	0.500	1.50	ug/L	U	SW6010B
	Arsenic (dissolved)	0.358	0.500	1.50	ug/L	U	SW6010B
	Copper	0.191	1.25	6.00	ug/L	U	SW6010B
	Copper (dissolved)	0.191	1.25	6.00	ug/L	U	SW6010B
	Lead	-0.0317	0.375	1.25	ug/L	U	SW6010B
	Lead (dissolved)	-0.0317	0.375	1.25	ug/L	U	SW6010B
0H23604-CCB5	Zinc	0.191	1.25	5.00	ug/L	U	SW6010B
	Zinc (dissolved)	0.191	1.25	5.00	ug/L	U	SW6010B
	Antimony	-0.527	5.00	15.0	ug/L	U	SW6010B
	Arsenic	0.671	2.00	6.00	ug/L	U	SW6010B
0H18004-BLK1	Copper	0.470	5.00	24.0	ug/L	U	SW6010B
	Lead	0.176	1.50	5.00	ug/L	U	SW6010B
	Zinc	0.00955	5.00	20.0	ug/L	U	SW6010B
	Antimony	0.0286	0.250	0.750	mg/Kg wet	U	SW6010B
0H23604-CCB6	Arsenic	-0.00788	0.150	0.350	mg/Kg wet	U	SW6010B
	Copper	0.0167	0.250	1.00	mg/Kg wet	U	SW6010B
	Lead	0.0337	0.0750	0.500	mg/Kg wet	U	SW6010B
	Zinc	0.300	0.250	1.00	mg/Kg wet	J	SW6010B
	Antimony	0.0334	5.00	15.0	ug/L	U	SW6010B
0H23604-CCB7	Arsenic	1.35	2.00	6.00	ug/L	U	SW6010B
	Copper	0.147	5.00	24.0	ug/L	U	SW6010B
	Lead	0.214	1.50	5.00	ug/L	U	SW6010B
	Zinc	-0.105	5.00	20.0	ug/L	U	SW6010B
	Antimony	0.604	5.00	15.0	ug/L	U	SW6010B
0H18005-BLK1	Arsenic	1.89	2.00	6.00	ug/L	U	SW6010B
	Copper	0.00159	5.00	24.0	ug/L	U	SW6010B
	Lead	0.232	1.50	5.00	ug/L	U	SW6010B
	Zinc	-0.200	5.00	20.0	ug/L	U	SW6010B
0H18005-BLK1	Antimony	0.0810	0.250	0.750	mg/Kg wet	U	SW6010B

**BLANKS
SW6010B**

Laboratory: Empirical Laboratories, LLC

SDG: 1008049

Client: CH2M Hill, Inc.

Instrument ID: ME-ICP

Project: Lejeune CTO-133

Sequence: 0H23604

Calibration: 0237008

Lab Sample ID	Analyte	Found	MDL	MRL	Units	C	Method
0H18005-BLK1	Arsenic	0.0583	0.150	0.350	mg/Kg wet	U	SW6010B
	Copper	0.00118	0.250	1.00	mg/Kg wet	U	SW6010B
	Lead	0.0168	0.0750	0.500	mg/Kg wet	U	SW6010B
	Zinc	0.302	0.250	1.00	mg/Kg wet	J	SW6010B
0H23604-CCB8	Antimony	1.40	5.00	15.0	ug/L	U	SW6010B
	Arsenic	0.249	2.00	6.00	ug/L	U	SW6010B
	Copper	0.243	5.00	24.0	ug/L	U	SW6010B
	Lead	0.313	1.50	5.00	ug/L	U	SW6010B
	Zinc	-0.0545	5.00	20.0	ug/L	U	SW6010B
0H23604-CCB9	Antimony	1.28	5.00	15.0	ug/L	U	SW6010B
	Arsenic	1.01	2.00	6.00	ug/L	U	SW6010B
	Copper	-0.298	5.00	24.0	ug/L	U	SW6010B
	Lead	0.459	1.50	5.00	ug/L	U	SW6010B
	Zinc	0.0970	5.00	20.0	ug/L	U	SW6010B
0H18006-BLK1	Antimony	0.0970	0.250	0.750	mg/Kg wet	U	SW6010B
	Arsenic	0.0283	0.150	0.350	mg/Kg wet	U	SW6010B
	Copper	-0.00236	0.250	1.00	mg/Kg wet	U	SW6010B
	Lead	0.0233	0.0750	0.500	mg/Kg wet	U	SW6010B
	Zinc	0.369	0.250	1.00	mg/Kg wet	J	SW6010B
0H23604-CCBA	Antimony	1.23	5.00	15.0	ug/L	U	SW6010B
	Arsenic	1.24	2.00	6.00	ug/L	U	SW6010B
	Copper	-0.384	5.00	24.0	ug/L	U	SW6010B
	Lead	1.11	1.50	5.00	ug/L	U	SW6010B
	Zinc	0.0162	5.00	20.0	ug/L	U	SW6010B

✓ U @ RL all results w
solid samples that are
> MDL < RL

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY
SW6010B

FC714-SS01-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Batch: 0H18004
 % Solids: 68.07
 Source Sample Name: 1008049-09

SDG: 1008049
 Project: Lejeune CTO-133

ANALYTE	SPIKE ADDED (mg/Kg dry)	SAMPLE CONCENTRATION (mg/Kg dry)	MS CONCENTRATION (mg/Kg dry)	MS % REC.	Q	QC LIMITS REC.
Antimony	18.27	ND	7.575	41.5	N	80 - 120
Arsenic	18.27	1.618	19.53	98.0		80 - 120
Copper	18.27	252.2	267.7	84.8		80 - 120
Lead	18.27	23.96	42.76	103		80 - 120
Zinc	36.55	11.43	50.96	108		80 - 120

ANALYTE	SPIKE ADDED (mg/Kg dry)	MSD CONCENTRATION (mg/Kg dry)	MSD % REC. #	% RPD	Q	QC LIMITS	
						RPD	REC.
Antimony	18.18	7.940	43.7	4.70	N	20	80 - 120
Arsenic	18.18	19.56	98.7	0.130		20	80 - 120
Copper	18.18	237.8	-79.1	11.8		20	80 - 120
Lead	18.18	42.26	101	1.18		20	80 - 120
Zinc	36.37	50.18	107	1.54		20	80 - 120

JTJ all soils

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY
SW6010B

FC714-SS21-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Batch: 0H18005
 % Solids: 71.09
 Source Sample Name: 1008049-20

SDG: 1008049
 Project: Leieune CTO-133

ANALYTE	SPIKE ADDED (mg/Kg dry)	SAMPLE CONCENTRATION (mg/Kg dry)	MS CONCENTRATION (mg/Kg dry)	MS % REC.	Q	QC LIMITS REC.
Antimony	17.67	ND	13.83	78.3	N	80 - 120
Arsenic	17.67	0.6789	17.56	95.5		80 - 120
Copper	17.67	2.480	20.69	103		80 - 120
Lead	17.67	14.31	31.89	99.5		80 - 120
Zinc	35.34	5.485	42.18	104		80 - 120

ANALYTE	SPIKE ADDED (mg/Kg dry)	MSD CONCENTRATION (mg/Kg dry)	MSD % REC. #	% RPD	Q	QC LIMITS	
						RPD	REC.
Antimony	17.50	13.61	77.8	1.62	N	20	80 - 120
Arsenic	17.50	17.31	95.1	1.42		20	80 - 120
Copper	17.50	20.30	102	1.89		20	80 - 120
Lead	17.50	31.83	100	0.181		20	80 - 120
Zinc	34.99	40.64	100	3.72		20	80 - 120

JTW all soils

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY
SW6010B

FC714-SD06-10C

Laboratory: Empirical Laboratories, LLC
 Client: CH2M Hill, Inc.
 Matrix: Solid
 Batch: 0H18006
 % Solids: 13.29
 Source Sample Name: 1008049-50

SDG: 1008049
 Project: Lejeune CTO-133

ANALYTE	SPIKE ADDED (mg/Kg dry)	SAMPLE CONCENTRATION (mg/Kg dry)	MS CONCENTRATION (mg/Kg dry)	MS % REC.	Q	QC LIMITS REC.
Antimony	95.01	ND	49.21	51.8	N	80 - 120
Arsenic	95.01	8.796	101.6	97.7		80 - 120
Copper	95.01	10.23	102.6	97.2		80 - 120
Lead	95.01	21.90	114.0	96.9		80 - 120
Zinc	190.0	238.4	451.0	112		80 - 120

ANALYTE	SPIKE ADDED (mg/Kg dry)	MSD CONCENTRATION (mg/Kg dry)	MSD % REC. #	% RPD	Q	QC LIMITS	
						RPD	REC.
Antimony	91.76	48.12	52.4	2.25	N	20	80 - 120
Arsenic	91.76	101.5	101	0.0433		20	80 - 120
Copper	91.76	103.6	102	1.01		20	80 - 120
Lead	91.76	115.3	102	1.17		20	80 - 120
Zinc	183.5	450.0	115	0.217		20	80 - 120

JTW all soils

Appendix E
Data Tables and Raw Analytical Data

CTO-133
Camp Lejeune - FC714
Validated Surface Soil Raw Analytical Results
August 2010

Station ID	Camp Lejeune Background SS 2X Mean	CLEAN NCSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	FC714-SS01	FC714-SS02	FC714-SS03		FC714-SS04	FC714-SS05	FC714-SS06	FC714-SS07	FC714-SS08	FC714-SS09
Sample ID					FC714-SS01-10C	FC714-SS02-10C	FC714-SS03-10C	FC714-SS03D-10C	FC714-SS04-10C	FC714-SS05-10C	FC714-SS06-10C	FC714-SS07-10C	FC714-SS08-10C	FC714-SS09-10C
Sample Date					08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10
Chemical Name														
Explosives (µg/kg)														
Perchlorate					1.47 U	1.16 U	1.31 U	1.31 U	1.34 U	1.64 U	1.12 U	1.3 U	1.41 U	1.18 U
Total Metals (mg/kg)														
Antimony	0.447	--	41	3.1	0.742 UJ	0.585 UJ	0.664 UJ	0.663 UJ	0.675 UJ	0.818 UJ	0.555 UJ	0.657 UJ	0.706 UJ	0.593 UJ
Arsenic	0.626	5.8	1.6	0.39	1.62	0.298 J	0.874	0.66	0.395 J	0.847	0.372 J	0.553	0.535	0.344 J
Copper	4.83	700	4,100	310	252	0.731 J	0.78 J	0.573 J	1.1 J	4.38	0.78 J	0.832 J	1.66	0.738 J
Lead	12.3	270	800	400	24	6.09	11.9	13.2	7.83	16.5	7.65	10.1	8.96	6.99
Zinc	10.8	1,200	31,000	2,300	11.4	3.24	5.12	4.32	1.91	5.54	2.46	2.64	5.3	2.81

Notes:

Shading indicates detections

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

µg/kg - Micrograms per kilogram

CTO-133
Camp Lejeune - FC714
Validated Surface Soil Raw Analytical Results
August 2010

Station ID	Camp Lejeune Background SS 2X Mean	CLEAN NCSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	FC714-SS10	FC714-SS11	FC714-SS12	FC714-SS13	FC714-SS14		FC714-SS15	FC714-SS16	FC714-SS17	FC714-SS18	FC714-SS19
Sample ID					FC714-SS10-10C	FC714-SS11-10C	FC714-SS12-10C	FC714-SS13-10C	FC714-SS14-10C	FC714-SS14-D-10C	FC714-SS15-10C	FC714-SS16-10C	FC714-SS17-10C	FC714-SS18-10C	FC714-SS19-10C
Sample Date					08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/04/10	08/03/10
Chemical Name															
Explosives (µg/kg)															
Perchlorate					1.52 U	1.32 U	1.31 U	1.26 U	1.09 U	1.09 U	1.13 U	1.23 U	1.06 U	1.28 U	1.63 U
Total Metals (mg/kg)															
Antimony	0.447	--	41	3.1	0.918 J	0.664 UJ	0.656 UJ	0.644 UJ	0.542 UJ	0.544 UJ	0.56 UJ	0.616 UJ	0.535 UJ	0.641 UJ	0.837 UJ
Arsenic	0.626	5.8	1.6	0.39	0.485 J	1.01	0.732	0.293 J	0.544	0.512	0.851	0.537	0.377	0.36 J	0.439 J
Copper	4.83	700	4,100	310	1.19 J	1.82	0.655 J	1.77	0.418 J	0.472 J	0.848 J	0.439 J	0.839 J	2	3.77
Lead	12.3	270	800	400	6.34	13.4	8.73	7.49	5.46	5.28	9.09	6.27	15.2	7.46	11.5
Zinc	10.8	1,200	31,000	2,300	9.52	7.69	3.08	4.34	2.18	2.14	2.42	1.52	2.87	3.78	8.46

Notes:

Shading indicates detections

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

µg/kg - Micrograms per kilogram

CTO-133
Camp Lejeune - FC714
Validated Surface Soil Raw Analytical Results
August 2010

Station ID	Camp Lejeune Background SS 2X Mean	CLEAN NCSLs (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	FC714-SS20	FC714-SS21	FC714-SS22	FC714-SS23	FC714-SS24	FC714-SS25	FC714-SS26	FC714-SS27		FC714-SS28
Sample ID					FC714-SS20-10C	FC714-SS21-10C	FC714-SS22-10C	FC714-SS23-10C	FC714-SS24-10C	FC714-SS25-10C	FC714-SS26-10C	FC714-SS27-10C	FC714-SS27-D-10C	FC714-SS28-10C
Sample Date					08/02/10	08/03/10	08/03/10	08/02/10	08/02/10	08/04/10	08/03/10	08/03/10	08/03/10	08/02/10
Chemical Name														
Explosives (µg/kg)														
Perchlorate					1.13 U	1.41 U	1.17 U	1.16 U	1.19 U	1.14 U	1.16 U	1.12 U	1.39 U	1.56 U
Total Metals (mg/kg)														
Antimony	0.447	--	41	3.1	0.579 UJ	0.71 UJ	0.586 UJ	0.589 UJ	0.567 UJ	0.582 UJ	0.588 UJ	0.547 UJ	0.682 UJ	0.797 UJ
Arsenic	0.626	5.8	1.6	0.39	0.634	0.679	0.229 J	0.352 J	0.28 J	0.359 J	0.397 J	0.298 J	0.3 J	0.64
Copper	4.83	700	4,100	310	0.544 J	2.48	2.81	0.789 J	0.574 J	1.1 J	1.41	8.5 J	2.52 J	3.38
Lead	12.3	270	800	400	7.47	14.3	5.01	13.7	5.75	5.71	11.8	3.75	4.38	8.77
Zinc	10.8	1,200	31,000	2,300	3.01	5.49	3.94	5.67	4.22	3.2	4.22	3.37	4.21	10.5

Notes:

Shading indicates detections

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

µg/kg - Micrograms per kilogram

CTO-133
Camp Lejeune - FC714
Validated Surface Soil Raw Analytical Results
August 2010

Station ID	Camp Lejeune Background SS 2X Mean	CLEAN NCSLS (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	FC714-SS29	FC714-SS30	FC714-SS31		FC714-SS32
Sample ID					FC714-SS29-10C	FC714-SS30-10C	FC714-SS31-10C	FC714-SS31-D-10C	FC714-SS32-10C
Sample Date					08/04/10	08/03/10	08/03/10	08/03/10	08/03/10
Chemical Name									
Explosives (µg/kg)									
Perchlorate					1.35 U	1.19 U	1.16 U	1.14 U	1.19 U
Total Metals (mg/kg)									
Antimony	0.447	--	41	3.1	0.659 UJ	0.591 UJ	0.573 UJ	0.554 UJ	0.589 UJ
Arsenic	0.626	5.8	1.6	0.39	0.641	0.295 J	0.545	0.487	0.631
Copper	4.83	700	4,100	310	0.493 J	0.62 J	1.24	1.3	2.47
Lead	12.3	270	800	400	6.9	5.1	8.02	8.99	9.72
Zinc	10.8	1,200	31,000	2,300	2.52	2.83	4.12	4.34	4.52

Notes:

Shading indicates detections

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

µg/kg - Micrograms per kilogram

CTO-133
Camp Lejeune - FC714
Validated Sediment Raw Analytical Results
August 2010

Station ID	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	FC714-SD01/SW01	FC714-SD02/SW02		FC714-SD03/SW03	FC714-SD04/SW04	FC714-SD05/SW05	FC714-SD06/SW06
Sample ID			FC714-SD01-10C	FC714-SD02-10C	FC714-SD02-D-10C	FC714-SD03-10C	FC714-SD04-10C	FC714-SD05-10C	FC714-SD06-10C
Sample Date			08/03/10	08/03/10	08/03/10	08/03/10	08/03/10	08/03/10	08/03/10
Chemical Name									
Explosives (µg/kg)									
Perchlorate			1.33 U	1.33 U	1.37 U	1.43 U	3.05 U	9.16 U	7.52 UJ
Total Metals (mg/kg)									
Antimony			0.658 UJ	0.641 UJ	0.675 UJ	0.681 UJ	1.45 UJ	4.51 UJ	3.84 UJ
Arsenic	1.6	0.39	0.338 J	0.303 J	0.412 J	0.485	9.32	18.6	8.8
Copper	4,100	310	2.54	1.43	1.6	2.38	3.33	14.6	10.2
Lead	800	400	5.81	8.24	10.4	10.8	4.87	20.6	21.9
Zinc	31,000	2,300	3.51	1.86	2.64	4.9	121	366	238

Notes:

Shading indicates detections

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

µg/kg - Micrograms per kilogram

CTO-133
Camp Lejeune - FC714
Validated Subsurface Soil Raw Analytical Results
August 2010

Station ID	Camp Lejeune Background SB 2X Mean	CLEAN NCSLS (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	FC714-SB01/TW01		FC714-SB02/TW02	FC714-SB03/TW03	FC714-SB04/TW04	FC714-SB05/TW05	FC714-SB06/TW06	FC714-SB07/TW07
Sample ID					FC714-SB01-5-6-10C	FC714-SB01D-5-6-10C	FC714-SB02-6-7-10C	FC714-SB03-4-5-10C	FC714-SB04-5-6-10C	FC714-SB05-4-5-10C	FC714-SB06-7-8-10C	FC714-SB07-5-6-10C
Sample Date					08/17/10	08/17/10	08/17/10	08/17/10	08/17/10	08/16/10	08/16/10	08/16/10
Chemical Name												
Explosives (µg/kg)												
Perchlorate					1.13 U	1.13 U	1.14 U	1.14 U	1.14 U	1.31 U	1.09 U	1.03 U
Total Metals (mg/kg)												
Antimony					0.562 UJ	0.545 UJ	0.556 UJ	0.559 UJ	0.571 UJ	0.639 UJ	0.526 UJ	0.514 UJ
Arsenic	2.12	5.8	1.6	0.39	1.32	1.24	0.839	1.3	3.5	0.383 U	0.316 U	0.294 J
Copper	8.49	700	4,100	310	0.728 J	0.68 J	0.424 J	0.414 J	0.855 J	0.458 J	0.421 U	0.411 U
Lead	2.56	270	800	400	2.84	2.62	3.22	2.8	4.8	2.99	1.64	0.953
Zinc	6.59	1,200	31,000	2,300	1.82	2.19	1.41	1.47	2.52	1.37	0.859 J	0.514 U

Notes:
 Shading indicates detections.
 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
 µg/kg - Micrograms per kilogram

CTO-133
Camp Lejeune - FC714
Validated Subsurface Soil Raw Analytical Results
August 2010

Station ID	Camp Lejeune Background SB 2X Mean	CLEAN NCSLS (January, 2010)	Adjusted Industrial Soil RSLs (May, 2010)	Adjusted Residential Soil RSLs (May, 2010)	FC714-SB08/TW08	FC714-SB09		FC714-SB10	FC714-SB11	FC714-SB12	FC714-SB13
Sample ID					FC714-SB08-9-10-10C	FC714-SB09-3-4-10C	FC714-SB09D-3-4-10C	FC714-SB10-6-7-10C	FC714-SB11-1_5-2_5-10C	FC714-SB12-2-3-10C	FC714-SB13-8-9-10C
Sample Date					08/16/10	08/17/10	08/17/10	08/17/10	08/17/10	08/17/10	08/16/10
Chemical Name											
Explosives (µg/kg)											
Perchlorate					1.07 U	1.06 U	1.03 U	1.19 U	1.2 U	1.1 U	1.05 U
Total Metals (mg/kg)											
Antimony					0.533 UJ	0.513 UJ	0.519 UJ	0.57 UJ	0.582 UJ	0.528 UJ	0.512 UJ
Arsenic	2.12	5.8	1.6	0.39	0.41	0.308 U	0.173 J	4.02	0.325 J	0.446	0.307 U
Copper	8.49	700	4,100	310	0.978 J	0.41 U	0.415 U	1.11 J	0.466 U	0.394 J	0.41 U
Lead	2.56	270	800	400	2.84	1.04	1.13	4.49	2.05	3.77	0.967
Zinc	6.59	1,200	31,000	2,300	4.78	0.513 U	0.736 J	1.87	0.703 J	1.67	0.676 J

Notes:

Shading indicates detections.
 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
 µg/kg - Micrograms per kilogram

CTO-133
Camp Lejeune - FC-714
Validated Groundwater Raw Analytical Results
August 2010

Station ID	Camp Lejeune Background GW 2X Mean	NC2LGW (January, 2010)*	Adjusted Tap Water RSLs (May, 2010)	FC714-SB01/TW01	FC714-SB02/TW02		FC714-SB03/TW03	FC714-SB04/TW04	FC714-SB05/TW05	FC714-SB06/TW06	FC714-SB07/TW07	FC714-SB08/TW08
Sample ID				FC714-GW01-10C	FC714-GW02-10C	FC714-GW02D-10C	FC714-GW03-10C	FC714-GW04-10C	FC714-GW05-10C	FC714-GW06-10C	FC714-GW07-10C	FC714-GW08-10C
Sample Date				08/25/10	08/25/10	08/25/10	08/25/10	08/25/10	08/24/10	08/24/10	08/24/10	08/24/10
Chemical Name												
Explosives (µg/l)												
Perchlorate				0.1 U								
Total Metals (µg/l)												
Antimony				2 UJ								
Arsenic	5.77	10	0.045	1.25 U	1.08 J	1.25 U	1.25 U	1.25 U				
Copper				2.5 U								
Lead	2.8	15	15	0.872 J	1.04 J	1.05 J	0.75 UJ	0.906 J	0.75 UJ	1.89 J	0.987 J	1.05 J
Zinc	42.1	1,000	1,100	8.33 J	8.64 J	8.42 J	12.1 J	11.4 J	20 J	9.07 J	10.7 J	8.03 J
	5.77	10	0.045									
Dissolved Metals (µg/l)	2.8	15	15									
Antimony, Dissolved	42.1	1,000	1,100	2 UJ								
Arsenic, Dissolved	5.77	10	0.045	1.25 U	1.14 J	1.25 U	1.25 U	1.25 U				
Copper, Dissolved				2.5 U								
Lead, Dissolved	2.8	15	15	0.755 J	1.34 J	1.05 J	0.968 J	0.97 J	0.75 UJ	2.05 J	1 J	1.18 J
Zinc, Dissolved	42.1	1,000	1,100	8.03 J	11.8 J	8.31 J	10.6 J	14.4 J	14.8 J	8.67 J	8.97 J	9.13 J

Notes:

Shading indicates detections

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

µg/l - Micrograms per liter

CTO-133
Camp Lejuene - FC714
Validated Surface Water Raw Analytical Results
August 2010

Station ID	NC2B-SW-Human Health & Water Supply ¹	NRWQC-Human Health - Organisms & Water + Organisms ²	Adjusted Tap Water RSLs (May, 2010)	FC714-SD01/SW01		FC714-SD02/SW02	FC714-SD03/SW03	FC714-SD04/SW04	FC714-SD05/SW05	FC714-SD06/SW06
				FC714-SW01-10C	FC714-SW01-D-10C	FC714-SW02-10C	FC714-SW03-10C	FC714-SW04-10C	FC714-SW05-10C	FC714-SW06-10C
Sample ID				08/03/10	08/03/10	08/03/10	08/03/10	08/03/10	08/03/10	08/03/10
Sample Date										
Chemical Name										
Explosives (µg/l)										
Perchlorate	--	--	2.6	0.1 U	0.1 U	0.1 U	0.1 U	0.104 J	0.219 J	0.277 J
Total Metals (µg/l)										
Antimony				2 U	2 U	2 U	2 U	2 U	2 U	2 U
Arsenic	10	0.018	0.045	0.639 J	1.19 J	1.25 U	0.718 J	0.64 J	14.5	0.908 J
Copper	--	1300	150	2.5 U	1.63 J	2.5 U	2.5 U	2.5 U	6.54	2.5 U
Lead	--	--	15	1.15 J	1.93	0.913 J	0.617 J	0.484 J	8.87	0.393 J
Zinc	--	7400	1,100	2.5 U	4.63 J	2.5 U	2.5 U	4.8 J	179	1.89 J
Dissolved Metals (µg/l)										
Antimony, Dissolved				2 U	2 U	2 U	2 U	2 U	2 U	2 U
Arsenic, Dissolved	10	0.018	0.045	0.509 J	0.817 J	1.25 U	1.25 U	1.25 U	1.25 U	0.7 J
Copper, Dissolved				2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Lead, Dissolved	--	--	15	0.386 J	0.421 J	0.499 J	0.508 J	0.75 U	0.75 U	0.75 U
Zinc, Dissolved	--	7400	1,100	2.5 U	1.45 J	2.5 U	2.5 U	1.74 J	1.48 J	2.5 U

Notes:

Shading indicates detections

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 F
Human Health Risk Screening
Figure and Tables

Appendix F

TABLE 2.1

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Proposed Fitness Center

MCB Camp Lejeune, North Carolina

Scenario Timeframe: 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	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 Soil at Fitness Center	14797-73-0	Perchlorate	ND	ND	MG/KG		0/32	0.00212 - 0.00329	3.3E-03	N/A	5.5E+00 N	N/A		NO	DLBSL
	7440-36-0	Antimony	9.2E-01 J	9.2E-01 J	MG/KG	FC714-SS10-10C	1/32	0.802 - 1.26	9.2E-01	4.5E-01	3.1E+00 N	N/A		NO	BSL
	7440-38-2	Arsenic	2.3E-01 J	1.6E+00	MG/KG	FC714-SS01-10C	32/32	0.374 - 0.586	1.6E+00	6.3E-01	3.9E-01 C*	5.8E+00	Csoil	YES	ASL
	7440-50-8	Copper	4.4E-01 J	2.5E+02	MG/KG	FC714-SS01-10C	32/32	1.07 - 1.67	2.5E+02	4.8E+00	3.1E+02 N	7.0E+02	Csoil	NO	BSL
	7439-92-1	Lead	4.4E+00	2.4E+01	MG/KG	FC714-SS01-10C	32/32	0.535 - 0.837	2.4E+01	1.2E+01	4.0E+02 N	2.7E+02	Csoil	NO	BSL
7440-66-6	Zinc	1.5E+00	1.1E+01	MG/KG	FC714-SS01-10C	32/32	1.07 - 1.67	1.1E+01	1.1E+01	2.3E+03 N	1.2E+03	Csoil	NO	BSL	

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening. If ND, maximum detection limit used for screening.

[3] 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.

[4] Oak Ridge National Laboratory (ORNL). May 17, 2010. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites. Available: <http://epa-prgs.ornl.gov/chemicals/index.shtml>. Adjusted (noncarcinogenic RSLs adjusted by dividing by 10) residential soil RSLs. 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.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)
 Deletion Reason: No Toxicity Information (NTX)
 Essential Nutrient (NUT)
 Below Screening Level (BSL)
 Detection Limit Above Screening Levels (DLASL)
 Detection Limit Below Screening Levels (DLBSL)

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/
 To Be Considered

J = Estimated Value

N/A = Not Applicable/Not Available

C = Carcinogenic

C* - Carcinogenic (where nc RSL < 100 x ca RSL)

N = Noncarcinogenic

Csoil = Federal Remediation Branch Target Screening Values, calculated source for soil which is protective of groundwater, January 2010

MG/KG = Milligrams per kilogram

Appendix F

TABLE 2.1a

Risk Ratio Screening for Surface Soil, Maximum Detected Concentration

Proposed Fitness Center

MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier)	Sample	Residential Soil RSL	Acceptable Risk Level	Corresponding Hazard Index ^a	Corresponding Cancer Risk ^b	Target Organ
Metals (mg/kg)								
Arsenic	32 / 32	1.6E+00	FC714-SS01-10C	3.9E-01	1E-06	NA	4E-06	NA
Cumulative Corresponding Hazard Index^c						NA		
Cumulative Corresponding Cancer Risk^d							4E-06	

^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

HI = Hazard Index

mg/kg = milligrams per kilogram

RSL = Oak Ridge National Laboratory (ORNL), May 2010. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites. [Online].

Available: <http://epa-prgs.ornl.gov/chemicals/index.shtml>

Appendix F

TABLE 2.2

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Proposed Fitness Center

MCB Camp Lejeune, North Carolina

Scenario Timeframe: 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 Used for Screening [2]	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 at Fitness Center	14797-73-0	Perchlorate	1.0E-01 J	2.8E-01 J	UG/L	FC714-SW06-10C	3/6	0.5 - 0.5	2.8E-01	N/A	2.6E+00 R-n			NO	BSL
	7440-36-0	Antimony	ND	ND	UG/L		0/6	3.75 - 3.75	3.8E+00	N/A	5.6E+00 A			NO	DLBSL
	7440-38-2	Arsenic	6.4E-01 J	1.5E+01	UG/L	FC714-SW05-10C	5/6	1.5 - 1.5	1.5E+01	N/A	1.8E-02 A	1.0E+01	N	YES	ASL
	7440-50-8	Copper	1.6E+00 J	6.5E+00	UG/L	FC714-SW05-10C	2/6	6 - 6	6.5E+00	N/A	1.3E+03 A			NO	BSL
	7439-92-1	Lead	3.9E-01 J	8.9E+00	UG/L	FC714-SW05-10C	6/6	1.25 - 1.25	8.9E+00	N/A	1.5E+01 M			NO	BSL
	7440-66-6	Zinc	1.9E+00 J	1.8E+02	UG/L	FC714-SW05-10C	4/6	5 - 5	1.8E+02	N/A	7.4E+03 A			NO	BSL

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening. If ND, maximum detection limit 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>

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)
 Deletion Reason: No Toxicity Information (NTX)
 Essential Nutrient (NUT)
 Below Screening Level (BSL)
 Detection Limit Below Screening Levels (DLBSL)

COPC = Chemical of Potential Concern

J = Estimated Value

To Be Considered

J = Estimated Value

N - North Carolina 15A NCAC 2B Human Health, amended Feb. 2010.

A - Federal Ambient Water Quality Criteria, Consumption of Water and Organisms

M - Action level for lead from Federal Drinking Water MCLs

R-n - USEPA Regional Screening Level, noncarcinogenic (therefore, RSL divided by 10, see text)

N/A - Not available

COPC - Chemical of potential concern

µg/L - microgram per liter

Appendix F

TABLE 2.2a

Risk Ratio Screening for Surface Water, Maximum Detected Concentration

Proposed Fitness Center

MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier)	Sample	Screening Level	Acceptable Risk Level	Corresponding Hazard Index ^a	Corresponding Cancer Index ^b	Target Organ
Metals (ug/L)								
Arsenic	5 / 6	1.5E+01	FC714-SW05-10C	4.5E-02	1.E-06	NA	3E-04	NA
Cumulative Corresponding Hazard Index^c						NA		
Cumulative Corresponding Cancer Risk^d							3E-04	

Screening level used for Step 2, risk ratio evaluation is the Tap Water RSL, May 2010. The North Carolina WQS for Human Health and Federal Ambient Water Quality Criteria are not risk-based, and are not appropriate for use in Step 2.

^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

ug/L = micrograms per liter

Appendix F

TABLE 2.2b

Risk Ratio Screening for Surface Water, 95% UCL Concentration

Proposed Fitness Center

MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	95% UCL		95% UCL Rationale	Screening Level	Acceptable Risk Level	Corresponding Hazard Index ^a	Corresponding Cancer Risk ^b	Target Organ
Arsenic	5 / 6	1.5E+01	Max	4, 5	4.5E-02	1.E-06	NA	3.E-04	NA
Cumulative Corresponding Hazard Index ^c							NA		
Cumulative Corresponding Cancer Risk ^d								3E-04	

^a Corresponding Hazard Index equals 95% UCL divided by the RSL divided by the acceptable risk level.

^b Corresponding Cancer Risk equals 95% UCL 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

Constituents selected as COPCs are indicated by shading.

ug/L = micrograms per liter

HI = Hazard Index

ProUCL, Version 4.00.05 used to determine distribution of data and calculate 95% UCL, following recommendations

in users guide (USEPA, May 2010, ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).

Options: Maximum Detected Concentration (Max); 97.5% Kaplan-Meier Chbyshev UCL (97.5% KM)

UCL Rationale:

- (1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
- (2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
- (3) Test indicates data are gamma distributed.
- (4) Distribution tests are inconclusive
- (5) Maximum value used because calculated 95% UCL exceeds maximum concentration.

Appendix F

TABLE 2.3

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Proposed Fitness Center

MCB Camp Lejeune, North Carolina

Scenario Timeframe: 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	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Sediment at Fitness Center	14797-73-0	Perchlorate	ND	ND	MG/KG		0/6	0.00266 - 0.0183	1.8E-02	N/A	5.5E+00 N	N/A	N/A	NO	DLBSL
	7440-36-0	Antimony	ND	ND	MG/KG		0/6	0.961 - 6.77	6.8E+00	N/A	3.1E+00 N	N/A	N/A	YES	DLASL
	7440-38-2	Arsenic	3.4E-01 J	1.9E+01	MG/KG	FC714-SD05-10C	6/6	0.449 - 3.16	1.9E+01	N/A	3.9E-01 C*	N/A	N/A	YES	ASL
	7440-50-8	Copper	1.6E+00	1.5E+01	MG/KG	FC714-SD05-10C	6/6	1.28 - 9.02	1.5E+01	N/A	3.1E+02 N	N/A	N/A	NO	BSL
	7439-92-1	Lead	4.9E+00	2.2E+01	MG/KG	FC714-SD06-10C	6/6	0.641 - 4.51	2.2E+01	N/A	4.0E+02 N	N/A	N/A	NO	BSL
7440-66-6	Zinc	2.6E+00	3.7E+02	MG/KG	FC714-SD05-10C	6/6	1.28 - 9.02	3.7E+02	N/A	2.3E+03 N	N/A	N/A	NO	BSL	

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening. If ND, maximum detection limit used for screening.

[3] Background values not available.

[4] Oak Ridge National Laboratory (ORNL). May 2010. Residential Soil Regional Screening Levels for Chemical Contaminants at Superfund Sites (based on 10⁻⁶ for carcinogens and HQ of 0.1 for noncarcinogens). [Online]. Available: <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.

[5] Rationale Codes

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

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/
 To Be Considered

J = Estimated Value

C = Carcinogenic

C* = N screening level < 100x C screening level

N = Noncarcinogenic

mg/kg = milligram per kilogram

Appendix F

TABLE 2.3a

Risk Ratio Screening for Sediment, Maximum Detected Concentration

Proposed Fitness Center

MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier)	Sample	Residential Soil RSL	Acceptable Risk Level	Corresponding Hazard Index ^a	Corresponding Cancer Risk ^b	Target Organ
Metals (mg/kg)								
Arsenic	6 / 6	1.9E+01	FC714-SD05-10C	3.9E-01	1E-06	NA	5E-05	NA
Cumulative Corresponding Hazard Index^c						NA		
Cumulative Corresponding Cancer Risk^d							5E-05	

^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

HI = Hazard Index

mg/kg = milligrams per kilogram

RSL = Oak Ridge National Laboratory (ORNL). May 2010. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites. [Online].

Available: <http://epa-prgs.ornl.gov/chemicals/index.shtml>

Generated by: D. Stannard/WDC

Checked by: S.Overheim

Appendix F

TABLE 2.4

Occurrence, Distribution, and Selection of Chemicals of Potential Concern
 Proposed Fitness Center
 MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
 Medium: Groundwater
 Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection [5]
Groundwater at Fitness Center	14797-73-0	Perchlorate	ND	ND	UG/L		0/8	0.5 - 0.5	5.0E-01	N/A	2.6E+00 N	N/A	N/A	NO	DLBSL
	7440-36-0	Antimony	ND	ND	UG/L		0/8	3.75 - 3.75	3.8E+00	3.3E+00	1.5E+00 N	6.0E+00	MCL	YES	DLASL
	7440-38-2	Arsenic	1.1E+00 J	1.1E+00 J	UG/L	FC714-GW05-10C	1/8	1.5 - 1.5	1.1E+00	5.8E+00	4.5E-02 C	1.0E+01	MCL	NO	BBK
	7440-50-8	Copper	ND	ND	UG/L		0/8	6 - 6	6.0E+00	2.8E+00	1.5E+02 N	1.3E+03	MCL	NO	DLBSL
	7439-92-1	Lead	8.7E-01 J	1.9E+00 J	UG/L	FC714-GW06-10C	6/8	1.25 - 1.25	1.9E+00	2.8E+00	1.5E+01	1.5E+01	MCL, 15A NCAC 2L	NO	BSL
	7440-66-6	Zinc	8.0E+00 J	2.0E+01 J	UG/L	FC714-GW05-10C	8/8	5 - 5	2.0E+01	4.2E+01	1.1E+03 N	1.0E+03	15A NCAC 2L	NO	BSL

[1] Minimum/Maximum detected concentration. Unfiltered results for metals since in general no significant difference between filtered and unfiltered results.
 [2] Maximum concentration is used for screening. If ND, maximum detection limit used for screening.
 [3] Background values are two times the arithmetic mean basewide background shallow groundwater concentrations.
 [4] Oak Ridge National Laboratory (ORNL). May, 2010. Regional Screening Levels for Chemical Contaminants at Superfund Sites.
 Available: <http://epa-prgs.ornl.gov/chemicals/index.shtml>. Adjusted (noncarcinogenic RSLs adjusted by dividing by 10) tap water RSLs.

MCL = Maximum Contaminant Level from EPA's National Primary Drinking Water Standards
 SMCL = Secondary Maximum Contaminant Level from EPA's National Primary Drinking Water Standards
 15A NCAC 2L = North Carolina Classifications and Groundwater Quality Standards, Amended January 2010.
 COPC = Chemical of Potential Concern
 ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
 J = Estimated Value
 C = Carcinogenic
 N = Noncarcinogenic
 ND = Not detected
 ug/L = micrograms per liter
 N/A = Not available

Selection Reason: Above Screening Levels (ASL)
 Deletion Reason: No Toxicity Information (NTX)
 Essential Nutrient (NUT)
 Below Screening Level (BSL)
 Detection Limit Below Screening Levels (DLBSL)
 Below Background Level (BBK)

Appendix F

TABLE 2.5

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Proposed Fitness Center

MCB Camp Lejeune, North Carolina

Scenario Timeframe: Future
 Medium: Subsurface Soil
 Exposure Medium: Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Subsurface Soil at Fitness Center	14797-73-0	Perchlorate	ND	ND	MG/KG		0/13	0.00205 - 0.00262	2.6E-03	N/A	5.5E+00 N	N/A		NO	DLBSL
	7440-36-0	Antimony	ND	ND	MG/KG		0/13	0.769 - 0.959	9.6E-01	3.6E-01	3.1E+00 N	N/A		NO	DLBSL
	7440-38-2	Arsenic	1.7E-01 J	4.0E+00	MG/KG	FC714-SB10-6-7-10C	10/13	0.359 - 0.447	4.0E+00	2.1E+00	3.9E-01 C*	5.8E+00	Csoil	YES	ASL
	7440-50-8	Copper	3.9E-01 J	1.1E+00 J	MG/KG	FC714-SB10-6-7-10C	8/13	1.02 - 1.28	1.1E+00	1.7E+01	3.1E+02 N	7.0E+02	Csoil	NO	BSL
	7439-92-1	Lead	9.5E-01	4.8E+00	MG/KG	FC714-SB04-5-6-10C	13/13	0.512 - 0.639	4.8E+00	9.6E+00	4.0E+02 N	2.7E+02	Csoil	NO	BSL
7440-66-6	Zinc	6.8E-01 J	4.8E+00	MG/KG	FC714-SB08-9-10-10C	12/13	1.02 - 1.28	4.8E+00	6.6E+00	2.3E+03 N	1.2E+03	Csoil	NO	BSL	

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening. If ND, maximum detection limit used for screening.

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

[4] Oak Ridge National Laboratory (ORNL). May 17, 2010. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites. Available: <http://epa-prgs.ornl.gov/chemicals/index.shtml>. Adjusted (noncarcinogenic RSLs adjusted by dividing by 10) residential soil RSLs. 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.

[5] Rationale Codes

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

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/
 To Be Considered

J = Estimated Value

N/A = Not Applicable/Not Available

C = Carcinogenic

N = Noncarcinogenic

Csoil = Federal Remediation Branch Target Screening Values, calculated source for soil which is protective of groundwater, January 2010

MG/KG = Milligrams per kilogram

Appendix F

TABLE 2.5a

Risk Ratio Screening for Subsurface Soil, Maximum Detected Concentration

Proposed Fitness Center

MCB Camp Lejeune, North Carolina

Analyte	Detection Frequency	Maximum Detected Concentration (Qualifier)	Sample	Residential Soil RSL	Acceptable Risk Level	Corresponding Hazard Index ^a	Corresponding Cancer Risk ^b	Target Organ
Metals (mg/kg)								
Arsenic	10 / 13	4.0E+00	FC714-SB10-6-7-10C	4E-01	1E-06	NA	1E-05	NA
Cumulative Corresponding Hazard Index^c						NA		
Cumulative Corresponding Cancer Risk^d							1E-05	

^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.

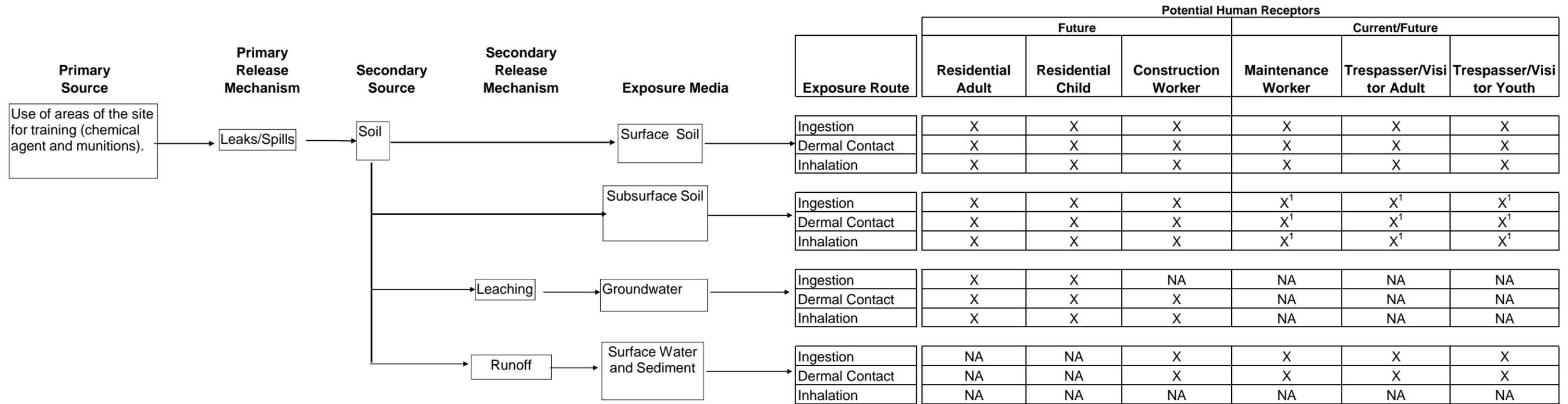
COPC = Constituent of Potential Concern

HI = Hazard Index

mg/kg = milligrams per kilogram

RSL = Oak Ridge National Laboratory (ORNL), May 2010. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites. [Online].

Available: <http://epa-prgs.ornl.gov/chemicals/index.shtml>



NA - Not Applicable or pathway is incomplete
 X - Potentially complete exposure pathways
 1 - future exposure only

FIGURE 5-1
 Conceptual Site Model for HHRA
 Proposed Fitness Center
 Camp Lejeune, Jacksonville, NC

Appendix G
Ecological Risk Screening Tables

Table G-1

Fitness Center MILCON Surface Soil Screen

MCB CampLej, 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	Mean Hazard Quotient	2 X Mean Background	Exceeds 2 X Mean Background?	Step 2 COPC?	Rationale
Explosives (UG/KG)													
Perchlorate	1.06 - 1.64	0 / 32	--	--	NSV	-- / --	NSV	0.64	NSV	--	--	NO	Not detected
Inorganics (MG/KG)													
Antimony	0.54 - 0.84	1 / 32	0.92	FC714-SS10-10C	0.27	1 / 32	3.40	0.34	1.25	0.45	Yes	NO	Low frequency of detection
Arsenic	-- - --	32 / 32	1.62	FC714-SS01-10C	18.0	0 / 32	0.090	0.55	0.03	0.63	Yes	NO	HQ less than one
Copper	-- - --	32 / 32	252	FC714-SS01-10C	28.0	1 / 32	9.00	9.48	0.34	4.83	Yes	NO	Low frequency of exceedance
Lead	-- - --	32 / 32	24.0	FC714-SS01-10C	11.0	9 / 32	2.18	9.37	0.85	12.3	Yes	NO	Within range of background; low magnitude of exceedance
Zinc	-- - --	32 / 32	11.4	FC714-SS01-10C	46.0	0 / 32	0.25	4.53	0.10	10.80	Yes	NO	Within range of background; HQ less than one

NOTES

1 - Count of detected samples exceeding or equaling Screening Value

HQ - Hazard Quotient

NSV - No Screening Value

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

Generated by: Sara Kent

Checked by: Kelly Taylor

Table G-2

Fitness Center MILCON Subsurface Soil Screen

MCB CampLej, 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	Mean Hazard Quotient	2 X Mean Background	Exceeds 2 X Mean Background?	Retain?	Rationale
Explosives (UG/KG)													
Perchlorate	1.06 - 1.31	0 / 5	--	--	NSV	-- / --	NSV	0.58	NSV	--	--	NO	Not detected
Inorganics (MG/KG)													
Antimony	0.52 - 0.64	0 / 5	--	--	0.27	-- / --	2.37	0.28	1.05	0.36	Yes	NO	Not detected
Arsenic	0.38 - 0.38	4 / 5	1.30	FC714-SB03-4-5-10C	18.0	0 / 5	0.072	0.49	0.03	2.12	No	NO	Consistent with background; HQ less than one
Copper	0.42 - 0.47	3 / 5	0.46	FC714-SB05-4-5-10C	28.0	0 / 5	0.016	0.34	0.01	2.56	No	NO	Consistent with background; HQ less than one
Lead	-- - --	5 / 5	3.77	FC714-SB12-2-3-10C	11.0	0 / 5	0.34	2.55	0.23	8.49	No	NO	Consistent with background; HQ less than one
Zinc	-- - --	5 / 5	1.67	FC714-SB12-2-3-10C	46.0	0 / 5	0.036	1.19	0.03	6.59	No	NO	Consistent with background; HQ less than one

NOTES

1 - Count of detected samples exceeding or equaling Screening Value

HQ - Hazard Quotient

NSV - No Screening Value

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

Generated by: Sara Kent

Checked by: Kelly Taylor

Table G-3

Fitness Center MILCON Groundwater Screen

MCB CampLej, 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	Mean Hazard Quotient	2 X Mean Background	Exceeds 2 X Mean Background?	Retain?	Rationale
Explosives (UG/L)													
Perchlorate	0.10 - 0.10	0 / 8	--	--	NSV	-- / --	NSV	0.050	NSV	--	--	NO	Not detected
Inorganics (UG/L)													
Antimony	2.00 - 2.00	0 / 8	--	--	160	-- / --	0.013	1.00	0.01	3.275	Yes	NO	Not detected
Arsenic	1.25 - 1.25	1 / 8	1.08	FC714-GW05-10C	150	0 / 8	0.0072	0.68	0.005	5.77	No	NO	Consistent with background; HQ less than one
Copper	2.50 - 2.50	0 / 8	--	--	9.00	-- / --	0.28	1.25	0.14	2.76	Yes	NO	Not detected
Lead	0.75 - 0.75	6 / 8	1.89	FC714-GW06-10C	2.50	0 / 8	0.76	0.94	0.38	2.80	No	NO	Consistent with background; HQ less than one
Zinc	-- - --	8 / 8	20.0	FC714-GW05-10C	120	0 / 8	0.17	11.0	0.09	42.05	No	NO	Consistent with background; HQ less than one
Dissolved Metals (UG/L)													
Antimony, Dissolved	2.00 - 2.00	0 / 8	--	--	160	-- / --	0.013	1.00	0.01	3.28	Yes	NO	Not detected
Arsenic, Dissolved	1.25 - 1.25	1 / 8	1.14	FC714-GW05-10C	150	0 / 8	0.0076	0.69	0.005	5.77	No	NO	Consistent with background; HQ less than one
Copper, Dissolved	2.50 - 2.50	0 / 8	--	--	9.00	-- / --	0.28	1.25	0.14	2.76	Yes	NO	Not detected
Lead, Dissolved	0.75 - 0.75	7 / 8	2.05	FC714-GW06-10C	2.50	0 / 8	0.82	1.08	0.43	2.80	No	NO	Consistent with background; HQ less than one
Zinc, Dissolved	-- - --	8 / 8	14.8	FC714-GW05-10C	120	0 / 8	0.12	10.8	0.09	42.1	No	NO	Consistent with background; HQ less than one

NOTES

1 - Freshwater screening values

2 - Count of detected samples exceeding or equaling Screening Value

HQ - Hazard Quotient

NSV - No Screening Value

UG/L - Micrograms per liter

Generated by: Sara Kent

Checked by: Kelly Taylor

Table G-4

Fitness Center MILCON Surface Water Screen

MCB CampLej, 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	Mean Hazard Quotient	Supplemental Screening Value	Supplemental Screening Value Source	Supplemental Maximum Hazard Quotient	Retain?	Rationale
Explosives (UG/L)														
Perchlorate	0.10 - 0.10	3 / 6	0.28	FC714-SW06-10C	NSV	-- / --	NSV	0.13	NSV	9,300	Dean et. al, 2004	2.98E-05	NO	Supplemental HQ less than one
Inorganics (UG/L)														
Antimony	2.00 - 2.00	0 / 6	--	--	160	-- / --	0.013	1.00	0.01	--	--	--	NO	Not detected
Arsenic	1.25 - 1.25	5 / 6	14.5	FC714-SW05-10C	150	0 / 6	0.097	3.10	0.02	--	--	--	NO	HQ less than one
Copper	2.50 - 2.50	2 / 6	6.54	FC714-SW05-10C	9.00	0 / 6	0.73	2.20	0.24	--	--	--	NO	Not detected in filtered sample; HQ less than one
Lead	-- - --	6 / 6	8.87	FC714-SW05-10C	2.50	1 / 6	3.55	2.20	0.88	--	--	--	NO	Low magnitude of exceedance; HQ less than one in filtered sample
Zinc	2.50 - 2.50	4 / 6	179	FC714-SW05-10C	120	1 / 6	1.49	32.1	0.27	--	--	--	NO	Low magnitude of exceedance; HQ less than one in filtered sample
Dissolved Metals (UG/L)														
Antimony, Dissolved	2.00 - 2.00	0 / 6	--	--	160	-- / --	0.013	1.00	0.01	--	--	--	NO	Not detected
Arsenic, Dissolved	1.25 - 1.25	2 / 6	0.82	FC714-SW01-10C	150	0 / 6	0.0054	0.67	0.004	--	--	--	NO	HQ less than one
Copper, Dissolved	2.50 - 2.50	0 / 6	--	--	9.00	-- / --	0.28	1.25	0.14	--	--	--	NO	Not detected
Lead, Dissolved	0.75 - 0.75	3 / 6	0.51	FC714-SW03-10C	2.50	0 / 6	0.20	0.43	0.17	--	--	--	NO	HQ less than one
Zinc, Dissolved	2.50 - 2.50	3 / 6	1.74	FC714-SW04-10C	120	0 / 6	0.015	1.40	0.01	--	--	--	NO	HQ less than one

NOTES

1 - Freshwater screening values

2 - Count of detected samples exceeding or equaling Screening Value

HQ - Hazard Quotient

NSV - No Screening Value

UG/L - Micrograms per liter

Generated by: Sara Kent

Checked by: Kelly Taylor

Table G-5

Fitness Center MILCON Sediment Screen

MCB CampLej, 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	Mean Hazard Quotient	Retain?	Rationale
Explosives (UG/KG)											
Perchlorate	1.33 - 9.16	0 / 6	--	--	NSV	-- / --	NSV	1.99	NSV	NO	Not detected
Inorganics (MG/KG)											
Antimony	0.66 - 4.51	0 / 6	--	--	2.00	-- / --	2.26	0.98	0.49	NO	Not detected
Arsenic	-- - --	6 / 6	18.6	FC714-SD05-10C	7.24	3 / 6	2.57	6.33	0.87	NO	See text for discussion
Copper	-- - --	6 / 6	14.6	FC714-SD05-10C	18.7	0 / 6	0.78	5.78	0.31	NO	HQ less than one
Lead	-- - --	6 / 6	21.9	FC714-SD06-10C	30.2	0 / 6	0.73	12.4	0.41	NO	HQ less than one
Zinc	-- - --	6 / 6	366	FC714-SD05-10C	124	2 / 6	2.95	123	0.99	NO	See text for discussion

NOTES

1 - Count of detected samples exceeding or equaling Screening Value

HQ - Hazard Quotient

NSV - No Screening Value

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

Generated by: Sara Kent

Checked by: Kelly Taylor

**APPENDIX G
ATTACHMENT 1
CHECKLIST FOR ECOLOGICAL ASSESSMENTS/SAMPLING**

I. SITE LOCATION

1. Site Name _____ Fitness Center (P-714) MILCON _____
US EPA ID Number _____
Location United States Marine Corps Base (MCB), Camp Lejeune
County Onslow _____ City Jacksonville _____ State NC _____
2. Latitude 34°43'01.44" N _____ Longitude 77°27'53.39" 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. Figures 3-1 and 3-2 of this report presents site boundaries and sampling locations.

II. SITE CHARACTERIZATION

1. Indicate the approximate area of the site (i.e., acres or sq. ft.) approximately 13 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 available
CH2M HILL performed site investigations in 2010.
3. Are aerial or other site photographs available? X Yes No
If yes, please attach any available photo(s) to the site map to the report.
Figures 3-1 and 3-2 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>80</u> % Undisturbed	<u>20</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.
A man-made drainage ditch runs along the southeastern side 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 10% Light Industrial ____% Urban
____% Residential ____% Rural ____% Agricultural^b
____% Recreational^a 90% 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 X 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.* Yes. Wetlands are present immediately north and south of the site

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

MCB Camp Lejeune GIS Layer for Wetlands (National Wetlands Inventory).

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

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

Chemical Manufacturing Mixing

Waste Disposal X Other (specify)

The site is forested, undisturbed land.

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).

Inorganics were detected in the surface soil, subsurface soil, groundwater, surface water, and sediment. Explosives were detected in the surface water. Refer to the ERS for a detailed analysis.

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): Groundwater
11. Indicate the approximate depth to groundwater (in feet below ground surface [(bgs)]. Depth to groundwater is approximately 10 feet bgs.
12. Indicate the direction of groundwater flow (e.g., north, southeast, etc.)
Groundwater is assumed to flow south to southwest toward the un-named tributary.
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 Un-named tributary to Southwest Creek south of the site. 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 July 2009

Temperature (°C/°F) Warm

Wind (direction/speed): NA

Cloud Cover: Cloudy

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

Precipitation (rain, snow): Chance of rain

20. Describe reasonable and likely future land and/or water use(s) at the site.
A MILCON project for the new Fitness Center and future expansion is proposed for the site.
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.).
Two Small Arms Range (SAR) fans (the B-6, 50-foot SAR (ASR#2.134) and the B-12, Baffled Pistol Range (ASR#2.44)) overlap the Fitness Center MILCON area. 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).
- The B-12 (ASR#2.134) Range has been in use since 1970. This SAR is also known as the B-12 Rifle and Pistol Range, and has been used for firing of .22 caliber (rifle and pistol), .38, .45, and 9mm weapons.
- 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.
Inorganics were detected in the surface soil, subsurface soil, groundwater, surface water, and sediment. Explosives were detected in surface water.

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.

Receptors may be exposed to contaminants in soil, surface water, and sediment. They may also be exposed to contaminants in groundwater, upon discharge to surface water.

Checklist Completed by Sara Kent

Affiliation CH2M HILL

Author Assisted by _____

Date 11/8/2010

III. HABITAT EVALUATION

III.A Terrestrial Habitat Checklist

III.A.1 Wooded

Are any wooded areas on or adjacent to the site? X 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

X On-site Off-site

Name or Designation: Fitness Center MILCON site

1. Estimate the approximate size of the wooded area (100%, approximately 13 acres)
Please identify what information was used to determine the wooded area of the site (e.g., direct observation, photos, etc). Aerial photography available through Google Earth.



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

- Evergreen
- Deciduous
- X Mixed

Dominant plant species, if known: Not identified

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.

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

5. Specify type of understory present, if known. Provide a photograph, if available.

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

X On-site Off-site

Name or Designation: Un-named Tributary to Southwest Creek and man-made drainage ditch



Un-named tributary to Southwest Creek



Man-made drainage ditch

1. Indicate the type of flowing aquatic feature present.

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

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

If yes, please describe the indicators observed.

3. Indicate the general composition of the bottom substrate.

- | | | |
|---|---------------------------------------|--|
| <input type="checkbox"/> Bedrock | X Sand (course) | <input type="checkbox"/> Concrete |
| <input type="checkbox"/> Boulder (>10 in.) | X 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.) | X Muck (fine/black) | <input type="checkbox"/> Marl (Shells) |

X Other (please specify): Mowed grasses in man-made ditch

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

Un-named tributary has 2 foot, vertical banks vegetated with shrubs and trees. The man-made ditch has 2 foot, 3:1 sloped banks vegetated with mowed grasses.

5. Is the system influenced by tides? Yes No
 What information was used to make this determination?
Distance from the New River
6. Is the flow intermittent? Yes (man-made ditch) No (un-named tributary)
 If yes, please note the information used to make this determination.
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.
Groundwater and surface water may discharge to both features.
8. Indicate the discharge point of the water body. Specify name of the discharge, if known.
Both features discharge to Southwest Creek, which then flows into the New River.
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 during site visit

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.

13. What observations were made at the water body regarding the presence and/or absence of benthic macroinvertebrates, fish, birds, mammals, etc?

Unknown, not observed during site visit

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, North Carolina 2007-2011 Integrated Natural Resource Management Plan (INRMP), 2006.

MCB Camp Lejeune GIS Layer for Wetlands (NWI)

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

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.

Wetland Area Questions

On-site Off-site

Name or Designation: Wetlands occur in the areas immediately north and south of the site.

1. Indicate the approximate area of the wetland (acres or ft.²). A wetland delineation has not been conducted by CH2M HILL personnel for this area. Wetland habitats were observed during the site visits.

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
- Wooded
- Other (Please describe):

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. Observations were not recorded.

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 Marine

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:

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)

Other(specify)

7. Describe observed color and area of coloration. None recorded

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 and groundwater from the site discharges to the wetlands located to the south.

10. Is there a discharge from the wetland? Yes No

If yes, to what water body is discharge released?

- Marine (Name:_____)
- 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. None collected.

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.*

No

13. 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

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

Unknown

15. Is the site used by any ecologically³, recreationally or commercially important species? If yes, explain.

No

³ 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 onsite, 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. leaching, groundwater to surface water).

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 constituents in groundwater are not expected to be high enough to cause any discernable impact to Southwest Creek.

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.

Yes. Inorganics were detected in areas where receptors may be exposed. Additionally, perchlorate was detected in surface water.

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

None 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.

Water level measurement data suggests that shallow groundwater within the vicinity of the site generally flows south to the un-named tributary to Southwest Creek. Should the low level concentrations in groundwater migrate into the creek, concentrations will likely dilute and attenuate to the extent that aquatic receptors would not be at risk.

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

Runoff into the un-named tributary and man-made drainage ditch could reach receptors.

10. 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

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

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

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

- < 25%
- 25-75%
- > 75% (except in the area surrounding the man-made ditch)

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

- Yes
- No
- Do not know

14. 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

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

No

16. 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