FINAL
ENGINEERING EVALUATION/COST ANALYSIS (EE/CA)

SITE 95 MAGNOLIA ROAD
MARINE CORPS BASE
CAMP LEJEUNE NORTH, CAROLINA

Prepared for
Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic Division

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ACRONYMNS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
Baker	Baker Environmental, Inc.
bgs	Below Ground Surface
BHC	Benzene hexachloride
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cl	Clay (Visual Classification)
COC	Contaminant of Concern
DDD	4, 4' Dichlorodiphenyldichloroethane
DDT	4, 4' Dichlorodiphenyltrichloroethane
DDE	4, 4'Dichlorodiphenyldichloroethylene
DoN	Department of the Navy
DOT	Department of Transportation
DPT	Direct Push Technology
EE/CA	Engineering Evaluation/Cost Analysis
E&S Plan	Erosion Control and Sedimentation Plan
ºF	Fahrenheit
FFA	Federal Facilities Agreement
HHR	Human Health Risk
ITRC	Interstate Technology & Regulatory Council
IR	Installation Restoration
MCB	Marine Corps Base
MDL	Method Detection Limit
mg/kg	Milligram per Kilogram
mg/L	Milligram per Liter
msl	Mean Sea Level
NAVFAC	Naval Facilities Engineering Command
NC	North Carolina
NCAC	North Carolina Administrative Code
NCDAH	North Carolina Division of Archives and History
NCDENR	North Carolina Department of Environment and Natural Resources
NCGWQS	North Carolina Groundwater Quality Standards

NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NCTSV	North Carolina Federal Remediation Branch Target Screening Values
NEPA	National Environmental Policy Act
NTCRA	Non-Time-Critical Removal Action
O&M	Operation and Maintenance
OSHA	Office of Safety and Health Administration
PCB	Polychlorinated Biphenyls
PPE	Personal Protective Equipment
PRG	Preliminary Remediation Goal
RAO	Removal Action Objective
RCRA	Resource Conservation and Recovery Act
Rhēa	Rhēa Engineers & Consultants, Inc.
RSL	Regional Screening Level
SARA	Superfund Amendments and Reauthorization Act
sc	Clayey Sand (Visual Classification)
SI	Site Investigation
sm	Silty Sand (Visual Classification)
SSL	Soil Screening Level
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TBC	To Be Considered
TCLP	Toxicity Characteristic Leaching Procedure
USDA	United States Department of Agriculture
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
Water and Air	Water and Air Research, Inc.
WSDOE	State of Washington Department of Ecology

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EXECUTIVE SUMMARY

This report presents an engineering evaluation and cost analysis (EE/CA) for a Non-Time-Critical Removal Action (NTCRA) for arsenic contaminated surface and subsurface soil at Site 95 Magnolia Road at Marine Corps Base (MCB) Camp Lejeune, Onslow County, North Carolina. Site 95 consists of three locations (Lyman Road, Magnolia Road and Jaybird Road) where livestock dipping vats applied an arsenic-based pesticide.

A Site Investigation (SI) was conducted from 2006 to 2007. Arsenic concentrations in both the surface and subsurface soil samples from several locations at Site 95 Magnolia Road exceeded the acceptable human health risk (HHR) range of 10^{-4} to 10^{-6}. As a result of the sampling, arsenic was named a contaminant of concern (COC) for the Magnolia Road location. No soil contamination above the acceptable HHR was found at the remaining two Site 95 locations – Lyman Road and Jaybird Road. Also, groundwater was investigated at the three Site 95 locations (Magnolia Road, Lyman Road, or Jaybird Road) and determined to pose no unacceptable risk to human health or the environment.

The goals of this EE/CA are to identify the objectives of the removal action and to analyze the effectiveness, implementability, and cost of various alternatives that may satisfy these objectives for the identified source area at Site 95 Magnolia Road. Two action alternatives were evaluated to remove the arsenic-impacted soil: 1) excavation and 2) phytoremediation. Each technology was evaluated based on **effectiveness**, i.e., overall protection of human health and the environment, compliance with applicable or relevant and appropriate requirements (ARARs), long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, and short-term effectiveness; **implementability**, i.e., technical feasibility, administrative feasibility, availability of services and materials, and state and community acceptance; and **cost**, i.e., direct and indirect capital costs and operations and maintenance costs.

The 30-day public comment period for the Site 95 Magnolia Road EE/CA provides an opportunity for the community to provide input regarding the Preferred Alternative for Site 95 Magnolia Road.

During the comment period, interested parties may submit written comments to the following Partnering Team members:

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The Administrative Record, Community Relations Plan, and final technical reports concerning Site 95 Magnolia Road can be accessed by the public at home through the Internet at the link provided below, or at the following location where the Internet is available:

Onslow County Public Library
58 Doris Avenue East
Jacksonville, North Carolina 28540
(910) 455-7350

Administrative Record website address:

https://portal.navfac.navy.mil/portal/page/portal/navfac/navfac_ww_pp/navfac_hq_pp/navfac_env_pp/env_restoration_installations/lant/midlant/lejeune/records

1.0 INTRODUCTION

This report presents an engineering evaluation/cost analysis (EE/CA) for a Non-Time-Critical Removal Action (NTCRA) for Site 95 Magnolia Road at Marine Corps Base (MCB) Camp Lejeune, North Carolina. Site 95 consists of three areas (Lyman Road, Magnolia Road and Jaybird Road) where livestock dipping vats were located. The Magnolia Road site is located approximately 1,500 feet from the western bank of the New River, off of an unpaved road that branches south of Magnolia Road.

Investigations at Site 95 Magnolia Road indicated the presence of arsenic contamination within surface and subsurface soil at the site. Arsenic concentrations in both the surface and subsurface soil samples collected from several locations exceeded the acceptable human health risk (HHR) range of 10^{-4} to 10^{-6}. As a result of the sampling, arsenic was named a contaminant of concern (COC) for the Magnolia Road location. No soil contamination above the acceptable HHR was found at the remaining two Site 95 locations – Lyman Road and Jaybird Road. Groundwater at the three Site 95 locations was determined to have no unacceptable risk to human health and the environment.

The removal actions presented and evaluated are designed to address the arsenic contamination in the soil at Site 95 Magnolia Road. The actions are intended to remove or treat arsenic contaminated material from the site in the most practical and cost efficient manner.

1.1 REGULATORY BACKGROUND

This document is issued by the United States Department of the Navy (DoN), lead agency responsible for removal actions at Site 95, with the assistance of the United States Environmental Protection Agency (USEPA) Region 4 and the North Carolina Department of Environment and Natural Resources (NCDENR), under Section 104 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA). A removal action is being considered for Site 95 Magnolia Road where a source area has been identified. This removal action is not time-critical. NTCRAs are defined in 40 Code of Federal Regulations (CFR) Section 300.415(b)(4) as actions pertaining to a less imminent threat to human health and the environment and have planning periods of six months or more.

According to 40 CFR Section 300.415, the lead agency is required to conduct an EE/CA when a NTCRA is planned for a site. The goals of an EE/CA are to identify the objectives of the removal action and to analyze the effectiveness, implementability, and

cost of various alternatives that may satisfy these objectives. An EE/CA documents the removal action alternatives and selection process. NTCRAs also allow for the expedited cleanup of sites where the extent of the contamination is well defined.

1.2 PURPOSE OF THE EE/CA

According to the USEPA *Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA* (USEPA, 1993), "an EE/CA is a flexible document tailored to the scope, goals, and objectives of the NTCRA. It should contain only those data necessary to support the selection of a response alternative, and rely upon existing documentation whenever possible." The goals of an EE/CA are to:

- Satisfy environmental review requirements for removal action;
- Satisfy administrative record requirements for improved documentation of removal action selection; and
- Provide a framework for evaluating and selecting alternative technologies.

The guidance further notes the following:

- A separate risk assessment is not necessary;
- Data collection to characterize the nature and extent of contamination should be limited to those needed to support the specific objectives of the NTCRA; and
- Only a few viable alternatives relevant to the EE/CA objectives should be identified and analyzed.

An EE/CA must be completed for all NTCRA, under CERCLA, as required by Section 300.415(b)(4)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

1.3 ORGANIZATION OF THE EE/CA

The following information is presented in this EE/CA:

- Section 2 Site Characterization;
- Section 3 Identification of Removal Action Objectives;
- Section 4 Identification and Analysis of Removal Action Alternatives;
- Section 5 Comparative Analysis of Removal Action Alternatives; and
- Section 6 Recommended Removal Action Alternative.

2.0 SITE CHARACTERIZATION

2.1 FACILITY AND SITE DESCRIPTION

Site 95 is comprised of three separate locations (Lyman Road, Jaybird Road, and Magnolia Road), where cattle and goat dipping vats, required by the federal government to combat cattle tick fever, were used to apply arsenic-based pesticides to livestock from 1902 to 1950 (Townson, 2007). Of the three locations, the Magnolia Road site is the only location where arsenic exceeded background and regulatory levels (CH2M Hill, 2007). Refer to Figures 1 and 2 for the General Location Map and the Site Location Map, respectively. Descriptions of the three locations are provided below, followed by characterization details for Site 95 Magnolia Road where a NTCRA is proposed.

2.1.1 Site Location (Magnolia Road)

Site 95 Magnolia Road is located approximately 1,500 feet from the western bank of the New River. It is located to the west of an unpaved road that branches south of Magnolia Road in a previously heavily wooded area that was cleared for sampling purposes. The dipping vat at this location is constructed of concrete and is about 25 feet long, four feet deep, and four feet wide. Refer to Figure 3 for the Site 95 Magnolia Road location.

2.1.2 Site Location (Jaybird Road)

Site 95 Jaybird Road is located north of Jaybird Road approximately 1.6 miles from the eastern bank of the New River and 600 feet south of Frenchs Creek, a tributary of the New River. It is located off of an unpaved road north of Jaybird Road in a previously heavily wooded area that was cleared for sampling purposes. The dipping vat at this location is made of brick and is roughly 12 feet long, four to five feet deep and three feet wide (CH2M Hill, 2007). Refer to Figure 2 for the Site 95 Jaybird Road location.

2.1.3 Site Location (Lyman Road)

Site 95 Lyman Road is located on the northwest side of an unpaved road that branches to the north of Lyman Road approximately 2,600 feet west of State Route 172 in a previously heavily wooded area that was cleared for sampling purposes. The dipping vat at this location is made of concrete and is roughly 25 feet long, seven feet deep and three to four feet wide (CH2M Hill, 2007). Refer to Figure 2 for the Site 95 Lyman Road location.

2.1.4 Site History

Site 95 Magnolia Road was one of the many locations throughout North Carolina, as well as other southern and midwestern states that used livestock dipping vats in an attempt to eradicate ticks that caused illness in cattle and other livestock. These vats were widely used from 1906 to 1961 and were approximately 25 to 30 feet long, four to five feet deep, and two to four feet wide (Townson, 2007). Each vat could hold about 1,500 to 2,000 gallons of dipping solution, which up until 1950 usually contained 0.14 to 0.22 percent arsenic by weight. Constructed at the end of each vat was a drip pad, approximately 12 feet by 15 feet. Water was needed to make the arsenical dipping solution; therefore, the cattle dip vats were usually in close proximity to a well or surface water.

2.1.5 Topography

The site is located in the Coastal Plain Physiographic Province within North Carolina (NC). The Coastal Plain Province typically consists of topographically flat lying ground with very minor relief typically in the form of surficial drainage channels. Topographic elevations vary between zero to 30 feet.

Site 95 Magnolia Road is dominated by forests consisting of large trees and low growing shrubs. Several remnant foundations of pre-existing structures including the former dipping vat can be observed at various locations in and below the ground surface. The only existing infrastructure remaining is unimproved roads - Old Town Point Road to the south, Magnolia Road to the north, and an unnamed connector road to the east of the site (Figure 3).

The site is flat lying with a topographic relief of +/- two feet. Surficial drainage channels exist along Old Town Point Road and flow to the east toward the New River. The drainage channels are conveyed under the unnamed connector road via a corrugated steel drainage pipe.

2.1.6 Geology

The geology at Site 95 Magnolia Road is consistent with the facility and regional geology published literature. As part of the Site Investigation (SI), three soil borings were advanced to 15 feet below the ground surface (bgs), and 17 borings were advanced to four feet bgs. Surficial soil (0.0 to 1.0 foot bgs) is predominately composed of brown to gray silty sand or very fine to fine sand. The subsurface soil (1 foot to 15 feet bgs) is composed of tan to gray fine sands, which have varying amounts of silts and clays.

Typically tan to gray clay lenses, ranging from 0.1 to one foot thick, are noted throughout the area at depths ranging from four to 15 feet bgs (CH2M Hill, 2007).

The soil of interest identified within this report is isolated to the arsenic contaminated soil. The surficial soil is classified in accordance with the Unified Soil Classification System (USCS) as silty sand (sm). Clay was encountered around 1.5 feet to greater than four feet and is classified as clayey sand (sc) to clay (cl).

2.1.7 Hydrology

Groundwater elevations at Site 95 Magnolia Road range from 12.67 to 12.94 feet above mean sea level (msl) during the groundwater survey conducted as part of the SI. Data collected indicate the direction of groundwater flow is northeasterly across the site towards the New River. The average hydraulic gradient is 0.0072 feet/feet (CH2M Hill, 2007).

2.1.8 Surrounding Land Use and Populations

The site is located within a wooded area west of the New River. A building is located about 8,000 feet south of the site. No structures outside of the dipping vat exist in the immediate site area.

The closest water supply well is located approximately 15,000 feet (2.8 miles) to the east, within the Hadnot Point Industrial Area.

2.1.9 Sensitive Ecosystems and Historical Site

Camp Lejeune National Environmental Policy Act (NEPA) Departments (Threatened and Endangered Species, Archaeology, Forestry, and Land and Wildlife) were contacted on November 25, 2008 to determine if any environmental impacts would occur related to the remediation of Site 95 Magnolia Road. All parties contacted indicated there were no environmental impacts related to the remediation of the site. The site does not contain any jurisdictional wetlands.

The site is a documented historic site and is registered as Archaeology Site 31ON387 at the North Carolina Division of Archives and History (NCDAH). State and federal law required the consent of the NCDAH to make permanent modifications to the site. A letter from MCB Camp Lejeune requesting approval by the NCDAH to alter the site through arsenic remediation was sent on April 26, 2007. A letter approving the site

alterations was received by Camp Lejeune Base on May 23, 2007. The letters are provided in Appendix A.

2.1.10 Meteorology

MCB Camp Lejeune is located within southeastern North Carolina, near the Atlantic Ocean. Mild winters and hot humid summers characterize the climate. Winters are usually short and mild with occasional, short duration cold periods. Average annual precipitation is approximately 50 inches. Ambient air temperatures generally range from 33 to 53 degrees Fahrenheit (°F) in winter months and from 71°F to 88°F in the summer months. Winds are generally north-northwesterly in winter and south-southwesterly in the summer (Water and Air, 1983).

2.2 PREVIOUS INVESTIGATIONS

Site 95 Magnolia Road was discovered during an archaeological review of the MCB Camp Lejeune. The dipping vat location was forwarded to the base Environmental Management Department who authorized Baker Environmental, Inc. (Baker) to sample the locations for pesticides and metals. The initial sampling was completed and published in a letter report in 2004 (Baker, 2004).

CH2M Hill conducted a SI of Site 95 and published a Site Investigation Report in 2007. The conclusions of that report indicate arsenic concentrations did exceed regulatory limits. The report also delineated the surface and subsurface arsenic contaminated soils at Site 95 Magnolia Road, (CH2M Hill, 2007). Refer to Figures 4 and 5 for CH2M Hill's Site 95 Magnolia Road Surface Soil Arsenic Results and the Site 95 Magnolia Road Subsurface Soil Arsenic Results, respectively. These figures include the Baker sampling results and are updated with current state screening levels.

Rhēa Engineers and Consultants, Inc (Rhēa) collected waste characterization soil and concrete samples that were analyzed under the USEPA Toxicity Characteristic Leaching Procedure (TCLP) method to determine if they would be classified as hazardous. The soil sampling occurred in November 2008, and the concrete sampling occurred in July 2009. Both the soil and concrete were identified as non-hazardous. TCLP testing results are presented in Appendix B.

2.2.1 Initial Site Assessment

Initial assessment of the dipping vat at Magnolia Road was performed by Baker and is documented in the report *Suspected Dipping Vat Sampling and Suspected Asbestos Shingle/Transit Board Sampling* (Baker, 2004). Baker collected two soil samples inside the vat, which were later analyzed for pesticides and Resource Conservation and Recovery Act (RCRA) metals. According to the report, detected arsenic concentrations exceeded the Region 9 Residential Preliminary Remediation Goals (PRGs) [USEPA 2004], and the North Carolina Soil-to-Groundwater standard applicable at the time. The report indicated the following pesticides were detected at concentrations exceeding regulatory driven criteria in soil samples collected from the dipping vat at Site 95 Magnolia Road:

- 4,4'- Dichlorodiphenyldichloroethane (DDD);
- 4,4'- Dichlorodiphenyltrichloroethane (DDT); and
- 4,4'- Dichlorodiphenyldichloroethylene (DDE).

Further review of the data by CH2M Hill revealed the regulatory driven criteria were incorrectly reported, and the pesticides were not detected at concentrations exceeding the regulatory criteria (CH2M Hill, 2007).

2.2.2 Site Investigation

The SI at Site 95 Magnolia Road was completed by CH2M Hill from 2006 to 2007. The objective of the SI was to further characterize and delineate potential contamination and sources at Site 95 Magnolia Road in an effort to evaluate whether additional investigations and/or remediation activities were necessary.

Investigative activities conducted during the SI included the following:

- Surface and subsurface soil sampling;
- Installation of three monitoring wells;
- Groundwater sampling of the site monitoring wells; and
- Survey of monitoring well and soil boring locations.

Surface and Subsurface Soils

The SI included soil investigations consisting of gridded soil sampling using Direct Push Technology (DPT). In October 2006, 31 borings were advanced at the vat location and at 20 feet centers near the vat, with slightly wider spacing in the surrounding areas.

Continuous core soil samples were collected within disposable acetate sleeves using a macro-core soil sampler for Volatile Organic Compound (VOC) screening and visual description.

Surface Soil Samples

Surface soil samples were collected at each boring location at depths from zero to one foot bgs and sent for laboratory analysis. Seventeen subsurface soil samples were collected above the groundwater level at depths from three to four feet bgs and sent for laboratory analysis. The soil samples were analyzed for VOCs, Semivolatile Organic Compounds (SVOC)s, Polychlorinated Biphenyls (PCB)s, Target Analyte List (TAL) metals, and pesticides.

VOCs were not detected in surface soil exceeding method detection limits (MDLs) in samples collected from Site 95-Magnolia Road.

Eight SVOCs were detected at concentrations exceeding MDLs in surface soil, including di-n-butylphtalate, bis(2-ethylhexyl)phthalate, benzaldehyde, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluoranthene, and pyrene. None of the SVOCs were detected at concentrations exceeding the screening criteria.

Two pesticides, aldrin and endrin, were detected in surface soil exceeding MDLs; however, neither pesticide was detected at concentrations in exceedance of screening criteria. PCBs were not detected at concentrations exceeding MDLs in surface soil samples collected at Site 95-Magnolia Road.

Fourteen metals including aluminum, antimony, barium, beryllium, calcium, chromium, cobalt, copper, lead, magnesium, nickel, potassium, silver, and vanadium were detected at concentrations exceeding MDLs, but less than the screening criteria for the surface soil samples. Arsenic concentrations detected in the surface soil samples exceeded the Residential PRGs and the North Carolina Soil Screening Level (SSL) [NCDENR 2005] in nine locations. The maximum concentration was 188 milligrams per kilogram (mg/kg) in the surface soil sample collected from IR95B-IS115, as shown on Figure 4. Arsenic concentrations exceeded the acceptable HHR (10^{-4}) in three locations. Soil samples collected from within the vat during Baker's investigation also indicated arsenic concentrations in exceedance of the acceptable HHR.

Subsurface Soil Samples

Three VOCs, acetone, 2-butanone, and methylene, were detected in subsurface soil samples at concentrations exceeding MDLs, but not exceeding screening criteria. Two SVOCs, bis(2-ethylehxyl)phthalate and di-n-butylphthalate, were detected in subsurface soil samples at concentrations exceeding MDLs; however, the concentrations did not exceed the screening criteria. Pesticides and PCBs were not detected in subsurface soil samples exceeding MDLs.

Eighteen metals including, aluminum, antimony, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, lead, magnesium, manganese, nickel, potassium, silver, sodium, vanadium, and zinc, were detected in subsurface soil samples exceeding MDLs, but at levels below the screening criteria. Arsenic concentrations detected in subsurface soil samples exceeded the Residential PRG in 13 locations and exceeded the SSL in five locations. The maximum concentration of 436 mg/kg was collected from sample location IR95B-IS115 (see Figure 5). Arsenic concentrations in subsurface soil exceeded the acceptable HHR in two locations. Iron was detected at concentrations exceeding the SSL at 15 locations, but remains below the Base background concentration. The mercury SSL was exceeded in sample IR95B-IS109; however, the detected mercury concentration was below the Base background concentration.

Overall, analytical data indicated exceedances of regulatory criteria for arsenic in soil. Based on the results of the SI, arsenic concentrations in surface soil and subsurface soil at Site 95 Magnolia Road were identified with the potential to 1) pose unacceptable risks to human health and the environment and 2) contaminate the groundwater. Arsenic concentrations exceeded the acceptable USEPA Residential PRG of 39 mg/kg for HHR (10^{-4}) and the North Carolina SSL of 30 mg/kg for groundwater protection (NCDENR, 2008), which were applicable at the time of the SI in 2007. However, state criteria has changed since 2007; please see Section 2.4 for a discussion concerning the current 2009 criteria. A removal action was recommended. As a result of the analytical testing completed during the SI, a volume of 370 cubic yards of soil was estimated for excavation or treatment and removal.

Groundwater

Three monitoring wells were installed at Site 95 Magnolia Road (see Figure 4). The monitoring well locations were selected at the entrance to the dipping vat (IR95B-MW02), the exit of the dipping vat (IR95B-MW01), and at a down-gradient location (IR95B-MW03).

These shallow (i.e., 15 feet bgs) monitoring wells were installed in July 2006. They were constructed using two-inch ID, Schedule 40, PVC well riser and screen materials. Ten feet of 0.010-inch slot well screen was used in each well. After the well installations were completed and the wells developed, groundwater samples were collected as part of the SI field activities.

Groundwater samples were collected from the three monitoring wells using a peristaltic pump and low flow sampling techniques on August 1, 2006. The samples were analyzed for VOCs, SVOCs, PCBs, TAL metals, and pesticides.

VOCs and SVOCs were not detected at concentrations exceeding MDLs in the groundwater samples collected from the Site 95 Magnolia Road monitoring wells. One pesticide, Delta-benzene hexachloride (BHC), was detected in monitoring well IR95B-MW01 in exceedance of the MDL; however, it did not exceed the North Carolina Groundwater Quality Standards (NCGWQS).

Seven metals, aluminum, antimony, cadmium, manganese, potassium, silver and sodium were detected in groundwater samples exceeding MDLs, but less than NCGWQS. Iron was detected in exceedance of the NCGWQS in groundwater collected from IR95B-MW01; however, this concentration was an order of magnitude less than the Base background level. Overall, no unacceptable risks in the groundwater at Site 95 Magnolia Road were identified.

2.3 SOURCE, NATURE, AND EXTENT OF CONTAMINATION

Based on the chemical and physical data gathered during the SI at Site 95 Magnolia Road, a source area is located around the dipping vat structure where arsenic has been detected in both surface and subsurface soil. The source area identified for removal under this NTCRA is shown on Figures 4 and 5. Based on the information provided in the SI, the estimated source area is approximately 2,900 square feet to a depth of 3.5 feet. The volume of soil within the source area is estimated to be 10,150 cubic feet, or 376 cubic yards. During the SI, groundwater samples collected indicated the groundwater had not been impacted by the arsenic.

2.4 STREAMLINED RISK EVALUATION

According to the *USEPA Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA*, (1993), "…for the EE/CA, the streamlined risk evaluation should focus on the specific problem that the removal action is intended to address. If the action is intended to address a particular source of contamination, the risk evaluation should

address the risks related only to that source of contamination." Because this EE/CA addresses only the removal or treatment of arsenic, the risk evaluation is limited to arsenic only.

In October 2009, the NCDENR revised the SSL Table to reflect the USEPA Region 4 decision to use the updated USEPA Residential Regional Screening Level (RSL) Tables rather than the outdated Region 9 Tables. The NCDENR, Division of Waste Management, Federal Remediation Branch Target Screening Values (Soil to Groundwater) [NCTSV] Table is currently a NCDENR internal document compiled from RSL data and state specific calculations for groundwater criteria. The updated NCTSV Table lists the soil to groundwater protection criteria for arsenic at 5.44 mg/kg.

The arsenic concentrations in surface and subsurface soil exceeded the acceptable HHR range (10^{-4} to 10^{-6}) and the NCTSV for groundwater protection (NCDENR, October 2009); therefore, arsenic was identified as a COC for Site 95 Magnolia Road. No COC was identified for groundwater.

3.0 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

Conditions at Site 95 Magnolia Road warrant the evaluation of Removal Action Objectives (RAOs) for the protection of human health and the environment. The RAOs for Site 95 Magnolia Road include:

- Remove surface and subsurface arsenic-contaminated soil above the NCTSV of 5.44 mg/kg, based on the average value of 15 confirmatory samples, to reduce the potential for contaminant mass flux from the source area to groundwater; and
- Reduce exposure and risk to human receptors by meeting the acceptable HHR range of 10^{-4} to 10^{-6}.

3.1 STATUTORY LIMITS OF REMOVAL ACTIONS

Non time-critical removal actions funded by EPA have a $2 million and a 12-month statutory limit pursuant to Section 104(c)(1) CERCLA. This removal action will not be USEPA funded-financed. The Navy/Marine Corps Installation Restoration (IR) Manual does not limit the cost or duration of the removal action. However, cost effectiveness is a recommended criterion for evaluation of the removal action alternatives.

3.2 DETERMINATION OF REMOVAL ACTION SCOPE

The selected removal action is intended to be a final corrective action implemented at Site 95 Magnolia Road to achieve the identified RAOs. The removal action is intended to eliminate the amount of contaminant mass present at Site 95 Magnolia Road.

Upon conclusion of the removal action, a Closeout Report will be completed detailing the removal activities. The report will include descriptions of completed removal action objectives, daily safety logs, waste manifests, confirmatory sampling results, and any modifications made to the removal action based on field situations. This report will document the completion of the removal action and the compliance with the Applicable or Relevant and Appropriate Requirements (ARARs) leading to site closure.

3.3 DETERMINATION OF REMOVAL ACTION SCHEDULE

Implementation of alternative activities is anticipated to require three to six months based on the recommended remedies. The time frame of the alternatives evaluated ranges from several weeks to upwards of five years. Treatment operations may last for a few weeks to several years depending on the alternative selected.

Each alternative will have different implementation timeframes. Factors that may affect the removal action schedule primarily relate to site conditions, requirements of the removal technologies, availability of vendors and supplies, Camp Lejeune mission requirements, and inclement weather.

4.0 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

Response actions that may be used to satisfy the RAOs include removal and off-site disposal or in-situ treatment. In accordance with the USEPA *Guidance On Conducting Non-Time-Critical Removal Actions Under CERCLA* (USEPA, 1993), treatment technologies are preferred.

4.1 IDENTIFICATION OF REMOVAL ACTION ALTERNATIVES

In order to streamline the evaluation, the Camp Lejeune Partnering Team will evaluate the following alternatives:

- No Action Alternative;

- Excavation and Off-Site Disposal of Arsenic-Contaminated Soil and Concrete Vat, with Well Abandonment; and
- In-Situ Phytoremediation of Arsenic-Contaminated Soil, Excavation and Off-Site Disposal of Concrete Vat, and Well Abandonment.

4.1.1 Alternative 1 - No Action

The No Action alternative implies no treatment or excavation will be done at the site. The site will be left as it currently exists, leaving the soil and concrete structure in place. Because contaminants will remain at Site 95 Magnolia Road under this alternative, the NCP [40 CFR 300.430(f)(4)] requires the lead agency to review the effects of this alternative at least once every five years.

4.1.2 Alternative 2 - Excavation and Off-Site Disposal of Arsenic-Contaminated Soil and Concrete Vat, with Well Abandonment

The first action alternative considered is the excavation of the arsenic-contaminated soil source area and concrete vat using conventional earth moving equipment and disposal in a non-hazardous Subtitle D landfill (see Figure 6). To determine the feasibility of this disposal plan, a composite sample of the arsenic-contaminated soil was collected and analyzed using the TCLP method. The results of the TCLP analysis determine the final designation of the excavated soil as hazardous or non-hazardous depending on the concentration of the COC. Based on the results of the December 2008 composite sample analysis, the total arsenic concentration was reported as 40 mg/kg and the arsenic TCLP concentration was 0.114 milligrams per liter (mg/L), which is below the TCLP hazardous waste level of 5 mg/L. Therefore, the soil is considered non-hazardous. In addition, a TCLP sample was taken from the concrete vat structure and the results (0.04 mg/L) also indicate the status as non-hazardous. The concrete vat will be disposed at the Camp Lejeune MCB Recycling Center. Refer to Appendix B for the TCLP laboratory results.

Prior to excavation activities, erosion and sediment controls will be installed to prevent contaminated sediments from leaving the site. An erosion control and sedimentation plan (E&S Plan) will be developed for the site. Due to the small area of disturbance, the site will not need a formal E&S Plan approval (disturbance is less than one acre). The excavated area will be backfilled and restored to grade, fertilized, seeded and mulched to restore vegetation.

The proposed transportation route of the non-hazardous waste haulers will be along Old Town Point Road. This unimproved road will be posted with a work zone speed limit of 15 miles per hour. This posting with enforcement is required to protect troops during hauling activities while they perform field exercises nearby.

As part of this alternative, the nine existing monitoring wells at Site 95 Magnolia Road, Lyman Road and Jaybird Road will be abandoned. The well abandonment will be conducted in accordance with North Carolina regulations.

4.1.3 Alternative 3 - In-Situ Phytoremediation of Arsenic-Contaminated Soil, Excavation and Off-Site Disposal of Concrete Vat, and Well Abandonment

Phytoremediation is a removal technique which uses plants to remove contaminants from sites. Phytoremediation can employ several removal phytotechnologies including the following that would be applicable to Site 95 Magnolia Road:

- *Phytoextraction* – Ability of plants to take up contaminants into the plant and deposit the contaminants within the biomass. This process removes the contaminants from the ground and stores them in the biomass which can be harvested and disposed at selected intervals.

- *Phytostabilization* – Ability of plants to sequester contamination through the discharge of phytochemicals on the rhizosphere and on the roots through the transport of proteins during the cellular process. This process effectively traps portions of the contamination within the cell structure of the plant roots. The biomass, likewise, can be harvested and disposed at the conclusion of the removal action.

Design of a phytoremediation project is determined by several factors including the type, depth, and concentration of the contaminant; the total area, soil type, and the hydrogeology of the site; and the growth pattern, soil preferences, and climatic tolerance of the plants. While many of the site parameters, such as details of the contamination profile, the site area, and hydrogeology are already known, it is prudent for this alternative to initially conduct small scale tests to optimize this alternative before selection of a final a plant species (or more than one) for the Site 95 Magnolia Road phytoremediation. The initial evaluation assumes shallow arsenic soil contamination will be removed through phytoextraction using arsenic hyperaccumulating Chinese Brake ferns; and subsurface arsenic soil contamination will be removed by phytostabilization via the hybrid poplar tree (Carolina or Tulip Poplars) [see Figure 7]. Throughout the removal process, the biomass will be harvested, analyzed, and properly disposed at an appropriate landfill.

Clearing of major vegetation within and directly adjacent to the removal zone will be required. An eight feet high fence will be constructed to surround the removal zone to keep herbivores separated from the arsenic-rich biomass. Total arsenic testing of the surface and subsurface soil and TCLP testing of the biomass will be conducted throughout the removal process.

In addition to the phytoremediation treatment, the concrete vat will be disposed at the Camp Lejeune Base Recycling Center.

Also, as part of this alternative, the nine existing monitoring wells at Site 95 Magnolia Road, Lyman Road and Jaybird Road will be abandoned. The well abandonment will be conducted in accordance with North Carolina regulations.

4.2 ANALYSIS OF REMOVAL ACTION ALTERNATIVES

This section presents the detailed analysis of the Removal Action Alternatives developed in Section 4.1. The evaluation criteria used for the detailed analysis is presented in Section 4.3. An individual and comparative detailed analysis can be found in Sections 4.4 and 5.0, respectively.

The detailed analysis of alternatives was conducted in accordance with the USEPA *Guidance On Conducting Non-Time-Critical Removal Actions Under CERCLA* (USEPA, 1993). The following seven criteria were used for the detailed analysis:

- Overall protection of human health and the environment;
- Compliance with ARARs;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume through treatment;
- Short-term effectiveness;
- Implementability; and
- Cost.

4.3 OVERVIEW OF EVALUATION CRITERIA

The following paragraphs describe the evaluation criteria used in the detailed analysis.

Overall Protection of Human Health and the Environment

The primary criterion a removal action must meet is the overall protection of human health and the environment. If a remedy is adequate in eliminating, reducing or

controlling current and potential site risks, it is considered protective. Each exposure pathway at the site must be evaluated when evaluating a remedy. If a hazardous substance remains on site without engineering or institutional controls, there is a constant human health and environmental exposure risk. Engineering or industrial controls must be employed in a manner that ensures the adequate protection of both human health and environmental health over time. Additionally, a removal action cannot incur unacceptable short-term risks or cross-media impacts that can affect human health and the environment. Both CERCLA and the NCP require the selected remedy must meet the so-called "threshold criteria" of overall protection of human health and the environment and compliance with identified ARARs.

Compliance with ARARs and Other Criteria, Advisories, and Guidance

In accordance with the NCP in 40 CFR 300.415(j), on-site removal actions shall, to the extent practicable considering the exigencies of the situation, attain ARARs under federal environmental or state environmental or facility sitting laws. Applicable requirements, as defined in 40 C.F.R. § 300.5, means those cleanup standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility sitting laws that specifically address a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance at a CERCLA site. Only those state standards identified by the state in a timely manner and that are more stringent than federal requirements may be applicable. Relevant and appropriate requirements, as defined in 40 C.F.R. § 300.5, means those cleanup standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility sitting laws that, while not "applicable" to a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site and their use is well suited to the particular site. Only those state standards identified by the state in a timely manner and that are more stringent than federal requirements may be relevant and appropriate. The USEPA has created three categories of ARARs: Chemical-, Location- and Action-Specific. In addition to ARARs, the lead and support agencies may, as appropriate, identify other advisories, criteria, or guidance to be considered for a particular release. The "to-be-considered" (TBC) category consists of advisories, criteria, or guidance developed by USEPA, other federal agencies, or states that may be useful in developing CERCLA remedies. See 40 C.F.R. § 300.400(g)(3).

There are no Chemical-Specific ARARs applicable to the site; however the NCDENR identifies arsenic levels no greater than 5.44mg/kg, when evaluating leachability in soil for protection of groundwater resources, a TBC guidance. Consequently, arsenic contaminated soil would be excavated to remove soil above such concentration under Alternative 2. The removal action objective will be based on the average concentration of 15 samples. Site 95 has been determined to be eligible for inclusion on the National

Registry of Historic Places. Accordingly, Location-Specific ARARs include the National Historic Preservation Act of 1966 and its implementing regulations which require federal agencies to consult with State Historic Preservation Offices and undertake measures to avoid, minimize or mitigate any adverse impacts on the historic property. The primary Action-Specific ARARs related to addressing the excavation of arsenic contaminated soil and the demolition of the concrete dip vat structure at Site 95 Magnolia Road include federal and state requirements related to the generation, temporary storage and disposal of solid waste. In addition, NCDENR regulations related to control of storm water runoff and fugitive dust emissions are relevant and appropriate for land disturbing activities such as excavation of the contaminated soil and removal of the dip vat structure. Also, NCDENR well standards, including those related to abandonment of groundwater monitoring wells, are applicable for the removal action. Refer to Tables 1, 2, and 3 for the Site 95 Magnolia Road Chemical-, Location- and Action-Specific ARARs and TBC.

Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence as a criterion addresses CERCLA's concern for ensuring protection of human health and the environment. Residual on-site risks must be accounted, even after a removal action has been completed. Evaluating this criterion includes consideration of the following:

- Degree of threat posed by hazardous substances remaining on site;
- Adequacy of controls to manage the exposure to hazardous substances remaining at the site;
- Reliability of those controls; and
- Potential impacts on human health and the environment, in the event the remedy would fail.

Reduction of Toxicity, Mobility, or Volume through Treatment

Reduction of toxicity, mobility, or volume through treatment, as a criterion, addresses the statutory preference for treatment as a principal removal action. This criterion ensures the treatment efficiency of removal action is considered and evaluated by analyzing the magnitude, significance, and irreversibility of a treatment-mediated reduction in toxicity, mobility or volume of contamination.

Short-Term Effectiveness

Short-term effectiveness as a criterion examines the efficacy of a removal action in the immediate future. Even when the long-term impacts of a removal action are verifiably beneficial, it must be contrasted against the immediate effects of implementing that alternative. Evaluating short-term effectiveness includes considering the potential threats

excavation, treatment, and transportation may pose to human health of the community and on-site workers and the environment. Potential cross-media impacts, ecosystem disruption, and the time required to achieve human health and environmental protection are all to be considered.

Implementability

Implementability as a criterion considers the technical and administrative feasibility, the availability of resources to execute a removal action, and state and community acceptance. Technical feasibility considers the availability of a technology to implement the remedy. Administrative feasibility evaluates requirements for permits, zoning variances, and impacts on adjoining property. Availability of resources considers off-site treatment, storage, and disposal capacity; qualified personnel; and services and materials. State and community acceptance is gained with approval of the preferred removal alternative.

Cost

The cost of implementing a removal action is a critical criterion that must account for the present worth of the capital cost and annual operation and maintenance (O&M) costs. Cost-efficiency is a critical component when balancing the removal goals to be achieved and the financial means by which they are achieved. The USEPA Guidance (USEPA, 1988) predicts the cost estimate proposed in a preliminary removal scope will have a -30 to +50 percent accuracy, depending on the information available and the budgetary assumptions made in developing the cost estimates.

4.4 INDIVIDUAL ANALYSIS OF ALTERNATIVES

Each alternative has been individually analyzed, in detail, as presented in the following subsections. The analysis of each alternative will include a brief description and examination of how it ranks against the evaluation criteria described in Section 4.3.

4.4.1 Alternative 1 - No Action

Alternative 1 implies Site 95 Magnolia Road remains as is, without the implementation of any additional removal actions.

Overall Protection of Human Health and the Environment

Without the implementation of a removal action, access to land with known contamination would be permitted at Site 95 Magnolia Road. If the soil contamination remains on site without any protective measure, as Alternative 1 suggests, the goal of reducing potential human health or environmental risks is not achieved.

The existing monitoring wells at each of the sites within Site 95 would remain in place. Without proper well abandonment, vandalism could occur, which might result in human contact with contamination.

Compliance with ARARs and Other Criteria, Advisories, and Guidance

Alternative 1 does not demonstrate an effort to reduce contaminant levels or to achieve the chemical-specific TBC. Action-specific ARARs do not apply to Alternative 1, because soil contamination would remain in-situ at Site 95 Magnolia Road. Five-year reviews would be required for Alternative 1, as is the case for any alternative that involves leaving contamination on site, in exceedance of the TBC.

Long-Term Effectiveness and Permanence

Alternative 1 does not meet the criterion of ensuring long-term effectiveness and permanence. When contaminated soil is left on site, its presence creates a constant risk to humans that may come into contact with it. Currently, Site 95 Magnolia Road allows access to land with known contamination and Alternative 1 does not protect future land users from the effects of arsenic soil contamination.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 1 does not include a physical treatment remedy that reduces toxicity, mobility or volume of soil contamination.

Short-Term Effectiveness

Alternative 1 does not increase the short-term, on-site risk for workers or community members, and does not present an increased short-term environmental impact associated with its implementation. However, it also does not protect human health or the environment in the short term.

Implementability

Alternative 1 does not require the coordination or availability of resources, services, or technologies; however, it will not meet the threshold criteria so implementation would not be possible. State and community acceptance of this alternative is unlikely.

Cost

The cost of implementing Alternative 1 is $0, as shown in Table 4, as Alternative 1 requires no capital costs or annual O&M costs. However, the alternative has low cost-efficiency, because it does not meet the protective measures necessary for implementation.

4.4.2 Alternative 2 - Excavation and Off-Site Disposal of Arsenic-Contaminated Soil and Concrete Vat, with Well Abandonment

Alternative 2 involves excavation of arsenic-contaminated soil. After soil removal, Site 95 Magnolia Road will be cleared for unrestricted land use. In addition, the nine existing monitoring wells at Site 95 Magnolia Road, Lyman Road and Jaybird Road will be abandoned.

As excavation occurs, in-field confirmation samples will be obtained to ensure the excavation activities meet the removal action objectives of 15 confirmation samples averaging less than 5.44 mg/kg at the site. The excavated soil will be disposed of at a Subtitle D Landfill based on initial TCLP analytical results. Following site excavation, site restoration would occur to re-establish pre-excavation conditions. Refer to Figure 6 for Excavation Option Site Layout.

Overall Protection of Human Health and the Environment

Alternative 2 is an effective measure for protecting human health and the environment because it involves excavation and off-site disposal of contaminated soil. Removal of arsenic contaminated soil at or above 5.44 mg/kg will eliminate the risk to human health. Worker safety concerns are an issue during the implementation; however, due to the frequency of use of this alternative at other CERCLA sites within the Camp Lejeune area, workers are familiar with the processes and have the knowledge to avoid or minimize potentially dangerous situations.

The existing monitoring wells at the three Site 95 locations are proposed to be abandoned in accordance with state protocol. The proper abandonment will prevent potential well vandalism that could result in human contact with contamination.

Compliance with ARARs and Other Criteria, Advisories, and Guidance

Alternative 2 complies with the chemical-specific TBC by achieving arsenic soil concentrations that permit unrestricted land use. The location-specific ARAR under NCDAH would be relevant for Alternative 2 due to the excavation aspect of this alternative. Action-specific ARARs under North Carolina Administrative Code (NCAC), RCRA, and Department of Transportation (DOT) would also be relevant for Alternative 2 due to the need for excavating, staging, transporting and disposing of arsenic contaminated soil. Site activities will be implemented in a way consistent with meeting ARAR requirements.

This alternative complies with the following ARARs:

- Managing fugitive dust emissions;
- Generated non-hazardous waste removed from site;
- Storing, transportation, and disposal of waste generated from removal activities;
- Managing storm water, surface water, and sedimentation; and
- Abandonment of monitoring wells.

Long-Term Effectiveness and Permanence

Alternative 2 will effectively ensure long-term effectiveness or permanence by removing arsenic soil contamination in accordance with the removal action objective from Site 95 Magnolia Road. The conditions of appropriate waste disposal facilities eliminate the potential exposure of human receptors to contaminated substances. Excavation of arsenic contaminated soil to the removal action objective at Site 95 Magnolia Road will remove potential long-term risks to human health by reducing the overall magnitude of risk at the site. Confirmatory sampling will monitor the effectiveness of the action.

Reduction of Toxicity, Mobility, or Volume through Treatment

Treatment is not a component of Alternative 2; however, complete physical removal of contaminated soil will remove the source of contamination, such that toxicity, mobility, or volume reduction is no longer a relevant concern. The contaminated soil will be

transported to a site where human receptors are prevented from accessing the arsenic contamination.

Short-Term Effectiveness

During the excavation activities required for Alternative 2, human health and the environment will be protected by employing the proper use of Personal Protective Equipment (PPE) for remediation workers, establishing erosion and sediment control measures and dust control. Access to Site 95 Magnolia Road will be restricted to remediation workers and relevant personnel during excavation. All workers will be certified by the Office of Safety and Health Administration (OSHA) to ensure they are knowledgeable of the health and safety risks involved and how to protect themselves and the environment from harmful contaminant exposure. There is an increased risk to workers and the surrounding community because of soil excavation and transport during implementation of this alternative.

Implementability

Excavation activities required for Alternative 2 are fairly routine operations that involve readily accessible equipment and trained personnel. Alternative 2 does not involve the use of active treatment technologies that may be difficult to acquire or coordinate. Similar excavation activities have occurred on the Base in the past and were successfully executed.

Cost

A detailed cost estimate for Alternative 2 is presented in Table 5. The estimated net present worth cost for Alternative 2 is $174,647. Alternative 2 has high cost efficiency because it permits unrestricted land use within the shortest time frame.

4.4.3 Alternative 3 - In-Situ Phytoremediation of Arsenic-Contaminated Soil, Excavation and Off-Site Disposal of Concrete Vat, and Well Abandonment

Alternative 3 involves the use of plants to remove the arsenic contaminated soil. The Chinese Brake Fern (an arsenic hypoaccumulator) will be used to perform phytoextraction. Phytoextraction is the process of transferring the arsenic from the ground to the surface within the plant's biomass. Annual harvesting will be required. This action will remove arsenic from the surface soil to a depth of one foot. A second plant (Hybrid Poplar) will be used to remove the contaminants from the subsurface soil from one foot to up to four feet. The Hybrid Popular (variety Carolina or Tulip) is a

phytostabilizer. This process effectively traps the arsenic contamination within the root structure of the poplar trees. Annual harvesting is not required; however, removal of the poplar tree root systems will be required at the conclusion of the removal action. Refer to Figure 7 for Phytoremediation Site Layout. In addition, the nine existing monitoring wells at Site 95 Magnolia Road, Lyman Road and Jaybird Road will be abandoned.

Overall Protection of Human Health and the Environment

Alternative 3 by itself will not prevent human contact with contaminated soil, but an erected fence to prevent herbivores from entering the site will restrict site usage by trespassers while the removal process is occurring. Once the removal action objective is obtained, Site 95 Magnolia Road will have an unrestricted land use. Human health and the environment are protected with proper implementation and maintenance during and at the conclusion of the removal process.

The existing monitoring wells at the three Site 95 areas are proposed to be abandoned in accordance with state protocol. The proper abandonment will prevent any potential well vandalism that could result in human contact with contamination.

Compliance with ARARs and Other Criteria, Advisories, and Guidance

Alternative 3 complies with the chemical-specific TBC by achieving arsenic soil concentrations that permit unrestricted land use when the alternative is complete. The location-specific ARAR under NCDAH would be relevant for Alternative 3 due to the excavation aspect of this alternative. Action-specific ARARs under NCAC, RCRA, and DOT would also be relevant for Alternative 3 due to the need for excavating, staging, transporting and disposing of arsenic contaminated biomass. Site activities will be implemented in a way consistent with meeting ARAR requirements.

This alternative would be required to comply with the following ARARs:

- Generated hazardous waste removed from site;
- Generated non-hazardous waste removed from site;
- Storing, transportation, and disposal of waste generated from removal activates;
- Transportation of hazardous materials; and
- Abandonment of monitoring wells.

Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence of Alternative 3 will allow the site to contain an unrestricted land use by physically removing arsenic concentrations from the surface and subsurface soil. Areas targeted will include those where soil exceeds the level of 5.44 mg/kg. Following completion of the removal action, the land will have unrestricted use. This alternative will reduce the magnitude of risk once the treatment is completed. The effectiveness of the treatment option is still in its infancy and much of the published data represents ideal conditions within laboratory settings. Real world environments may provide inconsistencies with published arsenic accumulation rates. Furthermore, remediation can only occur during the growing seasons.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 3 is an active treatment process to remove arsenic contamination from the site. With arsenic (V) being the likely form of site contamination because of its lack of mobility, it is reasonable to assume groundwater will not be contaminated during the duration of active treatment; therefore, the reduction of toxicity, mobility, and volume treated will be met through off-site disposal of the biomass. Typically, the Chinese Brake fern will convert the arsenic (V) to arsenic (III) during the phytoextraction process. It is possible dead leaves from the fern decay could release the arsenic (III) back into the ground and arsenic (III) could leach to the groundwater. Therefore, a yearly maintenance program is required to remove all biomass at the conclusion of the growing season.

Short-Term Effectiveness

To prevent any short-term risks associated with the implementation of Alternative 3, construction workers will use PPE during the site clearing and planting phases. Alternative 3 does not require intrusive activities by heavy equipment; however, hand excavation will occur during the planting phase. Upon completion of Alternative 3 installation, this alternative will be effective in protecting human health and the environment mainly by the perimeter fence preventing access during the removal process.

Implementability

Construction activities required for Alternative 3 are fairly routine operations that involve readily accessible equipment and trained personnel. It may be difficult to acquire materials for this alternative (e.g., specialized plants). After initial installation, annual maintenance and harvesting will be required. It is assumed the biomass related to the

Brake Fern will be hazardous and require disposal in a Subtitle C hazardous waste landfill (WSDOE, 2009).

Cost

A detailed cost estimate for Alternative 3 is presented in Table 6. The estimated net present worth cost for Alternative 3 is $150,292. Alternative 3 has moderate cost-efficiency because it requires long term maintenance, hazardous waste disposal, temporary site restrictions, and root mass extraction after the completion of the treatment.

5.0 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

This section presents a comparative analysis of the three alternatives presented for the soil remediation at Site 95 Magnolia Road. The purpose of the comparative analysis is to identify the relative advantages and disadvantages of each alternative. Thus, the seven previously introduced criteria used for the detailed analysis will be the basis for the following comparative analysis.

Overall Protection of Human Health and the Environment

Each alternative will protect human health and the environment for the desired future land use with the exception of Alternative 1, the No Action alternative. Alternative 2 is most protective of human health and the environment because soil exceeding the chemical-specific TBC cleanup goal is removed from the site within the shortest time frame; however, Alternative2 has the highest risk for potential worker health impacts. For Alternatives 2 and 3, protection of human health and the environment will be achieved through the removal and off-site disposal of the arsenic contamination.

Compliance with ARARs and Other Criteria, Advisories, and Guidance

All of the alternatives, except for No Action, meet the applicable chemical-specific TBC requirement for the desired future land use, location-specific ARARs, and action-specific ARARs.

Long-Term Effectiveness and Permanence

The No Action alternative will not be effective over the long-term in protecting human health and the environment because the contaminants will remain at the site and will not be contained, removed, treated, nor controlled. Both Alternative 2 and Alternative 3 are effective because arsenic contamination will be removed from the site to levels meeting

the removal action objective. The long-term effectiveness of Alternative 3 is uncertain because much of the published data represents ideal conditions within laboratory settings. Real world environments may provide inconsistencies with published arsenic accumulation rates.

Reduction of Toxicity, Mobility, or Volume through Treatment

Only Alternative 3 will reduce toxicity, mobility, or volume of contaminants through treatment. The treatment will transport the arsenic contamination to the plants which will be harvested and disposed at an appropriate landfill. Though Alternative 2 is not a treatment process, it effectively removes the arsenic contamination from the site thus complying with the requirements of this section.

Short-Term Effectiveness

While the No Action Alternative will not cause increased risk for workers and community members, it also is not effective at protecting human health and the environment in the short-term. For Alternatives 2 and 3 to be effective in the short-term, worker and environmental protection plans will need to be in place. Because of the significant amount of excavation required for Alternative 2, as compared to Alternative 3, there is an increased risk to workers and community members. It is estimated all of the alternatives can be implemented in less than one year.

Implementability

The No Action alternative does not require the coordination or availability of resources, services, or technologies; however, it will not meet the threshold criteria so implementation would not be possible. All of the other alternatives have an “easy” level of difficulty to implement and similar work to Alternative 2 has been completed successfully at other CERCLA sites on Camp Lejeune. Alternative 3 may have a “moderate” difficulty in obtaining specific arsenic hypoaccumulating plants required by this type of treatment.

Cost

Estimated capital and O&M costs for each alternative, as discussed previously, are presented on Tables 4 through 6. The estimated total net present worth cost for each alternative is provided below:

Alternative Name	Alternative Objective	Alternative Costs
No Action (Alternative 1)	No Action	$0
Excavation and Off-Site Disposal of Arsenic-Contaminated Soil and Concrete Vat, with Well Abandonment (Alternative 2)	Excavation of arsenic soil contamination >5.44 mg/kg (based on the average of 15 confirmatory samples)	$174,647
In-Situ Phytoremediation of Arsenic-Contaminated Soil, Excavation and Off-Site Disposal of Concrete Vat, and Well Abandonment (Alternative 3)	Phytoremediation of arsenic soil contamination >5.44 mg/kg	$150,292

Alternative 1 has a low cost efficiency. The cost to implement Alternative 1 is $0; however, it does not meet the protection measures necessary for implementation. Alternative 2 has high cost efficiency because it permits unrestricted land use within the shortest time frame. Alternative 3 has moderate cost efficiency because it requires long-term maintenance, hazardous waste disposal, temporary site restrictions, and root mass extraction after the completion of treatment.

5.1 RELATIVE RANKING OF ALTERNATIVES

Below is a visual comparison of the three alternatives as discussed above:

Evaluation Criteria	No Action Alternative (Alternative 1)	Excavation with Off-Site Disposal (Alternative 2)	Phytoremediation Technology (Alternative 3)
Overall Protection of Human Health & Environment	○	◙	◙
Compliance with ARARs and Other Criteria, Advisories, and Guidance	○	◙	◙
Long-Term Effectiveness & Permanence	○	◙	●
Reduction of Toxicity, Mobility, or Volume through Treatment	○	●	●
Short-Term Effectiveness	○	●	◙
Implementability	○	◙	●
Cost*	○	◙	●

Ranking:
◙ High
● Moderate
○ Low

Rankings are provided as qualitative descriptions of the relative compliance of each alternative with the criteria.

*Cost category based on the concept of cost efficiency, rather than total cost.

Note:
No Action (Alternative 1) – No Action
Excavation with Off-Site Disposal (Alternative 2) – Excavation to 5.44 mg/kg Arsenic (based on average of 15 confirmatory samples)
Phytoremediation (Alternative 3) – Soil Treatment to 5.44 mg/kg Arsenic

6.0 RECOMMENDED REMOVAL ACTION ALTERNATIVE

As outlined above, Alternative 2 appears to be the Preferred Alternative for cleanup of Site 95 Magnolia Road. For the Preferred Alternative, protection of human health and the environment will be achieved with the off-site disposal of the arsenic contaminated soil above 5.44 mg/kg (based on the average of 15 confirmatory samples). Alternative 2 also meets the applicable chemical-specific TBC and action-specific ARARs. There will be no long-term risks associated with Alternative 2 because the arsenic contaminated soil will be removed from the site allowing unrestricted land use. Reduction in toxicity, mobility, or volume through treatment will be achieved not by treatment but by removal and disposal in an approved landfill. The short-term effectiveness may pose an increased danger to human health during the removal action, but with operational safety protocols this potential danger should be mitigated.

Furthermore, implementability of this alternative is "easy" due to the many similar removal actions that have occurred at MCB Camp Lejeune. The cost of Alternative 2 is the most efficient, because at a reasonable rate it permits the unrestricted land use at Site 95 Magnolia Road within the shortest time frame of the two removal alternatives. Based on the above, Alternative 2 satisfies the comparison criteria and provides the shortest time frame to site closure.

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TABLES

TABLE 1
CHEMICAL-SPECIFIC TBC
Site 95 EE/CA
MCB Camp Lejeune, North Carolina

Chemical	Requirements	Prerequisite	Citation
NC Soil Screening Levels			
Removal cleanup levels for arsenic contaminated soil.	Remove soil to protect groundwater.	Site with arsenic contamination in soil > 5.44 mg/kg – **TBC**	North Carolina Department of Environment and Natural Resources, Division of Waste Management, Federal Remediation Branch Target Screening Values (Soil to Groundwater), NCDENR Internal Document (October 2009)

TABLE 2
LOCATION-SPECIFIC ARAR
Site 95 EE/CA
MCB Camp Lejeune, North Carolina

Location Characteristics	Requirements	Prerequisite	Citation
Cultural Resources – Federal National Historic Preservation Act of 1966 (NHPA) (Amended through 2006)			
Presence of historic property – Archaeological Site 310N0387 (Site 95) deemed eligible for inclusion on National Register of Historic Places.	Consider adverse effects on historic properties per NHPA Section 106.	Undertaking [as defined in 36 CFR 800.16(y)] that has the potential to affect historic property on or eligible for inclusion on National Record of Historic Places – **applicable**	NHPA Section 106 36 CFR 800.1(a) 36 CFR 800.3
	Determine adverse effects per 36 CFR 800.5(a)(1), and if found, evaluate alternatives or modifications to the under taking to avoid, minimize, or mitigate the adverse effect on the property. *Note*: Consultation with the NC Division of Archives and History State Historic Preservation Office undertaken by MCB Camp Lejeune.		36 CFR 800.5(a) and (d) 36 CFR 800.6

TABLE 3
ACTION-SPECIFIC ARARs
Site 95 EE/CA
MCB Camp Lejeune, North Carolina

Action	Requirements	Prerequisite	Citation
Waste Characterization and Storage — Primary Wastes (e.g., excavated contaminated soils)			
Characterization of solid waste (e.g., contaminated soil).	Must determine if solid waste is hazardous waste or if waste is excluded under 40 CFR 261.4(b); and	Generation of solid waste as defined in 40 CFR 261.2 and which is not excluded under 40 CFR 261.4(a) — **applicable.**	40 CFR 262.11(a)
	Must determine if waste is listed as a hazardous waste under subpart D 40 CFR Part 261; or	Generation of solid waste which is not excluded under 40 CFR 261.4(a)— **applicable.**	40 CFR 262.11(b)
	Must characterize waste by using prescribed testing methods or applying generator knowledge based on information regarding material or processes used.	Solid waste not listed in subpart D of 40 CFR part 261 – **applicable.**	40 CFR 262.11(c)
	Must refer to Parts 261, 262, 264, 265, 266, 268, and 273 of Chapter 40 for possible exclusions or restrictions pertaining to management of the specific waste.	Generation of solid waste which is determined to be hazardous — **applicable.**	40 CFR 262.11(d)
Storage of solid waste (e.g., contaminated soil).	All solid waste shall be stored in such a manner as to prevent the creation of a nuisance, insanitary conditions, or a potential public health hazard.	Generation of solid waste which is determined not to be hazardous — **relevant and appropriate.**	15A NCAC 13B .0104(f)

TABLE 3 (cont'd)
ACTION-SPECIFIC ARARs
Site 95 EE/CA
MCB Camp Lejeune, North Carolina

Action	Requirements	Prerequisite	Citation
Waste Treatment and Disposal—Primary Wastes (excavated contaminated soils)			
Disposal of solid waste (e.g., contaminated soil).	Shall be responsible for the satisfactory storage, collection and disposal of solid waste.	Generation of solid waste intended for on-site storage and off-site disposal — **relevant and appropriate.**	15A NCAC 13B .0106(a)
	Shall ensure that waste is disposed at a site or facility which is permitted to receive the waste.	Generation of solid waste intended for off-site disposal — **applicable.**	15A NCAC 13B .0106(b)
Transportation of Wastes			
Transportation of hazardous materials.	Shall be subject to and must comply with all applicable provisions of the HMTA and DOT HMR at 49 CFR 171-180.	Any person who, under contract with a department or agency of the federal government, transports "in commerce," or causes to be transported or shipped, a hazardous material — **applicable.**	49 CFR 171.1(c)
Transportation of solid waste.	Solid waste shall be collected, transported, and disposed in a manner consistent with these rules.	Transportation of material that meet the definition of solid waste **– applicable.**	15A NCAC 13B .0105(a) - (d)
Abandonment of Monitoring Wells			
Abandonment of groundwater monitoring well(s).	Shall be abandoned in accordance with the requirements of 15A NCAC 02C .0113(b)(1) and (2).	Permanent abandonment of wells (including temporary wells) other than for water supply **— applicable.**	15A NCAC 02C .0113(b)

TABLE 3 (cont'd)
ACTION-SPECIFIC ARARs
Site 95 EE/CA
MCB Camp Lejeune, North Carolina

Action	Requirements	Prerequisite	Citation
General Management Standards — All Land-Disturbing Activities (i.e., excavation, clearing, grading, etc.)			
Managing fugitive dust emissions.	Shall not cause or allow fugitive dust emissions to cause or contribute to substantive complaints, or visible emissions in excess of that allowed under paragraph (e) of this Rule.	Activities within facility boundary that will generate fugitive dust emissions — **relevant and appropriate**	15A NCAC 02D.0540(c)
	Implement methods (e.g. wetting dry soils) to control dust emissions that could travel beyond the facility boundary.		15A NCAC 02D.0540(f)
Managing storm water runoff from land disturbing activities.	Shall take all reasonable measures to protect all public and private property from damage caused by such activities.	Land-disturbing activity (as defined in N.C.G.S. Ch. 113A-52) of more than 1 acre of land — **relevant and appropriate.**	15A NCAC 4B.0105
	Erosion and sedimentation control plan must address the following basic control objectives: (1) Identify areas subject to severe erosion, and off-site areas especially vulnerable to damage from erosion and sedimentation. (2) Limit the size of the area exposed at any one time. (3) Limit exposure to the shortest feasible time. (4) Control surface water run-off originating upgrade of exposed areas. (5) Plan and conduct land-disturbing activity so as to prevent off-site sedimentation damage. (6) Include measures to control velocity of storm water runoff to the point of discharge.	Land-disturbing activity (as defined in N.C.G.S. Ch. 113A-52) of more than 1 acre of land — **relevant and appropriate.**	15A NCAC 4B.0106
	Ground cover must be placed following construction or development, and an erosion and sedimentation control plan must be filed and approved by the agency having jurisdiction.	Land-disturbing activity (as defined in N.C.G.S. Ch. 113A-52) of more than 1 acre of land — **relevant and appropriate.**	15A NCAC 4B.0107

TABLE 3 (cont'd)
ACTION-SPECIFIC ARARs
Site 95 EE/CA
MCB Camp Lejeune, North Carolina

Action	Requirements	Prerequisite	Citation
General Management Standards — All Land-Disturbing Activities (i.e., excavation, clearing, grading, etc.)			
Managing storm water runoff from land disturbing activities.	Erosion and sedimentation control measures, structures, and devices shall be planned, designed, and constructed to provide protection from the run-off of 10 year storm.	Land-disturbing activity (as defined in N.C.G.S. Ch. 113A-52) of more than 1 acre of land — **relevant and appropriate.**	15A NCAC 4B.0108
	Temporary access and haul roads, other than public roads, constructed or used in connection with any land-disturbing activity shall be considered a part of such activity.	Land-disturbing activity (as defined in N.C.G.S. Ch. 113A-52) of more than 1 acre of land — **relevant and appropriate.**	15A NCAC 4B.0111
	Install and maintain temporary and permanent erosion and sedimentation control measures.	Land-disturbing activity (as defined in N.C.G.S. Ch. 113A-52) of more than 1 acre of land — **relevant and appropriate.**	15A NCAC 4B.0113
	Provided ground cover or other protective measures, structures, or devices sufficient to restrain accelerated soil erosion and control off-site sedimentation.	Land-disturbing activity (as defined in N.C.G.S. Ch. 113A-52) of more than 1 acre of land — **relevant and appropriate.**	15A NCAC 4B.0116

ARAR = applicable or relevant and appropriate requirement
CFR = Code of Federal Regulations
DOT = U.S. Department of Transportation
> greater than
HMR = Hazardous Materials Regulations
HMTA = Hazardous Materials Transportation Act
NC = North Carolina
NCAC = North Carolina Administrative Code
NHPA = The National Historic Preservation Act of 1966 (Amended 2006)
PPE = personal protective equipment
RCRA = Resource Conservation and Recovery Act of 1976
TBC = To be Considered

TABLE 4
COST ESTIMATE: NO ACTION
Site 95 EE/CA
MCB, Camp Lejeune, North Carolina

Cost Item	Unit	Qty	Unit Cost	Total Cost	Comments
DIRECT CAPITAL COSTS					
Capital Costs				$0	
PROFESSIONAL SERVICES					
Professional Services				$0	
ANNUAL OPERATION & MAINTENANCE COSTS					
Five-Year Review				$0	
SUBTOTAL PROJECT COST				***$0***	
Contingency 10%				$0	
TOTAL PROJECT COST				***$0***	

TABLE 5
COST ESTIMATE: EXCAVATION WITH OFF-SITE DISPOSAL
Site 95 EE/CA
MCB, Camp Lejeune, North Carolina

Cost Item	Unit	Qty	Unit Cost	Total Cost	Comments
DIRECT CAPITAL COSTS					
Excavation and Site Restoration					
Survey Subcontractor	LS	1	$5,417	$5,417	Estimate
Excavation Subcontractor	LS	1	$46,463	$46,463	Vendor quote
Transport and Dispose Nonhazardous Waste	LS	1	$34,308	$34,308	Vendor quote
Confirmatory Analytical Testing	EA	15	$77	$1,154	Vendor quote
Monitoring Well Abandonment	LS	1	$6,787	$6,787	Vendor quote
Portable Scales	EA	6	$323	$1,937	Vendor quote
Subtotal				$96,065	
PROFESSIONAL SERVICES					
Site Supervision, Equipment and Expenses	LS	1	$33,303	$33,303	Estimate
ANNUAL OPERATION & MAINTENANCE COSTS					
Total O&M Costs				$0	
SUBTOTAL PROJECT COST				***$129,368***	
Contingency 35%				$45,279	
TOTAL PROJECT COST				***$174,647***	

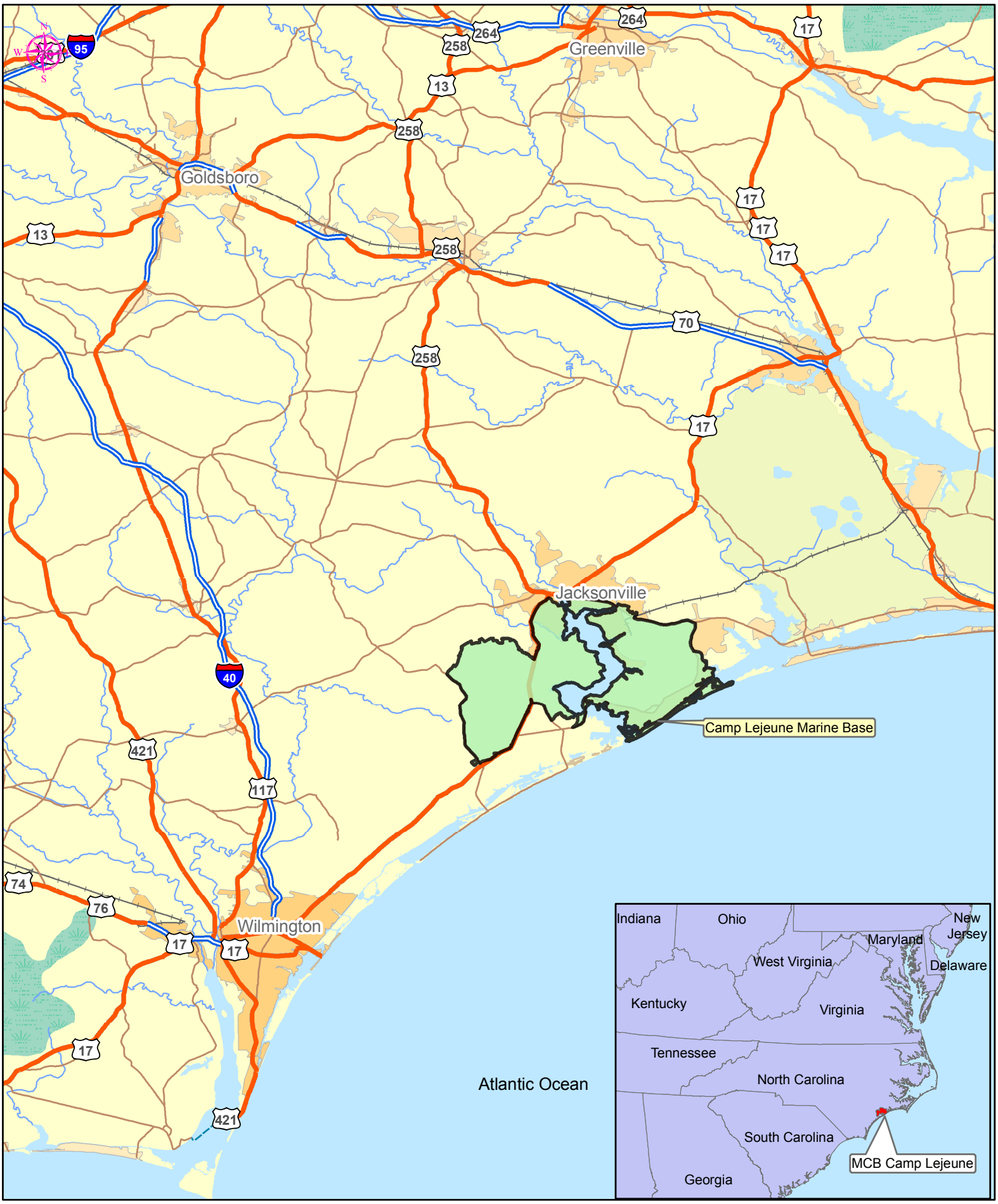
TABLE 6
COST ESTIMATE: PHYTOREMEDIATION
Site 95 EE/CA
MCB, Camp Lejeune, North Carolina

Cost Item	Unit	Qty	Unit Cost	Total Cost	Comments
INITIAL DIRECT CAPITAL COSTS					
Site Preparation					
Fence w/Gate	LS	1	$9,421	$9,421	Vendor quote
Site Clearing (ft) (Hot Spot)	LS	1	$4,171	$4,171	Vendor quote
Site Clearing (50 ft Perimeter)	LS	1	$4,171	$4,171	Vendor quote
Hybrid Poplar (*poplar canadensis* or *liriodendron tulipifera*)	EA	56	$18	$1,008	Vendor quote
Brake Fern (*pteris Vittata*)	EA	206	$12	$2,472	Vendor quote
Excavation and cleaning of concrete	LS	1	$3,575	$3,575	Vendor quote
Concrete Removal	LS	1	$1,454	$1,454	Vendor quote
Monitoring Well Abandonment	LS	1	$6,787	$6,787	Vendor quote
Subtotal				$33,059	
INITIAL PROFESSIONAL SERVICES					
Site Supervision, Equipment and Expenses	LS	1	$4,341	$4,341	Estimate
Total Initial Implementation				$37,400	
ANNUAL OPERATION & MAINTENANCE COSTS (Per Year for 5 Years)					
Annual Perimeter Maintenance	EA	1	$596	$596	Vendor quote
Annual Harvesting	EA	1	$2,729	$2,729	Estimate
Annual Hazardous Waste Disposal	EA	1	$4,171	$4,171	Vendor quote
Annual Waste TCLP	EA	1	$1,543	$1,543	Vendor quote
Total Arsenic Biomass	EA	1	$84	$84	Vendor quote
Annual O&M Subtotal Cost				$9,123	
Effective Interest Rate of 3%					
Present Worth Factor = 4.5797					
Present Cost of Annual O&M for 5 years				$41,918	
Biomass Analytical Characterization (first year only)	EA	1	$668	$668	Vendor quote (No Present Worth Factor)

TABLE 6
COST ESTIMATE: PHYTOREMEDIATION
Site 95 EE/CA
MCB, Camp Lejeune, North Carolina

Cost Item	Unit	Qty	Unit Cost	Total Cost	Comments
FINAL DIRECT CAPITAL COSTS					
Site Demolition					
Fence Removal	LS	1	$9,421	$9,421	Derived from Vendor quote
TCLP Fern Biomass	EA	1	$1,543	$1,543	Derived from Vendor quote
TCLP Poplar Root Biomass	EA	1	$1,543	$1,543	Derived from Vendor quote
Excavation of Root Masses	LS	1	$11,916	$11,916	Estimate
Final Biomass Disposal	EA	2	$4,171	$8,342	Derived from Vendor quote
Confirmatory Sampling Total Arsenic	EA	10	$84	$840	Derived from Vendor quote
Subtotal				$33,605	
FINAL PROFESSIONAL SERVICES					
Site Supervision, Equipment and Expenses	LS	1	$2,729	$2,729	Estimate
Final Demolition Total				$36,334	
Effective Interest Rate of 3%					
Present Worth Factor = .8626					
Present Cost of Site Demolition after 5 Years				$31,341	
SUBTOTAL PROJECT COST				***$111,328***	
Contingency (35%)				$38,965	
TOTAL PROJECT COST				***$150,292***	

FIGURES



140 70 0 140 Miles

RHEA Engineers & Consultants, Inc.

Figure 1
General Location Map
MCB Camp Lejeune, North Carolina

NAVFAC/1409/390/Reports/R1/EECA

1,400 700 0 1,400 Feet

RHEA Engineers & Consultants, Inc.

Figure 2
Site Location Map
Site 95
MCB Camp Lejeune, North Carolina

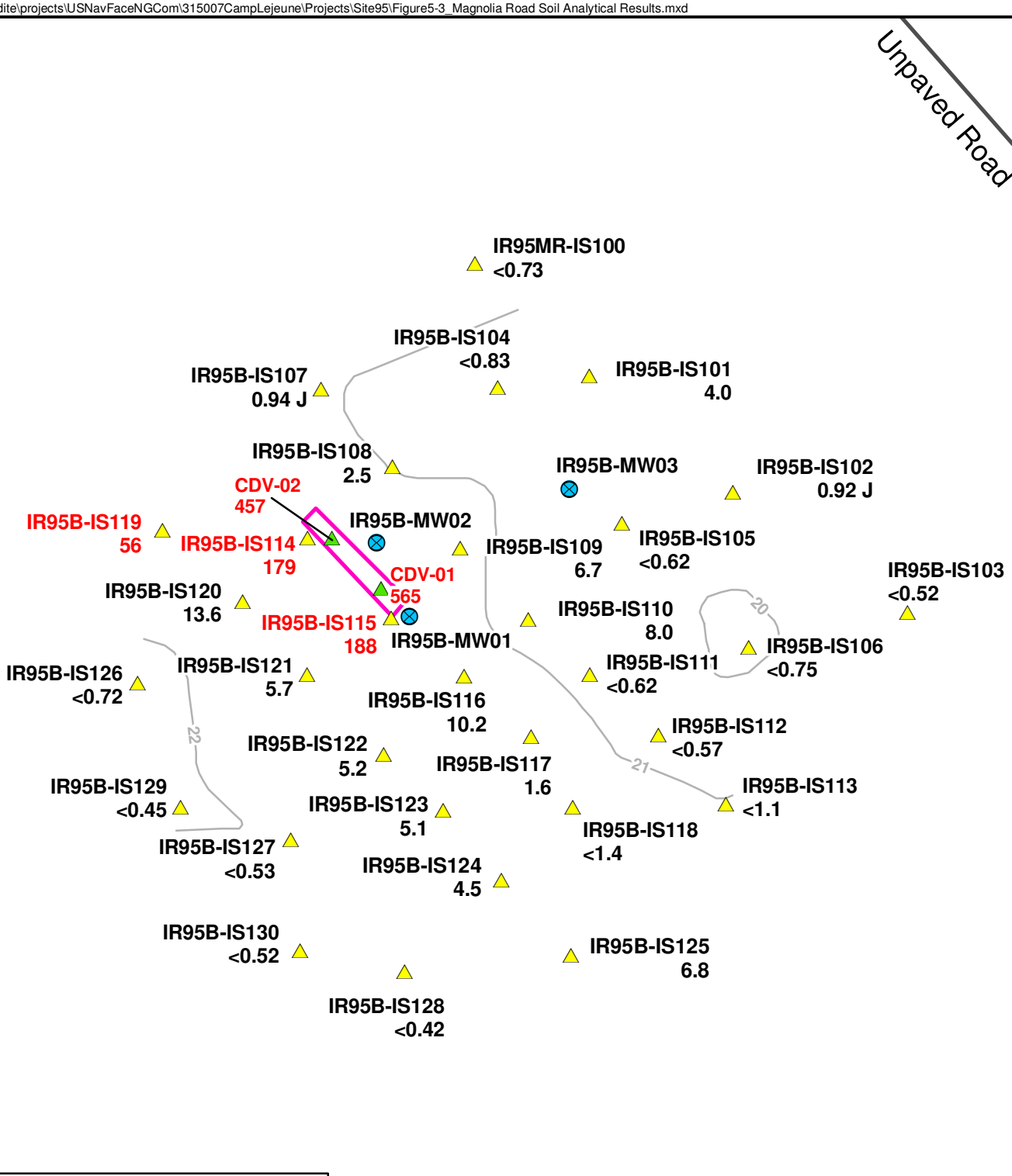
NAVFAC/1409/390/Reports/R1/EECA

100 50 0 100 Feet

NAVFAC/1409/390/Reports/R1/EECA

RHEA Engineers & Consultants, Inc.

Figure 3
Site 95 Magnolia Road Location Map
Site 95
MCB Camp Lejeune, North Carolina



Arsenic Screening Criteria	
Surface Soil Background Concentration	0.879 mg/kg
NCTSV*	5.44*mg/kg
Region 9 Residential PRG	0.39 mg/kg
10^{-4} Cancer Risk Concentration	39.0 mg/kg

Legend

- Monitoring Wells
- Soil Boring Locations
- Historical Boring Locations
- Livestock Dipping Vat
- Surface Contours
- Road

All concentration are reported in mg/kg.
J - Estimated Value
< - Arsenic was not detected above the corresponding detection limit.

IR95B-IS119 56 Surface Arsenic Exceedance of 10^{-4} Cancer Risk Concentration

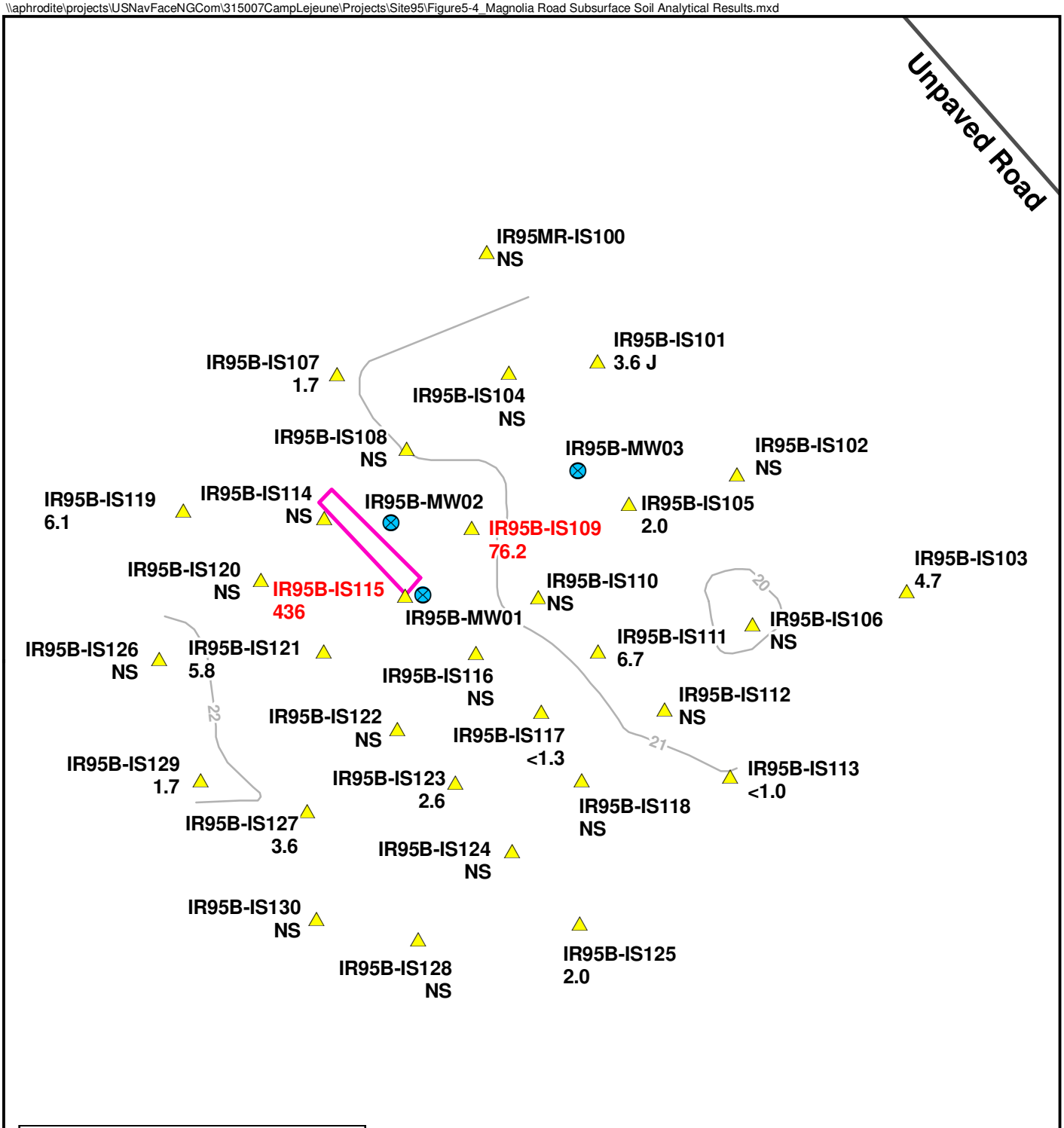
* - Updated from CH2MHill original Figure (12/23/09)

0 15 30 Feet

N W E S

Figure 4
Site 95 - Magnolia Road Surface Soil Arsenic Results
Site 95 - Site Investigation
MCB Camp Lejeune, North Carolina

CH2MHILL



Arsenic Screening Criteria	
Subsurface Soil Background Concentration	5.29 mg/kg
NCTSV*	5.44*mg/kg
Region 9 Residential PRG	0.39 mg/kg
10^{-4} Cancer Risk Concentration	39.0 mg/kg

Legend

- Soil Boring Locations
- Monitoring Wells
- Livestock Dipping Vat
- Surface Contours
- Road

IR95B-IS119 6.1 Subsurface Arsenic Exceedance of 10^{-4} Cancer Risk Concentration

* - Updated from the original CH2MHill Figure(12/23/09).

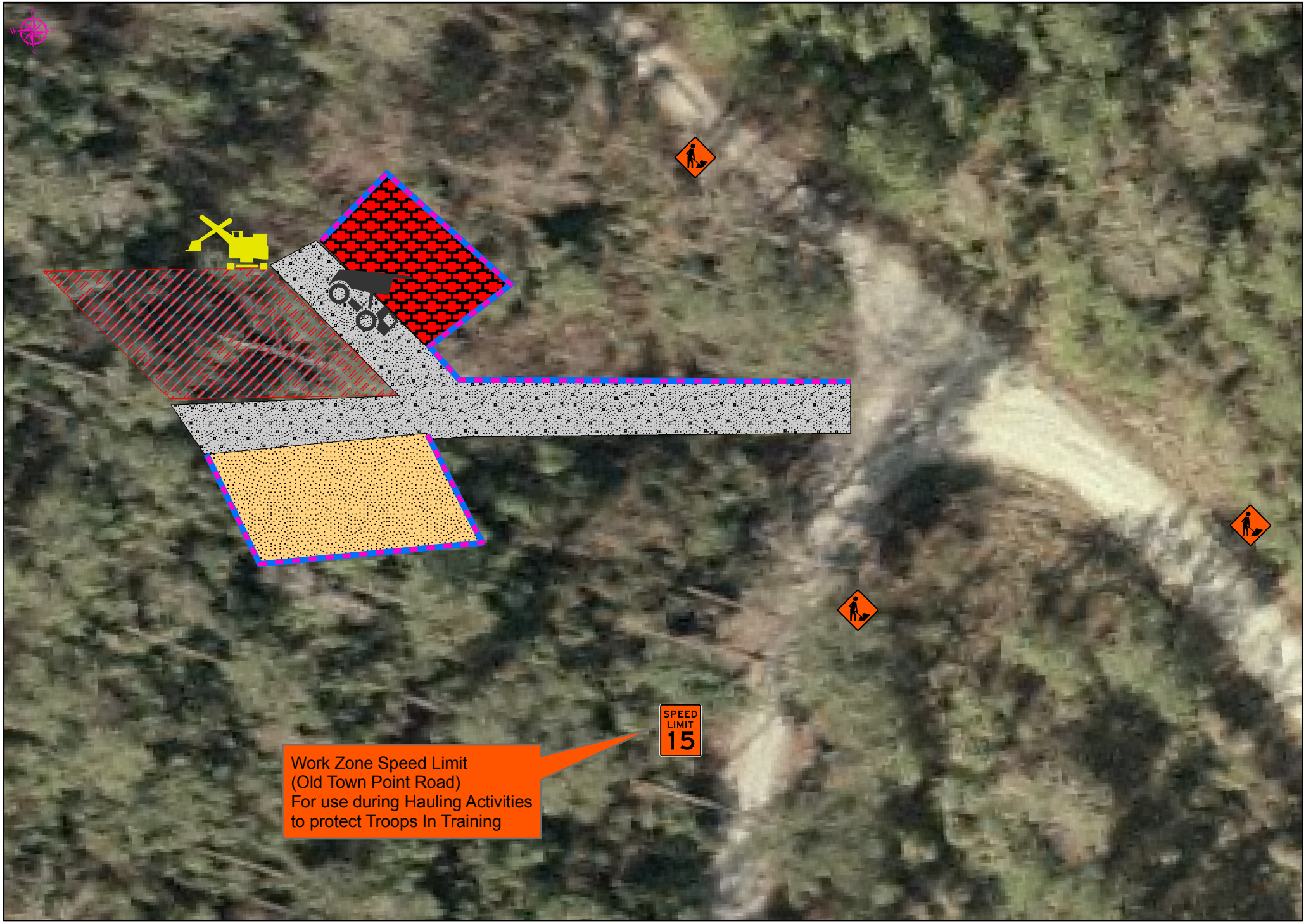
All concentration are reported in mg/kg.
J - Estimated Value
NS - Not Sampled
< - Arsenic was not detected above the corresponding detection limit.

0 15 30 Feet

N W E S

Figure 5
Site 95 - Magnolia Road Subsurface Soil Arsenic Results
Site 95 - Site Investigation
MCB Camp Lejeune, North Carolina

CH2MHILL



Legend

- E&S_Controls_(Silt_Fence)
- Excavated_Soil_Storage_Area_(if_needed)
- Clean_Soil_Staging_Area
- New_Construction_Road
- Excavation Area

20 10 0 20 Feet

NAVFAC/1409/390/Reports/R1/EECA

RHEA Engineers & Consultants, Inc.

Figure 6
Excavation Site Layout
Site 95, Magnolia Road
MCB Camp Lejeune, North Carolina

9 4.5 0 9 Feet

RHEA Engineers & Consultants, Inc.

Figure 7
Phytoremediation Alternative Site Layout
Site 95
MCB Camp Lejeune, North Carolina

NAVFAC/1409/390/Reports/R1/EECA

APPENDIX A

ARCHAEOLOGY SITE 31ON387
SUBMITTAL AND RESPONSE LETTERS

UNITED STATES MARINE CORPS
MARINE CORPS BASE
PSC BOX 20004
CAMP LEJEUNE, NORTH CAROLINA 28542-0004

IN REPLY REFER TO:
5090.8
BEMD
APR 26 2007

Mr. Peter Sandbeck
Administrator, State Historic Preservation Office
North Carolina Division of Archives and History
507 North Blount Street
Raleigh, North Carolina 27604-1119

Subj: REMOVAL OF CONTAMINATED LIVESTOCK DIPPING VAT AND SOILS FROM ARCHAEOLOGICAL SITE 31ON0387, MARINE CORPS BASE, CAMP LEJEUNE, ONSLOW COUNTY, NORTH CAROLINA

Dear Mr. Sandbeck:

Marine Corps Base, Camp Lejeune (MCBCL) proposes to conduct Interim Measures (IM) excavations for the removal and disposal of contaminated soils which exceed regulatory thresholds for pesticides and metals. The MCBCL Installation Restoration (IR) Program, through contract with Baker Environmental, Inc., performed a preliminary assessment at the location of a historic livestock dipping vat (enclosure 1) within the boundary of National Register of Historic Places (NRHP) eligible archaeological site 31ON0387 (enclosure 2). The archaeological site has been investigated, reported and recommended eligible as a result of several past archaeological studies (Loftfield and Littleton 1981, Wayne and Dickinson 1987, Espinshade et al. 1990, and Espinshade et al. 1992). Enclosure 3 details the approximate location of the livestock dipping vat within the archaeological site boundary, and enclosures 4 through 5 provide photographic and scaled drawing details of the vat. Cleanup of this area will require the removal and disposal of the concrete vat and soils in an area measuring approximately 50 feet by 50 feet (.06 acres) surrounding the vat.

Archaeological site 31ON0387 represents the former location and remains of the Glenoe Stock Farm, an experimental farm established in 1892 by Thomas A. McIntyre (Espinshade et al. 1992). The original farm encompassed nearly 2600 acres, and during the early twentieth century, the farm became a highly visited recreational center, with facilities for bowling, tennis, swimming and horse racing (Littleton 1981). Site 31ON0387 apparently represents the main residential complex of the farm, and the remnants of structural features such as brick building foundations, cellars, cisterns, as well as the concrete livestock dipping vat are still present. The use of dipping vats was a Federal government requirement during

period from 1906-1961 in the southern United States in an effort to control cattle tick fever. The precise construction year of the livestock dipping vat at site 31ON0387 is not known, and the vat may not meet the 100 year age criterion for archaeological remains as defined by the Archeological Resources Protection Act of 1979 (16 U.S.C. 470aa et seq.). However, it has been recorded as a structural feature remnant of the Glenoe Stock Farm. The vat measures approximately 8.2 meters in length and 1.15 meters in width (enclosure 5). The vat appears to be constructed entirely of poured concrete, and a segment of the northern wall has collapsed into the vat trench.

Baker Environment, Inc., at the request of MCBCL, performed a preliminary assessment of the dipping vat locale in April 2004. Further investigations during 2006 required the placement of three groundwater monitoring wells (see enclosure 4a) in the area of the vat. Groundwater samples were collected from the monitoring wells, and surficial and subsurface soil samples were collected within and adjacent to the vat using a gridded sampling pattern. With the exception of naturally occurring compounds, targeted compounds were not detected in the groundwater samples. However, compounds exceeding the regulatory standards for soils were detected in surficial and subsurface soils, and include 4,4-DDT, 4,4-DDE, 4,4-DDD, arsenic, chromium, and/or mercury. The concentrations of these compounds detected exceed risk-based concentrations, and thus require removal and disposal through excavation.

Due to the health and safety risks involved with the soils within and surrounding the dipping vat feature at site 31ON0387, further archaeological investigation of this portion of the NRHP eligible site is not feasible. Previous investigations of the site, as well as the enclosed photographs and scaled drawing will serve as the archaeological recordation of this feature prior to removal. Based on previous investigations and the enclosed documentation, we feel that further investigation of the livestock dipping vat locale of the archaeological site would not provide additional important information concerning late-nineteenth through twentieth century farming practices. Thus, the removal and disposal of this feature would not adversely affect site 31ON0387.

The enclosed are provided for your files and your comments in accordance with Section 106 of the National Historic Preservation Act and 36 CFR 800, Protection of Historic and Cultural Properties. If you have any questions on this matter, please contact

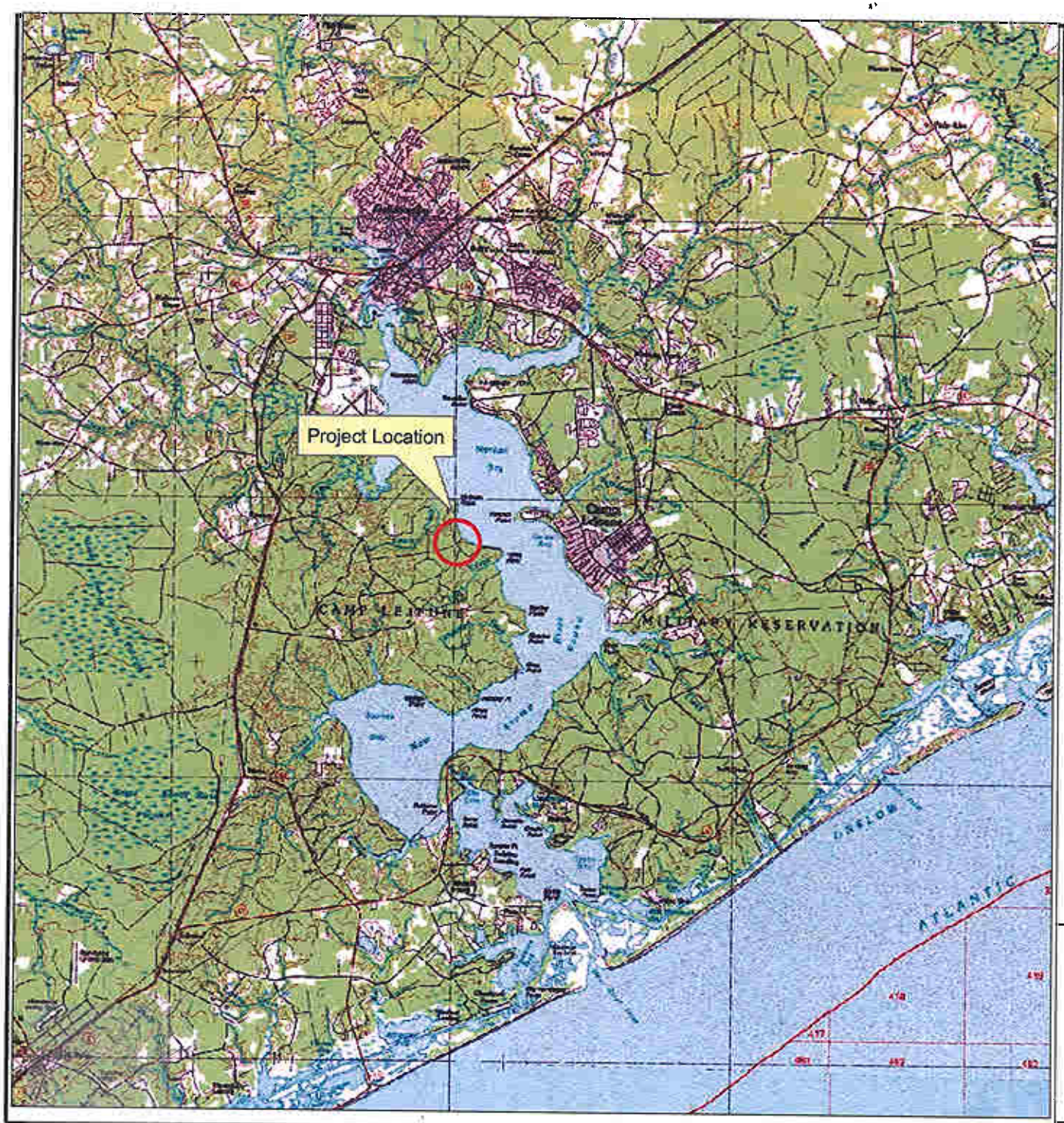
5090.8
BEMD
MAR 2 6 2007

Rick Richardson, Base Archaeologist, Environmental Conservation Branch, Environmental Management Division, Installations and Environment Department, at (910) 451-7230, or email at rick.richardson@usmc.mil.

Sincerely,

JOHN R. TOWNSON
Director, Environmental Management
By direction of
the Commanding Officer

Enclosures:
1. Project Location
2. Magnolia Lane Dipping Vat Site 31ON0387
3. Location of Dipping Vat on Site 31ON0387
4. Digital Images of Dipping Vat Surrounding Area
5. Scaled Plan Drawing of Dipping Vat



MAGNOLIA LN DIPPING VAT SITE
ENCLOSURE 1

Prepared: 10 APRIL 2007
Author: Cultural Resources
Organization: ECON/EMD
Telephone: 910-451-7009

N

1 0 1 2 3
Miles

Map Projection: UTM (NAD83, GRS 1980)

Map Generated using the Geographic Information System
Managed by the GIS Office
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Business & Logistics Support Department (BLSD)

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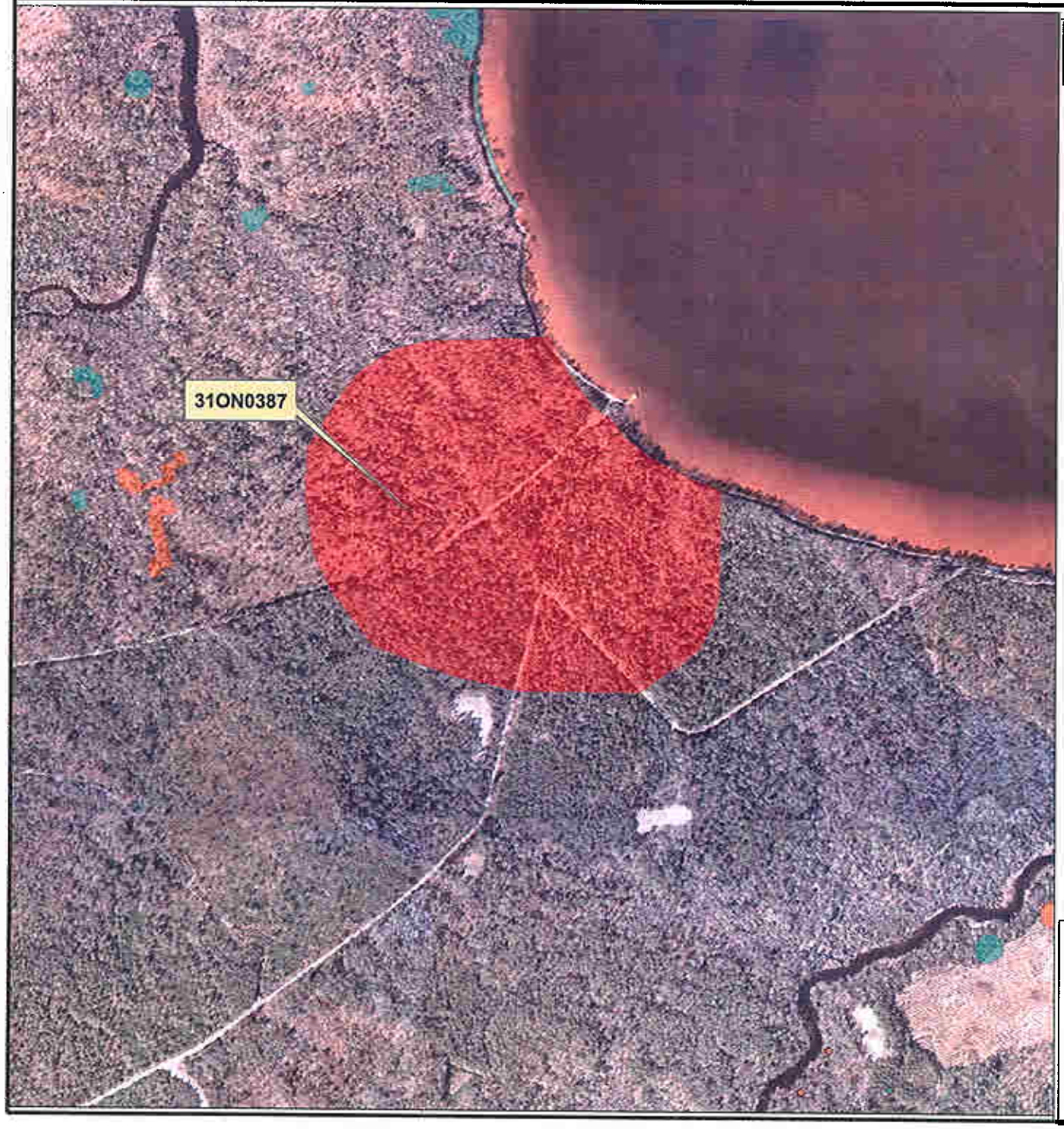

MAGNOLIA LN DIPPING VAT SITE
ENCLOSURE 2

Prepared: 10 APRIL 2007
Author: Cultural Resources
Organization: ECON/EMD
Telephone: 910-451-7009

Map Projection: UTM (NAD83, GRS 1980)

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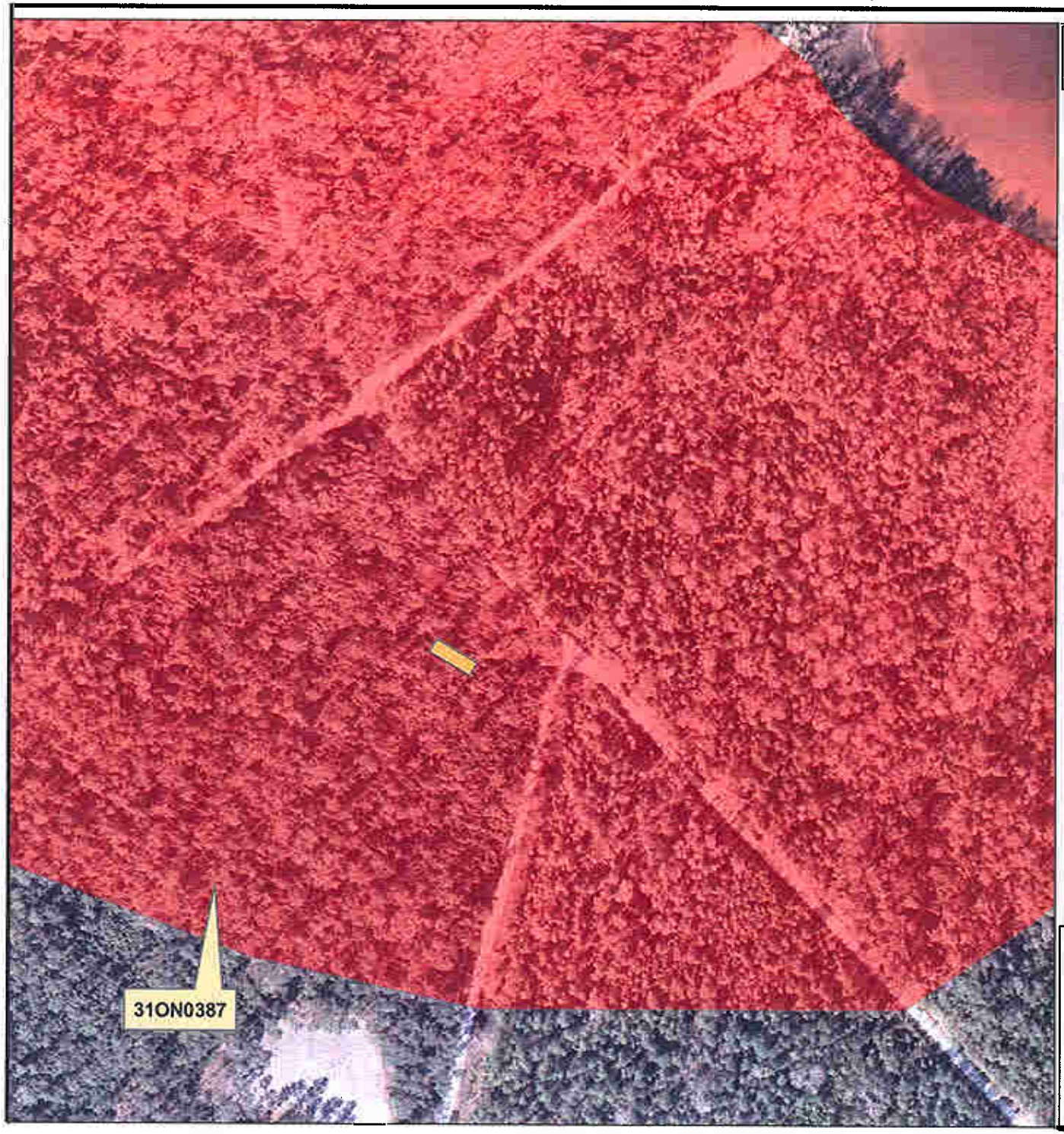

DIPPING VAT: SITE 31ON0387
ENCLOSURE 3

Approximate Location of Dipping Vat

Prepared: 10 APRIL 2007
Author: Cultural Resources
Organization: ECON/EMD
Telephone: 910-451-7009

N

40 0 40 80 120
Meters

Map Projection: UTM (NAD83, GRS 1980)

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Business & Logistics Support Department (BLSD)

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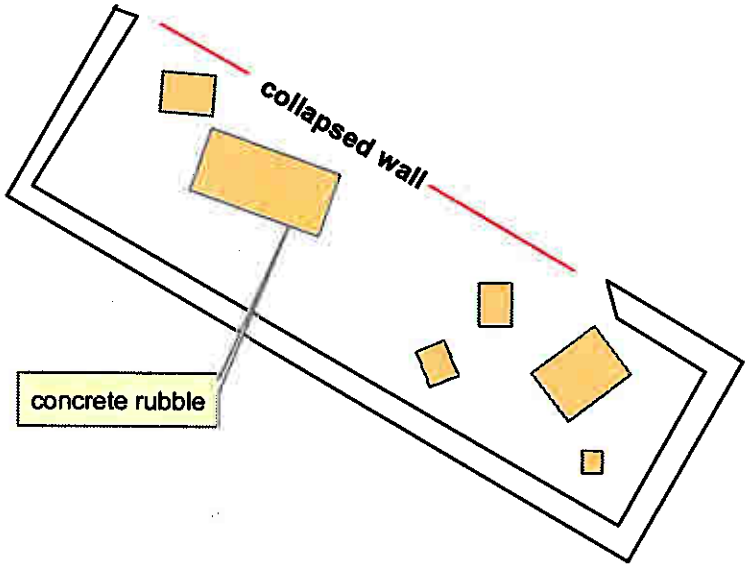
Enclosure 4a: Site 31ON0387 Dipping vat area, view from east. (note: monitoring wells in area of dipping vat)

Enclosure 4b: Lengthwise view of dipping vat, view from southeast.

Enclosure 4c: Dipping vat, view from northeast.

Enclosure 4d: Close-up view of dipping vat showing collapsed wall, view from east.

SCALED DRAWING OF DIPPING VAT
ENCLOSURE 5



Concrete Dipping Vat

Prepared: 11 APRIL 2007
Author: Cultural Resources
Organization: ECON/EMD
Telephone: 910-451-7009

Map Projection: UTM (NAD83, GRS 1980)

Map Generated using the Geographic Information System
Managed by the GIS Office
Communications/Information Technology Services Division (CITSD)
Business & Logistics Support Department (BLSD)

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Marine Corps Base Camp Lejeune
EMD Document Routing Slip

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TO:
For: Info ☐ Review ☐ Action ☐

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For: Review ☐ Routing ☐ Signature ☑

Tickler # ☐

384
Correspondence ID Number:

Due Date

Interim Review Due Date

SUBJECT: SHPO Coordination for ER-07-117: Interim Measures (Excavation) at the Magnolia Road Livestock Dipping Vat Location.

COMMENTS: Vat is a feature of NRHP eligible site. Vat and 50ftx50ft area of soil surrounding it to be removed and disposed due to contaminants. No adverse effect (we hope).

Special Mailing Instructions: none

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ELECTRONIC WORKING: DATE FILED: 4/12/2007 Initial RRR RR

LINK TO WORKING: ..\5090_08_Historic_and_Archaeological_Resources_Protection\Official Correspondence drafts\MagnoliaLaneSHPO.doc ... 042607-db

Originator Initials: RRR RR Date: 4-12-07

Section Head Initials: RRR RR Date: 4-12-07

Branch Head Initials: GWH Date: 4/13/07

Director Initials: Date:

EQB Initials: RMR Date: 4/26/07

Initials: Date:

North Carolina Department of Cultural Resources

State Historic Preservation Office

Peter B. Sandbeck, Administrator

Michael F. Easley, Governor
Lisbeth C. Evans, Secretary
Jeffrey J. Crow, Deputy Secretary

Office of Archives and History
Division of Historical Resources
David Brook, Director

May 23, 2007

John R. Townson, Director
Environmental Management Division
Marine Corps Base, Camp Lejeune
PSC Box 20004
Camp Lejeune, NC 28542-0004

Re: Removal of Contaminated Livestock Dipping Vat and Soils From Archaeological Site 31ON387 at Marine Corps Base, Camp Lejeune, Onslow County, ER 07-1010

Dear Mr. Townson:

Thank you for your letter of April 26, 2007. We have reviewed the proposal for the above project and offer the following comments.

Marine Corps Base, Camp Lejeune plans to remove and dispose of contaminated soils from a historic livestock dipping vat within the boundary of 31ON387, a site deemed eligible for inclusion on the National Register of Historic Places (NRHP). In addition, the vat itself will be removed. Previous work on the site has recorded the feature with photographs and scale drawings. Due to the hazardous nature of the feature, no further archaeological work is proposed. It has also been concluded that the work will not constitute an adverse effect on the site.

We concur that the dipping vat at 31ON387 poses a significant health and safety risk. We agree that further work would not provide additional important information concerning nineteenth through twentieth century farming or livestock practices. We also concur that removal and disposal of the vat will not adversely affect 31ON387.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, please contact Renee Gledhill-Earley, environmental review coordinator, at 919-733-4763. In all future communication concerning this project, please cite the above-referenced tracking number.

Sincerely,

Renee Gledhill-Earley

Peter Sandbeck

cc: Rick Richardson, Camp Lejeune

North Carolina Department of Cultural Resources

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Sincerely,

Renee Gledhill-Earley

Peter Sandbeck

cc: Rick Richardson, Camp Lejeune

Marine Corps Base Camp Lejeune
EMD Document Routing Slip

Open ☑ Closed ☐

579
Correspondence ID Number

Due Date

Tickler # ☐

Info ☑
Review ☐
Action ☑
Routing ☐
Signature ☐

FROM: DIRECTOR
TO: ECON
RETURN:

Outgoing ☐
Incoming ☑

SUBJECT: REMOVAL OF CONTAMINATED LIVESTOCK DIPPING VAT

COMMENTS: Bill/Rich - fyi + action. May 30 07
M/S
ST

ROUTING: Originator:

1. _____ Initials: ACV Date: 5/30/07
2. _____ Initials: _____ Date: _____
3. _____ Initials: _____ Date: _____
   Initials: _____ Date: _____

Hard Copy Location: Bldg 12 **Room:** 241 **Date filed:** **Filed by:**

Official Electronic Copy Location **Date filed:** **Filed by:**

LINK TO OFFICIAL:

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Working Electronic Copy Location **Date filed:** **Filed by:**

LINK TO WORKING:

Special Mailing Instructions:

Date Mailed: **Mailed By:**

Mail Tracking Info: ☐ Regular ☐ Certified ☐ FedEx #: Scanned ☐

APPENDIX B

TCLP RESULTS

RHEA ENGINEERS AND CONSULTANTS,INC.
SITE 95 MAGNOLIA ROAD
39001
SB7085

KATAHDIN ANALYTICAL SERVICES, INC.
600 TECHNOLOGY WAY
SCARBOROUGH, ME 04074

TABLE OF CONTENTS

Total number of pages: 890

SAMPLE DATA PACKAGE

SDG NARRATIVE
KATAHDIN ANALYTICAL SERVICES
RHEA ENGINEERS AND CONSULTANTS, INC.
SITE 95 MAGNOLIA ROAD / 39001
SB7085

Sample Receipt

The following samples were received on December 10, 2008 and were logged in under Katahdin Analytical Services work order number SB7085 for a hardcopy due date of December 22, 2008.

KATAHDIN Sample No.	RHEA Sample Identification
SB7085-1	CLJ95M-COMP1
SB7085-2	CLJ95M-COMP1

The samples were logged in for the analyses specified on the chain of custody form. All problems encountered and resolved during sample receipt have been documented on the applicable chain of custody forms.

We certify that the test results provided in this report meet all the requirements of the NELAC standards unless otherwise noted in this narrative or in the Report of Analysis.

Sample analyses have been performed by the methods as noted herein.

Should you have any questions or comments concerning this Report of Analysis, please do not hesitate to contact your Katahdin Analytical Services Project Manager, **Ms. Andrea Colby**. This narrative is an integral part of the Report of Analysis.

Organics Analysis

The samples of Work Order SB7085 were analyzed in accordance with "Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods." SW-846, 2nd edition, 1982 (revised 1984), 3rd edition, 1986, and Updates I, II, IIA, III, IIIA, and IIIB 1996, 1998 & 2004, Office of Solid Waste and Emergency Response, U.S. EPA, and/or for the specific methods listed below or on the Report of Analysis. Some manual integrations may have been performed due to split peaks and/or corrected baselines. All have been flagged with an "M" (software-generated) on the pertinent quantitation reports.

8260B TCLP Analysis

The reported percent recovery acceptance limits for the Laboratory Control Samples (LCSs) are for the full list of spiked compounds from the DoD QSM. The recoveries of the spiked analytes in the LCS, Matrix Spike (MS) and Matrix Spike Duplicate (MSD) are compared to these acceptance limits. Katahdin standard operating procedure is to take corrective action only if the number of spiked analytes in the LCS that are outside of the QC limits is greater than the DoD

QSM allowable number of exceedances. The LCS report consists of the full list of spiked analytes, but only the client's list of target analytes are evaluated. If the associated MS/MSD has greater than the allowable number of exceedances, no corrective action is taken, as long as the LCS is acceptable.

SW8015M-GRO Analysis

There were no protocol deviations or observations noted by the organics laboratory staff for this analysis.

SW8015M-DRO Analysis

The target range DRO was detected above the MDL but below the PQL in method blank WG59006-1. Any DRO that was also detected in any of the associated samples was flagged with a "B" qualifier indicating that the analyte was detected in the method blank analyzed and/or extracted concurrently with the sample.

Sample SB7085-1 was manually integrated for the target range DRO and the extraction surrogate o-Terphenyl. The specific reasons for the manual integrations are indicated on the raw data by the manual integration codes (M1-M11). These codes are further explained in the attachment following this narrative.

The opening calibration verification standard (CV) (file ABL1174) had a high response for the hydrocarbon, C36, which resulted in a %D that was greater than 20%. Since the method requirement applies to only the DRO range response, which was acceptable, the associated sample was not reanalyzed.

The closing CV (file ABL1187) had high responses for two individual hydrocarbons, which resulted in %D's that were greater than 20%. Since the method requirement applies to only the DRO range response, which was acceptable, the associated sample was not reanalyzed.

8270C-TCLP Analysis

Sample SB7085-1 and the TCLP fluid blank WG59113-4 had high recoveries for two surrogates, which were outside the laboratory established acceptance limits. Since a high recovery would indicate a high bias and there were no target analytes detected above the PQL, the samples were not reextracted.

The calibration verification standards (CV) (files G3491A and G3508A) had high responses for the calibration check compound (CCC) pentachlorophenol, which resulted in %D's that were outside the method acceptance limit of 20%. Since a high response would indicate a high bias and this target analyte was not detected above the PQL in the associated sample, the sample was not reanalyzed.

The laboratory control sample (LCS) and laboratory control sample duplicate (LCSD), WG59113-2 and 3, had a %RPD for the spiked target analyte pyridine that was outside of the laboratory acceptance limits. Since the LCS and LCSD had recoveries for pyridine which were within the laboratory acceptance limits, the associated sample was not reextracted.

8082 Analysis

The opening CV (file 6BL2178) had a low response for the surrogate DCB on channel B, which resulted in a D% that was outside of the method acceptance limits of 15%. Since the response for DCB on channel A was acceptable, the associated samples were not reanalyzed.

The closing CV (files 6BL192 and 6BL2192) had high responses for Aroclor 1016 on both channels and a high response for the surrogate TCX on channel B, which resulted in D%'s that were outside of the method acceptance limits of 15%. Since a high response would indicate a high bias and there were no target analytes detected above the PQL, the sample was not reanalyzed.

8081 TCLP Analysis

The closing CV (file 1BL00233) had a high response for heptachlor on channel B, which resulted in a D% that was outside of the method acceptance limits of 15%. Since the response for heptachlor on channel A was acceptable, the associated samples were not reanalyzed.

8151 TCLP Analysis

The TCLP blank WG59104-4 had low recoveries for the extraction surrogate 2,4-dichlorophenylacetic acid on both channels, which were outside of laboratory established acceptance limits. The client was contacted and informed the laboratory to proceed with narration.

There were no other protocol deviations or observations noted by the organics laboratory staff.

Metals Analysis

The samples of Katahdin Work Order SB7085 were prepared and analyzed for metals in accordance with the "Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods." SW-846. 2nd edition, 1982 (revised 1984), 3rd edition, 1986, and Updates I, II, IIA, III, IIIA and IIIB 1996, 1998 & 2004, Office of Solid Waste and Emergency Response, U.S. EPA.

Toxicity Characteristic Leaching Procedure (TCLP)

Katahdin Sample Number SB7085-1 was subjected to TCLP extraction on 12/15/08 in accordance with USEPA Method 1311. The resulting TCLP extract is identified throughout the raw data by the suffix "T" appended to the Katahdin Sample Number, e.g. "SB7085-001T". The TCLP fluid blank identified as PBT881B is associated with this TCLP extract. The measured concentrations of contaminants in this TCLP fluid blank are listed on the Extraction Fluid Blank Report appended after Form 3P in the accompanying data package.

Inductively-Coupled Plasma Atomic Emission Spectroscopic Analysis (ICP)

Aqueous-matrix Katahdin Sample Number SB7085-1T was digested for ICP analysis on 12/16/08 (QC Batch YL16ICW4) in accordance with USEPA Method 3010A.

Solid-matrix Katahdin Sample Number SB7085-2 was digested for ICP analysis on 12/20/08 (QC Batch YL20ICS0) in accordance with USEPA Method 3050B.

ICP analyses of Katahdin Work Order SB7085 sample digestates were performed using a Thermo iCAP 6500 ICP spectrometer. All samples were analyzed within holding times and all analytical run QC criteria were met.

Analysis of Mercury by Cold Vapor Atomic Absorption (CVAA)

Aqueous-matrix Katahdin Sample Number SB7085-1T was digested for mercury analysis on 12/16/08 (QC Batch YL16HGW0) in accordance with USEPA Method 7470.

Mercury analyses of Katahdin Work Order SB7085 sample digestates were performed using a Cetac M6100 automated mercury analyzer. All samples were analyzed within holding times and all analytical run QC criteria were met.

Wet Chemistry Analysis

The samples of Work Order SB7085 were analyzed in accordance with the specific methods listed on the Report of Analysis.

Analyses for reactive cyanide, ignitability, paint filter liquids, reactive sulfide, and pH (soil) were performed according to "Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods." SW-846. 2nd edition, 1982 (revised 1984), 3rd edition, 1986, and Updates I, II, IIA, III, IIIA and IIIB 1996, 1998 & 2004, Office of Solid Waste and Emergency Response, U.S. EPA.

Analyses for total solids were performed according to "Annual Book of ASTM Standards", Method D2216-98 "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass".

All analyses were performed within analytical holding times, and all quality control criteria were met.

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Operations Manager or the Quality Assurance Officer as verified by the following signature.

Leslie Dimond
12.23.08
Leslie Dimond
Quality Assurance Officer

Katahdin Analytical Services, Inc.

Manual Integration Codes For GC/MS, GC, HPLC and/or IC

M1	Peak splitting
M2	Well defined peaks on the shoulders of the other peaks.
M3	There is additional area due to a coeluting interferant
M4	There are negative spikes in the baseline.
M5	There are rising or falling baselines.
M6	The software has failed to detect a peak or misidentified a peak.
M7	Excessive peak tailing.
M8	Analysis such as GRO, DRO and TPH require a baseline hold
M9	Peak was not completely integrated.
M10	Primary ion was correctly integrated, but secondary or tertiary ion needed manual integration as in GC/MS.
M11	For GC analysis, when a sample is diluted by 1:10 or more, the surrogate is set to undetected and then the area under the surrogate is manually integrated.

Katahdin Analytical Services, Inc. **Sample Receipt Condition Report**

Client:	Rhea Engineers	KAS PM:	AJC	Sampled By:	client
Project:		KIMS Entry By:	DD	Delivered By:	Fed Ex
KAS Work Order#:	SB7085	KIMS Review By:	AJC	Received By:	DD
SDG #:		Cooler: 1 of 1		Date/Time Rec.:	12-10-08 1000

Receipt Criteria	Y	N	EX*	NA	Comments and/or Resolution
1. Custody seals present / intact?	✓				
2. Chain of Custody present in cooler?	✓				
3. Chain of Custody signed by client?	✓				
4. Chain of Custody matches samples?	✓				
5. Temperature Blanks present?	✓				Temp (°C): 6.0
6. Samples received at < 6 °C w/o freezing? Ice or ice packs present? Y or N	✓				Cooler temp. (°C): (if no temp blank)
7. Volatiles free of headspace?				✓	
Aqueous: No bubble larger than a pea					
Soil/Sediment:					
Received in airtight container?					
Received in methanol?					
Methanol covering soil?					
8. Trip Blank present in cooler?		✓			
9. Proper sample containers and volume?	✓				
10. Samples within hold time upon receipt?	✓				
11. Aqueous samples properly preserved?					
Metals, COD, NH3, TKN, O/G, phenol, TPO4, N+N, TOC, DRO, TPH – pH <2				✓	
Sulfide - >9				✓	
Cyanide – pH >12				✓	
12. Corrective Action Report Filed?				✓	

* Log-In Notes to Exceptions: document any problems with samples or discrepancies or pH adjustments

0000007

Katahdin ANALYTICAL SERVICES
600 Technology Way
Scarborough, ME 04074
Tel: (207) 874-2400
Fax: (207) 775-4029

CHAIN of CUSTODY

PLEASE BEAR DOWN AND PRINT LEGIBLY IN PEN

Client	Contact	Phone #	Fax #
Rhoa Engineers	Toby Grzejka	(724) 443-4111	(724) 443-4157

Address	City	State	Zip Code
4951 Wm Flynn Hwy Suite 12	Gibsonia	PA	15044

Purchase Order #	Proj. Name / No.	Katahdin Quote #
39001	Site 95 Magnolia Rd / 39001	5556GDLRev

Bill (if different than above) Address

Sampler (Print / Sign) Toby Grzejka

Copies To:

LAB USE ONLY WORK ORDER #:

KATAHDIN PROJECT NUMBER SB7085

REMARKS:

SHIPPING INFO: ☐ FED EX ☐ UPS ☐ CLIENT

AIRBILL NO:

TEMP°C ☐ TEMP BLANK ☐ INTACT ☐ NOT INTACT

*	Sample Description	Date / Time coll'd	Matrix	No. of Cntrs.	ANALYSIS AND CONTAINER TYPE PRESERVATIVES: Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐N	Filt. ☐Y ☐
					Temp/PCB's/RCRA Pt. Filter	TCLP VOA	6020	Arsenic-Total	DRO					
	CL395M-COMP1	12-9-08/10am	soil	1	X									
	"	" / "	"	"		X								
	"	" / "	"	"			X							
	"	" / "	"	"				X						
	"	" / "	"	"					X					
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COMMENTS

12-10-08 1000

Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)
	12-9-08 1043				
Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)

ORIGINAL

Katahdin ANALYTICAL SERVICES

Katahdin Analytical Services

Login Chain of Custody Report (lno1)

Dec. 10, 2008
02:40 PM

Login Number: SB7085

Account: RHEA001 NoWeb
Rhea Engineers and Consultants, Inc.

Project:

Primary Report Address:
Toby Grzejka
Rhea Engineers and Consultants, Inc.
4951 William Flynn Hwy
Suite 12
Gibsonia,PA 15044

Primary Invoice Address:
Accounts Payable
Rhea Engineers and Consultants, Inc.
4951 William Flynn Hwy
Suite 12
Gibsonia,PA 15044

Report CC Addresses:
Invoice CC Addresses:

Login Information

ANALYSIS INSTRUCTIONS	:	
CHECK NO.	:	
CLIENT PO#	:	39001
COOLER TEMPERATURE	:	6.0
DELIVERY SERVICES	:	Fed Ex
EDD FORMAT	:	
PM	:	AJC
PROJECT NAME	:	Site 95 Magnolia Road / 39001
QC LEVEL	:	IV
REGULATORY LIST	:	
REPORT INSTRUCTIONS	:	Send ~~copy of~~ rpt on CD, no fax
SDG ID	:	
SDG STATUS	:	

Laboratory Sample ID	Client Sample Number	Collect Date/Time	Receive Date	PR	Verbal Date	Due Date	Mailed
SB7085-1	CLJ95M-COMP1	09-DEC-08 10:00	10-DEC-08			22-DEC-08	

Matrix		Product	Hold Date (shortest)	Bottle Type	Bottle Count	Comments
Solid	S	SW1010-IGNITABILITY	23-DEC-08	250mL Plastic	1	
Solid	S	SW7.3.4-REAC CYANIDE	23-DEC-08	500mL P+ZnAc/NaOH		
Solid	S	SW7.3.4-REAC SULFIDE	16-DEC-08	100g Glass		
Solid	S	SW8015M-DRO	23-DEC-08	100g Glass		
Solid	S	SW8015M-GRO	23-DEC-08	100g Glass	1	
Solid	S	SW8082	23-DEC-08	100g Glass	1	
Solid	S	SW9045C-PH SOIL	06-JAN-09	100g Glass	1	
Solid	S	SW9095A-PNTFILTRTEST	06-JAN-09	50g Glass		
Solid	P	TCLP-HERB8151				
SW1311-EXT-HERB		TCLP-SW8151				
Solid	P	TCLP-METALS				
SW1311-EXT		SW3010-PREP		TCLP-ARSENIC		
TCLP-BARIUM		TCLP-CADMIUM		TCLP-CHROMIUM		
TCLP-LEAD		TCLP-MERCURY		TCLP-SELENIUM		
TCLP-SILVER						
Solid	P	TCLP-PEST				
SW1311-EXT-PEST		TCLP-SW8081				
Solid	P	TCLP-SVOA				
SW1311-EXT-SVOA		TCLP-SW8270				
Solid	P	TCLP-VOA			1	
SW1311-EXT-VOA		TCLP-SW8260				
Solid	S	TS	08-JAN-09			

SB7085-2	CLJ95M-COMP1	09-DEC-08 10:00	10-DEC-08		22-DEC-08	

Matrix		Product	Hold Date (shortest)	Bottle Type	Bottle Count	Comments
Solid	S	SW3050-PREP	07-JUN-09			**Use TS from SB7085-1. Jars are all labeled as SB7085-1.**
Solid	S	SW6010-ARSENIC	07-JUN-09	1000mL Plastic	1	
Solid	S	TS	08-JAN-09			

Total Samples: *2* ***Total Analyses:*** *17*

0000091

SAMPLE DATA SUMMARY PACKAGE

KATAHDIN ANALYTICAL SERVICES - ORGANIC DATA QUALIFIERS

U Indicates the compound was analyzed for but not detected above the laboratory Practical Quantitation Limit.

* Compound recovery outside of quality control limits.

D Indicates the result was obtained from analysis of a diluted sample. Surrogate recoveries may not be calculable.

E Estimated value. This flag identifies compounds whose concentrations exceed the upper level of the calibration range of the instrument for that specific analysis.

J Estimated value. The analyte was detected in the sample at a concentration less than the laboratory Practical Quantitation Limit (PQL), but above the Method Detection Limit (MDL).

or

J Used for Pesticide/Aroclor analyte when there is a greater than 40% difference for detected concentrations between the two GC columns.

B Indicates the analyte was detected in the laboratory method blank analyzed concurrently with the sample.

N Presumptive evidence of a compound based on a mass spectral library search.

A Indicates that a tentatively identified compound is a suspected aldol-condensation product.

P Used for Pesticide/Aroclor analyte when there is a greater than 25% difference for detected concentrations between the two GC columns. (for CLP methods only).

KATAHDIN ANALYTICAL SERVICES – INORGANIC DATA QUALIFIERS

(Refer to BOD Qualifiers Page for BOD footnotes)

U	Indicates the compound was analyzed for but not detected above the laboratory Practical Quantitation Limit.
E	Estimated value. This flag identifies compounds whose concentrations exceed the upper level of the calibration range of the instrument for that specific analysis.
J	Estimated value. The analyte was detected in the sample at a concentration less than the laboratory Practical Quantitation Limit (PQL), but above the Method Detection Limit (MDL).
I-7	The laboratory's Practical Quantitation Level could not be achieved for this parameter due to sample composition, matrix effects, sample volume, or quantity used for analysis.
A-4	Please refer to cover letter or narrative for further information.
MCL	Maximum Contaminant Level
NL	No limit
NFL	No Free Liquid Present
FLP	Free Liquid Present
NOD	No Odor Detected
H1	Please note that the regulatory holding time for pH is "analyze immediately". Ideally, this analysis must be performed in the field at the time of sample collection. pH for this sample was not performed at the time of sample collection. The analysis was performed as soon as possible after receipt by the laboratory.
H2	Please note that the regulatory holding time for DO is "analyze immediately". Ideally, this analysis must be performed in the field at the time of sample collection. DO for this sample was not performed at the time of sample collection. The analysis was performed as soon as possible after receipt by the laboratory.
H3	Please note that the regulatory holding time for sulfite is "analyze immediately". Ideally, this analysis must be performed in the field at the time of sample collection. Sulfite for this sample was not performed at the time of sample collection. The analysis was performed as soon as possible after receipt by the laboratory.
H4	Please note that the regulatory holding time for residual chlorine is "analyze immediately". Ideally, this analysis must be performed in the field at the time of sample collection. Residual chlorine for this sample was not performed at the time of sample collection. The analysis was performed as soon as possible after receipt by the laboratory.

METALS SAMPLE FLAGGING

FLAG	SPECIFIED MEANING
E	The reported value is estimated because of the presence of interference (as indicated by serial dilution).
N	Spiked sample recovery not within control limits.
*	Duplicate sample analysis not within control limits.
•	Analytical run QC sample (e.g. ICV, CCV, ICB, CCB, ICSA, ICSAB) not within control limits.
U	The analyte was not detected in the sample at a level greater than the instrument detection limit or greater than the method detection limit.
B	The analyte was detected in the sample at a concentration greater than the instrument detection limit or greater than the method detection limit, but less than the laboratory's Practical Quantitation Level (PQL).

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Rhea Engineers and
Project: Site 95 Magnolia Road / 39001
PO No:
Sample Date: 12/09/08
Received Date: 12/10/08
Extraction Date:
Analysis Date: 17-DEC-2008 10:44
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7085-1DL
Client ID: CLJ95M-COMP1
SDG: SB7085
Extracted by:
Extraction Method: 5030/1311
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG59148
Units: ug/l

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
71-43-2	Benzene	U	5	1.0	5	5	0.3
56-23-5	Carbon Tetrachloride	U	5	1.0	5	5	0.4
108-90-7	Chlorobenzene	U	5	1.0	5	5	0.2
67-66-3	Chloroform	U	5	1.0	5	5	0.2
107-06-2	1,2-Dichloroethane	U	5	1.0	5	5	0.3
75-35-4	1,1-Dichloroethene	U	5	1.0	5	5	0.3
78-93-3	2-Butanone	U	15	1.0	15	15	1
127-18-4	Tetrachloroethene	U	5	1.0	5	5	0.4
79-01-6	Trichloroethene	U	5	1.0	5	5	0.4
75-01-4	Vinyl chloride	U	5	1.0	5	5	0.3
1868-53-7	Dibromofluoromethane		94%				
17060-07-0	1,2-Dichloroethane-D4		93%				
2037-26-5	Toluene-D8		99%				
460-00-4	P-Bromofluorobenzene		100%				

Sample Data Summary A0000005

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Rhea Engineers and
Project: Site 95 Magnolia Road / 39001
PO No:
Sample Date: 12/09/08
Received Date: 12/10/08
Extraction Date: 12/16/08
Analysis Date: 16-DEC-2008 21:17
Report Date: 12/18/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7085-1
Client ID: CLJ95M-COMP1
SDG: SB7085
Extracted by: KF
Extraction Method: 3510/1311
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG59113
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
110-86-1	Pyridine	U	250	1.0	250	250	17
106-46-7	1,4-Dichlorobenzene	U	50	1.0	50	50	10
95-48-7	2-Methylphenol	U	50	1.0	50	50	20
65794-96-9	3&4-Methylphenol	U	100	1.0	100	100	13
67-72-1	Hexachloroethane	U	50	1.0	50	50	11
98-95-3	Nitrobenzene	U	50	1.0	50	50	11
87-68-3	Hexachlorobutadiene	U	50	1.0	50	50	12
88-06-2	2,4,6-Trichlorophenol	U	50	1.0	50	50	16
95-95-4	2,4,5-Trichlorophenol	U	120	1.0	120	120	21
121-14-2	2,4-Dinitrotoluene	U	50	1.0	50	50	7
118-74-1	Hexachlorobenzene	U	50	1.0	50	50	5
87-86-5	Pentachlorophenol	U	120	1.0	120	120	38
367-12-4	2-Fluorophenol		* 65%				
13127-88-3	Phenol-D6		* 61%				
4165-60-0	Nitrobenzene-D5		71%				
321-60-8	2-Fluorobiphenyl		69%				
118-79-6	2,4,6-Tribromophenol		75%				
1718-51-0	Terphenyl-D14		99%				

Sample Data Summary A0000006

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Rhea Engineers and
Project: Site 95 Magnolia Road / 39001
PO No:
Sample Date: 12/09/08
Received Date: 12/10/08
Extraction Date: 12/17/08
Analysis Date: 19-DEC-2008 12:35
Report Date: 12/22/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7085-1
Client ID: CLJ95M-COMP1
SDG: SB7085
Extracted by: CB
Extraction Method: 3510/1311
Analyst: JLP
Analysis Method: SW846 8081A
Lab Prep Batch: WG59137
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
58-89-9	gamma BHC	U	0.25	1.0	0.050	0.25	0.029
76-44-8	Heptachlor	U	0.25	1.0	0.050	0.25	0.070
1024-57-3	Heptachlor Epoxide	U	0.25	1.0	0.050	0.25	0.032
72-20-8	Endrin	U	0.50	1.0	0.10	0.50	0.016
72-43-5	Methoxychlor	U	2.5	1.0	0.50	2.5	0.065
8001-35-2	Toxaphene	U	5.0	1.0	1.0	5.0	0.29
12789-03-6	Chlordane	U	2.5	1.0	0.50	2.5	0.70
877-09-8	Tetrachloro-m-Xylene		82%				
2051-24-3	Decachlorobiphenyl		82%				

Sample Data Summary A0000007

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** CLJ95M-COMP1

Matrix: WATER **SDG Name:** SB7085

Percent Solids: 0.00 **Lab Sample ID:** SB7085-001T

Concentration Units : ug/L

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted IDL
7440-38-2	ARSENIC, TCLP	115			P	5	40	4.90
7440-39-3	BARIUM, TCLP	138			P	5	25	3.30
7440-43-9	CADMIUM, TCLP	0.50	U		P	5	50	0.50
7440-47-3	CHROMIUM, TCLP	3.6	B		P	5	75	1.85
7439-92-1	LEAD, TCLP	11.5	B		P	5	25	5.00
7439-97-6	MERCURY, TCLP	0.01	U		CV	1	0.20	0.01
7782-49-2	SELENIUM, TCLP	10.50	U		P	5	50	10.50
7440-22-4	SILVER, TCLP	2.60	U		P	5	75	2.60

Bottle ID: A

Comments:

INORGANIC ANALYSIS DATA SHEET

Lab Name: Katahdin Analytical Services **Client Field ID:** CLJ95M-COMP1

Matrix: SOIL **SDG Name:** SB7085

Percent Solids: 82.4 **Lab Sample ID:** SB7085-002

Concentration Units : mg/Kgdrywt

CAS No.	Analyte	Concentration	C	Q	M	DF	Adjusted PQL	Adjusted IDL
7440-38-2	ARSENIC, TOTAL	44.0			P	1	0.54	0.07

Bottle ID: A

Comments:

Report of Analytical Results

Client: Toby Grzejka
Rhea Engineers and Consultants, Inc.
4951 William Flynn Hwy
Gibsonia,PA 15044

Lab Sample ID: SB7085-1
Report Date: 22-DEC-08
Client PO: 39001
Project: Site 95 Magnolia Road / 39001
SDG: SB7085

Sample Description	Matrix	Date Sampled	Date Received
CLJ95M-COMP1	SL	09-DEC-08	10-DEC-08

Parameter	Result	Adj PQL	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Analyst	Footnotes
Cyanide, Reactive	U1.0 mg/Kg	1	SW846 7.3.4	WG59216	17-DEC-08 16:48:00	SW846 7.3.4	15-DEC-08	GJH	
Ignitability	>71. Deg. C	71	SW846 1010	WG59109	16-DEC-08 09:30:00	N/A	N/A	JF	
Paint Filter Liquids Test	NFL		SW846 9095A	WG59111	11-DEC-08 15:45:00	N/A	N/A	JF	
Sulfide,Reactive	U27 mg/Kg	27	SW846 7.3.4	WG59093	15-DEC-08 14:49:00	SW846 7.3.4	15-DEC-08	AMB	
Total Solids	82. %	1	D2216	WG59083	15-DEC-08 11:24:00	ASTM D2216	11-DEC-08	JF	
pH(Soil)	6.0 pH	.1	SW846 9045C	WG59020	11-DEC-08 12:20:00	SW846 9045C	11-DEC-08	JF	

Report of Analytical Results

Client: Toby Grzejka
Rhea Engineers and Consultants, Inc.
4951 William Flynn Hwy
Gibsonia,PA 15044

Lab Sample ID: SB7085-2
Report Date: 22-DEC-08
Client PO: 39001
Project: Site 95 Magnolia Road / 39001
SDG: SB7085

Sample Description	Matrix	Date Sampled	Date Received
CLJ95M-COMP1	SL	09-DEC-08	10-DEC-08

Parameter	Result	Adj PQL	Anal. Method	QC.Batch	Anal. Date	Prep. Method	Prep. Date	Analyst	Footnotes
Total Solids	82. %	1	D2216	WG59083	15-DEC-08 11:24:00	ASTM D2216	11-DEC-08	JF	

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Rhea Engineers and
Project: Site 95 Magnolia Road / 39001
PO No:
Sample Date: 12/09/08
Received Date: 12/10/08
Extraction Date: 12/16/08
Analysis Date: 19-DEC-2008 18:59
Report Date: 12/22/2008
Matrix: SOIL
% Solids: 82.4

Lab ID: SB7085-1
Client ID: CLJ95M-COMP1
SDG: SB7085
Extracted by: CB
Extraction Method: SW846 3540
Analyst: RCT
Analysis Method: SW846 8082
Lab Prep Batch: WG59118
Units: ug/Kgdrywt

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
12674-11-2	Aroclor-1016	U	21	1.0	17	21	6.3
11104-28-2	Aroclor-1221	U	21	1.0	17	21	12
11141-16-5	Aroclor-1232	U	21	1.0	17	21	8.0
53469-21-9	Aroclor-1242	U	21	1.0	17	21	4.6
12672-29-6	Aroclor-1248	U	21	1.0	17	21	12
11097-69-1	Aroclor-1254	U	21	1.0	17	21	8.4
11096-82-5	Aroclor-1260	U	21	1.0	17	21	4.0
877-09-8	Tetrachloro-m-xylene		100%				
2051-24-3	Decachlorobiphenyl		102%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Rhea Engineers and
Project: Site 95 Magnolia Road / 39001
PO No:
Sample Date: 12/09/08
Received Date: 12/10/08
Extraction Date: 12/11/08
Analysis Date: 11-DEC-2008 16:52
Report Date: 12/18/2008
Matrix: SOIL
% Solids: 82.4

Lab ID: SB7085-1
Client ID: CLJ95M-COMP1
SDG: SB7085
Extracted by: EKC
Extraction Method: SW846 5030B
Analyst: EKC
Analysis Method: SW846 M8015B
Lab Prep Batch: WG58999
Units: mg/Kgdrywt

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
	Gasoline Range Organics	U	3.4	1.0	2.5	3.4	2.7
460-00-4	4-Bromofluorobenzene		97%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Rhea Engineers and
Project: Site 95 Magnolia Road/39001
PO No:
Sample Date: 12/09/08
Received Date: 12/10/08
Extraction Date: 12/11/08
Analysis Date: 16-DEC-2008 19:15
Report Date: 12/23/2008
Matrix: SOIL
% Solids: 82.4

Lab ID: SB7085-1RA
Client ID: CLJ95M-COMP1
SDG: SB7085
Extracted by: CB
Extraction Method: SW846 3550
Analyst: KGT
Analysis Method: SW846 M8015B
Lab Prep Batch: WG59006
Units: mg/Kgdrywt

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
	Diesel Range Organics	B	13	1.0	5.0	6.1	2.2
	O-Terphenyl		81%				

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Rhea Engineers and
Project: Site 95 Magnolia Road / 39001
PO No:
Sample Date: 12/09/08
Received Date: 12/10/08
Extraction Date: 12/16/08
Analysis Date: 19-DEC-2008 21:30
Report Date: 12/22/2008
Matrix: WATER
% Solids: NA

Lab ID: SB7085-1
Client ID: CLJ95M-COMP1
SDG: SB7085
Extracted by: KF
Extraction Method: 3510/1311
Analyst: JLP
Analysis Method: SW846 8151A
Lab Prep Batch: WG59104
Units: ug/L

CAS#	Compound	Flags	Results	DF	PQL	Adj.PQL	Adj.MDL
94-75-7	2,4-D	U	15	1.0	3.0	15	4.1
93-72-1	Silvex	U	15	1.0	3.0	15	4.0
19719-28-9	2,4-Dichlorophenylacetic Acid		40%				

Katahdin
ANALYTICAL SERVICES

Cert. No. E87604

July 30, 2009

Mr. Toby Grzejka
Rhea Engineers and Consultants, Inc.
4951 William Flynn Hwy
Suite 12
Gibsonia,PA 15044

RE: Katahdin Lab Number: SC4086
Project ID: Site 95
Project Manager: Mrs. Andrea Colby
Sample Receipt Date(s): July 22, 2009

Dear Mr. Grzejka:

Please find enclosed the following information:

* Report of Analysis (Analytical and/or Field)
* Quality Control Data Summary
* Chain of Custody (COC)
* Login Report

A copy of the Chain of Custody is included in the paginated report. The original COC is attached as an addendum to this report.

Should you have any questions or comments concerning this Report of Analysis, please do not hesitate to contact the project manager listed above. The results contained in this report relate only to the submitted samples. This cover letter is an integral part of the ROA.

We certify that the test results provided in this report meet all the requirements of the NELAC standards unless otherwise noted in an attached technical narrative or in the Report of Analysis.

We appreciate your continued use of our laboratory and look forward to working with you in the future. The following signature indicates technical review and acceptance of the data.

Please go to http://www.katahdinlab.com/cert.html for copies of Katahdin Analytical Services Inc. current certificates and analyte lists.

Sincerely,
KATAHDIN ANALYTICAL SERVICES

Deborah J. Nadeau
Authorized Signature

07/30/2009
Date

KATAHDIN ANALYTICAL SERVICES - ORGANIC DATA QUALIFIERS

The sampled date indicated on the attached Report(s) of Analysis (ROA) is the date for which a grab sample was collected or the date for which a composite sample was completed. Beginning and start times for composite samples can be found on the Chain-of-Custody.

U Indicates the compound was analyzed for but not detected above the laboratory Practical Quantitation Limit.

* Compound recovery outside of quality control limits.

D Indicates the result was obtained from analysis of a diluted sample. Surrogate recoveries may not be calculable.

E Estimated value. This flag identifies compounds whose concentrations exceed the upper level of the calibration range of the instrument for that specific analysis.

J Estimated value. The analyte was detected in the sample at a concentration less than the laboratory Practical Quantitation Limit (PQL), but above the Method Detection Limit (MDL).

or

J Used for Pesticide/Aroclor analyte when there is a greater than 40% difference for detected concentrations between the two GC columns.

B Indicates the analyte was detected in the laboratory method blank analyzed concurrently with the sample.

N Presumptive evidence of a compound based on a mass spectral library search.

A Indicates that a tentatively identified compound is a suspected aldol-condensation product.

P Used for Pesticide/Aroclor analyte when there is a greater than 25% difference for detected concentrations between the two GC columns. (for CLP methods only).

KATAHDIN ANALYTICAL SERVICES – INORGANIC DATA QUALIFIERS

(Refer to BOD Qualifiers Page for BOD footnotes)

The sampled date indicated on the attached Report(s) of Analysis (ROA) is the date for which a grab sample was collected or the date for which a composite sample was completed. Beginning and start times for composite samples can be found on the Chain-of-Custody.

U	Indicates the compound was analyzed for but not detected above the laboratory Practical Quantitation Limit.
E	Estimated value. This flag identifies compounds whose concentrations exceed the upper level of the calibration range of the instrument for that specific analysis.
J	Estimated value. The analyte was detected in the sample at a concentration less than the laboratory Practical Quantitation Limit (PQL), but above the Method Detection Limit (MDL).
I-7	The laboratory's Practical Quantitation Level could not be achieved for this parameter due to sample composition, matrix effects, sample volume, or quantity used for analysis.
A-4	Please refer to cover letter or narrative for further information.
MCL	Maximum Contaminant Level
NL	No limit
NFL	No Free Liquid Present
FLP	Free Liquid Present
NOD	No Odor Detected
TON	Threshold Odor Number
H1	Please note that the regulatory holding time for pH is "analyze immediately". Ideally, this analysis must be performed in the field at the time of sample collection. pH for this sample was not performed at the time of sample collection. The analysis was performed as soon as possible after receipt by the laboratory.
H2	Please note that the regulatory holding time for DO is "analyze immediately". Ideally, this analysis must be performed in the field at the time of sample collection. DO for this sample was not performed at the time of sample collection. The analysis was performed as soon as possible after receipt by the laboratory.
H3	Please note that the regulatory holding time for sulfite is "analyze immediately". Ideally, this analysis must be performed in the field at the time of sample collection. Sulfite for this sample was not performed at the time of sample collection. The analysis was performed as soon as possible after receipt by the laboratory.
H4	Please note that the regulatory holding time for residual chlorine is "analyze immediately". Ideally, this analysis must be performed in the field at the time of sample collection. Residual chlorine for this sample was not performed at the time of sample collection. The analysis was performed as soon as possible after receipt by the laboratory.

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Rhea Engineers and
Project: Site 95
PO No:
Sample Date: 07/21/09
Received Date: 07/22/09
Extraction Date:
Analysis Date: 28-JUL-2009 22:53
Report Date: 07/29/2009
Matrix: WATER
% Solids: NA

Lab ID: SC4086-1DL
Client ID: CONC-TCLP-95
SDG: SC4086
Extracted by:
Extraction Method: 5030/1311
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG66767
Units: ug/l

Compound	Flags	Results	DF	PQL	Adj.PQL
Benzene	U	100	20	5	100
Carbon Tetrachloride	U	100	20	5	100
Chlorobenzene	U	100	20	5	100
Chloroform	U	100	20	5	100
1,2-Dichloroethane	U	100	20	5	100
1,1-Dichloroethene	U	100	20	5	100
2-Butanone	U	300	20	15	300
Tetrachloroethene	U	100	20	5	100
Trichloroethene	U	100	20	5	100
Vinyl chloride	U	100	20	5	100
Dibromofluoromethane		92%			
1,2-Dichloroethane-D4		85%			
Toluene-D8		90%			
P-Bromofluorobenzene		81%			

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Rhea Engineers and
Project: Site 95
PO No:
Sample Date: 07/21/09
Received Date: 07/22/09
Extraction Date: 07/24/09
Analysis Date: 27-JUL-2009 22:07
Report Date: 07/28/2009
Matrix: WATER
% Solids: NA

Lab ID: SC4086-1
Client ID: CONC-TCLP-95
SDG: SC4086
Extracted by: KF
Extraction Method: 3510/1311
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG66609
Units: ug/L

Compound	Flags	Results	DF	PQL	Adj.PQL
Pyridine	U	250	1.0	250	250
1,4-Dichlorobenzene	U	50	1.0	50	50
2-Methylphenol	U	50	1.0	50	50
3&4-Methylphenol	U	50	1.0	50	50
Hexachloroethane	U	50	1.0	50	50
Nitrobenzene	U	50	1.0	50	50
Hexachlorobutadiene	U	50	1.0	50	50
2,4,6-Trichlorophenol	U	50	1.0	50	50
2,4,5-Trichlorophenol	U	120	1.0	120	120
2,4-Dinitrotoluene	U	50	1.0	50	50
Hexachlorobenzene	U	50	1.0	50	50
Pentachlorophenol	U	120	1.0	120	120
2-Fluorophenol		48%			
Phenol-D6		29%			
Nitrobenzene-D5		70%			
2-Fluorobiphenyl		83%			
2,4,6-Tribromophenol		64%			
Terphenyl-D14		93%			

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Rhea Engineers and
Project: Site 95
PO No:
Sample Date: 07/21/09
Received Date: 07/22/09
Extraction Date: 07/24/09
Analysis Date: 24-JUL-2009 17:31
Report Date: 07/27/2009
Matrix: WATER
% Solids: NA

Lab ID: SC4086-1
Client ID: CONC-TCLP-95
SDG: SC4086
Extracted by: KF
Extraction Method: 3510/1311
Analyst: RCT
Analysis Method: SW846 8081A
Lab Prep Batch: WG66607
Units: ug/L

Compound	Flags	Results	DF	PQL	Adj.PQL
gamma BHC	U	0.25	1.0	0.050	0.25
Heptachlor	U	0.25	1.0	0.050	0.25
Heptachlor Epoxide	U	0.25	1.0	0.050	0.25
Endrin	U	0.50	1.0	0.10	0.50
Methoxychlor	U	2.5	1.0	0.50	2.5
Toxaphene	U	5.0	1.0	1.0	5.0
Chlordane	U	2.5	1.0	0.50	2.5
Tetrachloro-m-Xylene		89%			
Decachlorobiphenyl		79%			

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client: Rhea Engineers and
Project: Site 95
PO No:
Sample Date: 07/21/09
Received Date: 07/22/09
Extraction Date: 07/27/09
Analysis Date: 28-JUL-2009 13:51
Report Date: 07/28/2009
Matrix: WATER
% Solids: NA

Lab ID: SC4086-1
Client ID: CONC-TCLP-95
SDG: SC4086
Extracted by: CB
Extraction Method: 3510/1311
Analyst: JLP
Analysis Method: SW846 8151A
Lab Prep Batch: WG66690
Units: ug/L

Compound	Flags	Results	DF	PQL	Adj.PQL
2,4-D	U	15	1.0	3.0	15
Silvex	U	15	1.0	3.0	15
2,4-Dichlorophenylacetic Acid		58%			

Data File: \\Target_server\GG\chem\gc08.i\GC08CG28.b\8CG00273.D
Report Date: 28-Jul-2009 14:36

Katahdin Analytical Services

Data file : \\Target_server\GG\chem\gc08.i\GC08CG28.b\8CG00273.D
Lab Smp Id: SC4086-1 Client Smp ID: CONC-TCLP-95
Inj Date : 28-JUL-2009 13:51
Operator : JLP Inst ID: gc08.i
Smp Info : SC4086-1
Misc Info : SW846 8151A
Comment :
Method : \\Target_server\GG\chem\gc08.i\GC08CG28.b\HERB002.m
Meth Date : 28-Jul-2009 11:53 gc08.i Quant Type: ESTD
Cal Date : 20-JUL-2009 19:22 Cal File: 8CG00182.D
Als bottle: 70
Dil Factor: 1.00000
Integrator: Falcon Compound Sublist: TCLP-sample.sub
Target Version: 4.12
Processing Host: V200T2

Concentration Formula: Amt * DF * 1000*Vt/Vo * CpndVariable

Name	Value	Description
DF	1.000	Dilution Factor
Vt	0.01000	Final Volume (L)
Vo	0.20000	Sample Volume (L)
Cpnd Variable		Local Compound Variable

					CONCENTRATIONS		
					ON-COLUMN	FINAL	
Compounds	RT	EXP RT	DLT RT	RESPONSE	(ng/uL)	(ug/L)	REVIEW CODE
$ 2 2,4-Dichlorophenylacetic Acid	10.080	10.075	0.005	1251	0.23764	11.9	

Katahdin ANALYTICAL SERVICES

REPORT OF ANALYTICAL RESULTS

Client: Toby Grzejka
Rhea Engineers and Consultants, Inc.
4951 William Flynn Hwy
Suite 12
Gibsonia, PA 15044

Lab Sample ID: SC4086-001
Report Date: 7/28/2009
PO No.:
Project: Site 95

Sample Description	Matrix	Filtered	Date Sampled	Date Received
CONC-TCLP-95	AQ	No(Total)	07/21/2009	07/22/2009

Parameter	Result	Units	Adjusted PQL	Dilution Factor	PQL	Analytical Method	Analysis Date	By	Prep Method	Prepped Date	By	QC	Notes
ARSENIC, TCLP	0.04	mg/L	0.04	5	0.008	SW846 6010	7/27/09	EAM	SW846 3010	7/24/09	AJB	ZG24ICW1	
BARIUM, TCLP	0.333	mg/L	0.025	5	0.005	SW846 6010	7/27/09	EAM	SW846 3010	7/24/09	AJB	ZG24ICW1	
CADMIUM, TCLP	U 0.0500	mg/L	0.0500	5	0.01	SW846 6010	7/27/09	EAM	SW846 3010	7/24/09	AJB	ZG24ICW1	1
CHROMIUM, TCLP	U 0.0750	mg/L	0.0750	5	0.015	SW846 6010	7/27/09	EAM	SW846 3010	7/24/09	AJB	ZG24ICW1	1
LEAD, TCLP	U 0.02	mg/L	0.02	5	0.005	SW846 6010	7/27/09	EAM	SW846 3010	7/24/09	AJB	ZG24ICW1	1
MERCURY, TCLP	U 0.20	ug/L	0.20	1	0.2	SW846 7470	7/28/09	DWM	SW846 7470	7/27/09	DWM	ZG27HGW1	
SELENIUM, TCLP	U 0.050	mg/L	0.050	5	0.01	SW846 6010	7/27/09	EAM	SW846 3010	7/24/09	AJB	ZG24ICW1	1
SILVER, TCLP	U 0.0750	mg/L	0.0750	5	0.015	SW846 6010	7/27/09	EAM	SW846 3010	7/24/09	AJB	ZG24ICW1	1

1 The laboratory's Practical Quantitation Level could not be achieved for this parameter due to sample composition, matrix effects,sample volume, or quantity used for analysis.

FORM 4
VOLATILE METHOD BLANK SUMMARY

CLIENT SAMPLE ID

WG66767-BLANK

Lab Name: KATAHDIN ANALYTICAL SERVICES Lab Code: KAS

Project: SITE 95 SDG No.: SC4086

Lab File ID: S7649 Lab Sample ID: WG66767-2

Date Analyzed: 07/28/09 Time Analyzed: 1840

GC Column: RTX-VMS ID: 0.18 (mm) Heated Purge: (Y/N) N

Instrument ID: GCMS-S

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

	CLIENT SAMPLE ID	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	WG66767-LCS	WG66767-1	S7646	07/28/09	1705
02	WG66767-TCLPBLANK	WG66767-6	S7650	07/28/09	1911
03	CONC-TCLP-95	SC4086-1DL	S7657	07/28/09	2253
04					
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COMMENTS:

FORM IVVOA

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client:
Project: Site 95
PO No:
Sample Date:
Received Date:
Extraction Date:
Analysis Date: 28-JUL-2009 18:40
Report Date: 07/29/2009
Matrix: WATER
% Solids: NA

Lab ID: WG66767-2
Client ID: WG66767-Blank
SDG: SC4086
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG66767
Units: ug/l

Compound	Flags	Results	DF	PQL	Adj.PQL
Benzene	U	1	1.0	1	1
Carbon Tetrachloride	U	1	1.0	1	1
Chlorobenzene	U	1	1.0	1	1
Chloroform	U	1	1.0	1	1
1,2-Dichloroethane	U	1	1.0	1	1
1,1-Dichloroethene	U	1	1.0	1	1
2-Butanone	U	5	1.0	5	5
Tetrachloroethene	U	1	1.0	1	1
Trichloroethene	U	1	1.0	1	1
Vinyl chloride	U	1	1.0	1	1
Dibromofluoromethane		93%			
1,2-Dichloroethane-D4		91%			
Toluene-D8		90%			
P-Bromofluorobenzene		79%			

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client:
Project: Site 95
PO No:
Sample Date:
Received Date:
Extraction Date:
Analysis Date: 28-JUL-2009 19:11
Report Date: 07/29/2009
Matrix: WATER
% Solids: NA

Lab ID: WG66767-6
Client ID: WG66767-TclpBlank
SDG: SC4086
Extracted by:
Extraction Method: 5030/1311
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG66767
Units: ug/l

Compound	Flags	Results	DF	PQL	Adj.PQL
Benzene	U	5	1.0	5	5
Carbon Tetrachloride	U	5	1.0	5	5
Chlorobenzene	U	5	1.0	5	5
Chloroform	U	5	1.0	5	5
1,2-Dichloroethane	U	5	1.0	5	5
1,1-Dichloroethene	U	5	1.0	5	5
2-Butanone	U	15	1.0	15	15
Tetrachloroethene	U	5	1.0	5	5
Trichloroethene	U	5	1.0	5	5
Vinyl chloride	U	5	1.0	5	5
Dibromofluoromethane		95%			
1,2-Dichloroethane-D4		92%			
Toluene-D8		90%			
P-Bromofluorobenzene		79%			

KATAHDIN ANALYTICAL SERVICES
LAB CONTROL SAMPLE

Client:
Project: Site 95
PO No:
Sample Date:
Received Date:
Extraction Date:
Analysis Date: 07/28/09
Report Date: 07/29/2009
Matrix: WATER

Lab ID: WG66767-1
Client ID: WG66767-LCS
SDG: SC4086
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG66767
Units: ug/l

COMPOUND	LCS SPIKE	SAMPLE CONC.	LCS CONC.		%REC.	QC. LIMITS
Dichlorodifluoromethane	50	NA	31		62	40-192
Chloromethane	50	NA	39		78	47-151
Vinyl chloride	50	NA	41		83	63-141
Bromomethane	50	NA	43		86	41-169
Chloroethane	50	NA	43		87	57-145
Trichlorofluoromethane	50	NA	49		99	85-164
Diethyl Ether	50	NA	52		104	74-132
Tertiary-butyl alcohol	250	NA	133		53	30-162
1,1-Dichloroethene	50	NA	53		106	79-126
Carbon Disulfide	50	NA	51		102	72-127
Freon-113	50	NA	53		106	78-132
Iodomethane	50	NA	50		99	54-181
Acrolein	250	NA	255		102	67-125
Methylene Chloride	50	NA	49		98	70-120
Acetone	50	NA	68	*	136	54-134
Isobutyl Alcohol	1000	NA	471		47	28-157
trans-1,2-Dichloroethene	50	NA	52		105	76-127
Allyl Chloride	50	NA	47		94	62-141
Methyl tert-butyl ether	100	NA	105		105	78-136
Acetonitrile	500	NA	460		92	47-143
Di-isopropyl ether	50	NA	53		106	72-129
Chloroprene	50	NA	52		104	74-132
Methacrylonitrile	500	NA	503		101	67-138
Propionitrile	500	NA	492		98	61-136
1,1-Dichloroethane	50	NA	51		103	80-126
Acrylonitrile	250	NA	253		101	63-135
Ethyl tertiary-butyl ether	50	NA	53		106	79-124
Vinyl Acetate	50	NA	47		94	68-135
cis-1,2-Dichloroethene	50	NA	54		107	80-116
1,2-Dichloroethylene (total)	100	NA	106		106	79-121
Methyl Methacrylate	50	NA	54		108	70-133
2,2-Dichloropropane	50	NA	47		95	66-150
Bromochloromethane	50	NA	50		100	90-131
Chloroform	50	NA	53		105	86-124
Carbon Tetrachloride	50	NA	51		102	73-146
Tetrahydrofuran	50	NA	53		106	66-120
1,1,1-Trichloroethane	50	NA	53		105	88-125
1,1-Dichloropropene	50	NA	53		106	84-123
2-Butanone	50	NA	54		108	59-125
Benzene	50	NA	52		103	88-115
Cyclohexane	50	NA	52		104	60-150
Ethyl Methacrylate	50	NA	54		108	76-121
Tertiary-amyl methyl ether	50	NA	51		102	80-122
1,2-Dichloroethane	50	NA	52		104	82-125
Trichloroethene	50	NA	52		104	84-115

KATAHDIN ANALYTICAL SERVICES
LAB CONTROL SAMPLE

Client:
Project: Site 95
PO No:
Sample Date:
Received Date:
Extraction Date:
Analysis Date: 07/28/09
Report Date: 07/29/2009
Matrix: WATER

Lab ID: WG66767-1
Client ID: WG66767-LCS
SDG: SC4086
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG66767
Units: ug/l

COMPOUND	LCS SPIKE	SAMPLE CONC.	LCS CONC.	%REC.	QC. LIMITS
Dibromomethane	50	NA	53	107	83-121
1,2-Dichloropropane	50	NA	52	104	79-121
Bromodichloromethane	50	NA	54	108	89-113
cis-1,3-dichloropropene	50	NA	52	104	87-118
1,4-Dioxane	1000	NA	210	21	10-156
2-Chloroethylvinylether	50	NA	41	82	30-177
Toluene	50	NA	51	102	87-119
4-methyl-2-pentanone	50	NA	52	103	70-123
Tetrachloroethene	50	NA	60	121	58-147
trans-1,3-Dichloropropene	50	NA	58	115	90-137
1,1,2-Trichloroethane	50	NA	52	103	80-115
Dibromochloromethane	50	NA	52	104	84-122
1,3-Dichloropropane	50	NA	50	100	76-118
1,2-Dibromoethane	50	NA	55	111	83-116
2-Hexanone	50	NA	49	99	66-121
Chlorobenzene	50	NA	50	100	88-112
Ethylbenzene	50	NA	48	96	86-116
1,1,1,2-Tetrachloroethane	50	NA	50	99	83-118
Xylenes (total)	150	NA	158	105	84-120
m+p-Xylenes	100	NA	104	104	83-122
o-Xylene	50	NA	54	107	82-119
Styrene	50	NA	54	107	85-116
Bromoform	50	NA	52	104	78-127
Isopropylbenzene	50	NA	58	117	90-132
cis-1,4-Dichloro-2-Butene	50	NA	54	107	70-126
trans-1,4-Dichloro-2-Butene	50	NA	51	103	69-132
Bromobenzene	50	NA	46	92	87-113
N-Propylbenzene	50	NA	51	102	84-121
1,1,2,2-Tetrachloroethane	50	NA	53	106	72-119
1,3,5-Trimethylbenzene	50	NA	52	104	84-121
2-Chlorotoluene	50	NA	55	110	85-114
1,2,3-Trichloropropane	50	NA	55	110	74-114
4-Chlorotoluene	50	NA	50	100	81-120
tert-Butylbenzene	50	NA	48	95	73-132
Pentachloroethane	50	NA	40	80	32-163
1,2,4-Trimethylbenzene	50	NA	50	100	80-116
P-Isopropyltoluene	50	NA	49	99	82-125
1,3-Dichlorobenzene	50	NA	48	97	82-118
1,4-Dichlorobenzene	50	NA	49	98	83-113
N-Butylbenzene	50	NA	45	90	72-128
sec-Butylbenzene	50	NA	49	98	83-120
1,2-Dichlorobenzene	50	NA	51	101	83-116
1,2-Dibromo-3-Chloropropane	50	NA	50	99	69-121
1,3,5-Trichlorobenzene	50	NA	44	88	80-123
Hexachlorobutadiene	50	NA	46	91	61-124

KATAHDIN ANALYTICAL SERVICES
LAB CONTROL SAMPLE

Client:
Project: Site 95
PO No:
Sample Date:
Received Date:
Extraction Date:
Analysis Date: 07/28/09
Report Date: 07/29/2009
Matrix: WATER

Lab ID: WG66767-1
Client ID: WG66767-LCS
SDG: SC4086
Extracted by:
Extraction Method: SW846 5030
Analyst: TTC
Analysis Method: SW846 8260B
Lab Prep Batch: WG66767
Units: ug/l

COMPOUND	LCS SPIKE	SAMPLE CONC.	LCS CONC.	%REC.	QC. LIMITS
1,2,4-Trichlorobenzene	50	NA	46	92	71-127
1,2,3-Trimethylbenzene	50	NA	50	100	89-115
Naphthalene	50	NA	39	77	57-132
1,2,3-Trichlorobenzene	50	NA	43	86	62-124
Methyl Acetate	50	NA	53	106	62-137
Methylcyclohexane	50	NA	53	106	74-128
1-Chlorohexane	50	NA	54	108	84-118
Total Alkylbenzenes	350	NA	344	98	60-140

FORM 4
SEMIVOLATILE METHOD BLANK SUMMARY

CLIENT SAMPLE ID

WG66609-BLANK

Lab Name: KATAHDIN ANALYTICAL SERVICES Lab Code: KAS

Project: SITE 95 SDG No.: SC4086

Lab File ID: R3475 Lab Sample ID: WG66609-1RA

Instrument ID: GCMS-R Date Extracted: 07/24/09

Matrix: (soil/water) WATER Date Analyzed: 07/27/09

Level:(low/med) LOW Time Analyzed: 2038

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

	CLIENT SAMPLE ID	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	WG66609-TCLPBLANK	WG66609-4	R3476	07/27/09	2123
02	CONC-TCLP-95	SC4086-1	R3477	07/27/09	2207
03	WG66609-LCS	WG66609-2RA	R3478	07/27/09	2251
04					
05					
06					
07					
08					
09					
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COMMENTS:

FORM IVSV

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client:
Project: Site 95
PO No:
Sample Date:
Received Date:
Extraction Date: 07/24/09
Analysis Date: 27-JUL-2009 20:38
Report Date: 07/28/2009
Matrix: WATER
% Solids: NA

Lab ID: WG66609-1RA
Client ID: WG66609-Blank
SDG: SC4086
Extracted by: KF
Extraction Method: SW846 3510
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG66609
Units: ug/L

Compound	Flags	Results	DF	PQL	Adj.PQL
Pyridine	U	50	1.0	250	50
1,4-Dichlorobenzene	U	10	1.0	50	10
2-Methylphenol	U	10	1.0	50	10
3&4-Methylphenol	U	10	1.0	50	10
Hexachloroethane	U	10	1.0	50	10
Nitrobenzene	U	10	1.0	50	10
Hexachlorobutadiene	U	10	1.0	50	10
2,4,6-Trichlorophenol	U	10	1.0	50	10
2,4,5-Trichlorophenol	U	25	1.0	120	25
2,4-Dinitrotoluene	U	10	1.0	50	10
Hexachlorobenzene	U	10	1.0	50	10
Pentachlorophenol	U	25	1.0	120	25
2-Fluorophenol		50%			
Phenol-D6		32%			
Nitrobenzene-D5		68%			
2-Fluorobiphenyl		76%			
2,4,6-Tribromophenol		68%			
Terphenyl-D14		92%			

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client:
Project: Site 95
PO No:
Sample Date:
Received Date:
Extraction Date: 07/24/09
Analysis Date: 27-JUL-2009 21:23
Report Date: 07/28/2009
Matrix: WATER
% Solids: NA

Lab ID: WG66609-4
Client ID: WG66609-TclpBlank
SDG: SC4086
Extracted by: KF
Extraction Method: 3510/1311
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG66609
Units: ug/L

Compound	Flags	Results	DF	PQL	Adj.PQL
Pyridine	U	250	1.0	250	250
1,4-Dichlorobenzene	U	50	1.0	50	50
2-Methylphenol	U	50	1.0	50	50
3&4-Methylphenol	U	50	1.0	50	50
Hexachloroethane	U	50	1.0	50	50
Nitrobenzene	U	50	1.0	50	50
Hexachlorobutadiene	U	50	1.0	50	50
2,4,6-Trichlorophenol	U	50	1.0	50	50
2,4,5-Trichlorophenol	U	120	1.0	120	120
2,4-Dinitrotoluene	U	50	1.0	50	50
Hexachlorobenzene	U	50	1.0	50	50
Pentachlorophenol	U	120	1.0	120	120
2-Fluorophenol		45%			
Phenol-D6		27%			
Nitrobenzene-D5		66%			
2-Fluorobiphenyl		75%			
2,4,6-Tribromophenol		76%			
Terphenyl-D14		88%			

KATAHDIN ANALYTICAL SERVICES
LAB CONTROL SAMPLE

Client:
Project: Site 95
PO No:
Sample Date:
Received Date:
Extraction Date: 07/24/09
Analysis Date: 07/27/09
Report Date: 07/28/2009
Matrix: WATER

Lab ID: WG66609-2RA
Client ID: WG66609-LCS
SDG: SC4086
Extracted by: KF
Extraction Method: SW846 3510
Analyst: JCG
Analysis Method: SW846 8270C
Lab Prep Batch: WG66609
Units: ug/L

COMPOUND	LCS SPIKE	SAMPLE CONC.	LCS CONC.	%REC.	QC. LIMITS
Pyridine	50	NA	18	36	10- 66
1,4-Dichlorobenzene	50	NA	38	77	38-103
2-Methylphenol	100	NA	75	75	45- 88
3&4-Methylphenol	100	NA	70	70	41- 80
Hexachloroethane	50	NA	44	88	31- 98
Nitrobenzene	50	NA	40	81	56-105
Hexachlorobutadiene	50	NA	37	75	39- 94
2,4,6-Trichlorophenol	100	NA	97	97	59-108
2,4,5-Trichlorophenol	100	NA	95	95	64-111
2,4-Dinitrotoluene	50	NA	34	68	63-122
Hexachlorobenzene	50	NA	51	102	75-109
Pentachlorophenol	100	NA	89	89	39-156

FORM 4

PESTICIDE METHOD BLANK SUMMARY

CLIENT SAMPLE ID

WG66607-BLANK

Lab Name: KATAHDIN ANALYTICAL SERVICES Lab Code: KAS

Project: SITE 95 SDG No.: SC4086

Lab Sample ID: WG66607-1 Lab File ID: 1CG00338

Matrix (soil/water) WATER Extraction:(SepF/Cont/Sonc) SW846 3510

Sulfur Cleanup: (Y/N) N Date Extracted: 07/24/09

Date Analyzed (1): 07/24/09 Date Analyzed (2): 07/24/09

Time Analyzed (1): 1621 Time Analyzed (2): 1621

Instrument ID (1): GC01 Instrument ID (2): GC01

GC Column (1): ZB-MULTIRESIDUE-1 ID: 0.53(mm) GC Column (2): ZB-MULTIRESIDUE-2 ID: 0.53(mm

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

	CLIENT SAMPLE ID	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED 1	DATE ANALYZED 2
01	WG66607-LCS	WG66607-2	1CG00339	07/24/09	07/24/09
02	WG66607-TCLPBLANK	WG66607-5	1CG00340	07/24/09	07/24/09
03	CONC-TCLP-95	SC4086-1	1CG00342	07/24/09	07/24/09
04					
05					
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COMMENTS: _____

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client:
Project: Site 95
PO No:
Sample Date:
Received Date:
Extraction Date: 07/24/09
Analysis Date: 24-JUL-2009 16:21
Report Date: 07/27/2009
Matrix: WATER
% Solids: NA

Lab ID: WG66607-1
Client ID: WG66607-Blank
SDG: SC4086
Extracted by: KF
Extraction Method: SW846 3510
Analyst: RCT
Analysis Method: SW846 8081A
Lab Prep Batch: WG66607
Units: ug/L

Compound	Flags	Results	DF	PQL	Adj.PQL
gamma BHC	U	0.25	1.0	0.25	0.25
Heptachlor	U	0.25	1.0	0.25	0.25
Heptachlor Epoxide	U	0.25	1.0	0.25	0.25
Endrin	U	0.50	1.0	0.50	0.50
Methoxychlor	U	2.5	1.0	2.5	2.5
Toxaphene	U	5.0	1.0	5.0	5.0
Chlordane	U	2.5	1.0	2.5	2.5
Tetrachloro-m-Xylene		85%			
Decachlorobiphenyl		57%			

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client:
Project: Site 95
PO No:
Sample Date:
Received Date:
Extraction Date: 07/24/09
Analysis Date: 24-JUL-2009 16:56
Report Date: 07/27/2009
Matrix: WATER
% Solids: NA

Lab ID: WG66607-5
Client ID: WG66607-TclpBlank
SDG: SC4086
Extracted by: KF
Extraction Method: 3510/1311
Analyst: RCT
Analysis Method: SW846 8081A
Lab Prep Batch: WG66607
Units: ug/L

Compound	Flags	Results	DF	PQL	Adj.PQL
gamma BHC	U	0.25	1.0	0.050	0.25
Heptachlor	U	0.25	1.0	0.050	0.25
Heptachlor Epoxide	U	0.25	1.0	0.050	0.25
Endrin	U	0.50	1.0	0.10	0.50
Methoxychlor	U	2.5	1.0	0.50	2.5
Toxaphene	U	5.0	1.0	1.0	5.0
Chlordane	U	2.5	1.0	0.50	2.5
Tetrachloro-m-Xylene		91%			
Decachlorobiphenyl		72%			

KATAHDIN ANALYTICAL SERVICES
LAB CONTROL SAMPLE

Client:
Project: Site 95
PO No:
Sample Date:
Received Date:
Extraction Date: 07/24/09
Analysis Date: 07/24/09
Report Date: 07/27/2009
Matrix: WATER

Lab ID: WG66607-2
Client ID: WG66607-LCS
SDG: SC4086
Extracted by: KF
Extraction Method: SW846 3510
Analyst: RCT
Analysis Method: SW846 8081A
Lab Prep Batch: WG66607
Units: ug/L

COMPOUND	LCS SPIKE	SAMPLE CONC.	LCS CONC.	%REC.	QC. LIMITS
gamma BHC	0.50	NA	0.52	104	65-124
Heptachlor	0.50	NA	0.50	101	60-114
Heptachlor Epoxide	0.50	NA	0.48	96	64-123
Endrin	0.50	NA	0.54	108	67-119
Methoxychlor	0.50	NA	0.45	90	64-129

FORM 4

PESTICIDE METHOD BLANK SUMMARY

CLIENT SAMPLE ID

WG66690-BLANK

Lab Name: KATAHDIN ANALYTICAL SERVICES Lab Code: KAS

Project: SITE 95 SDG No.: SC4086

Lab Sample ID: WG66690-1 Lab File ID: 8CG00269

Matrix (soil/water) WATER Extraction:(SepF/Cont/Sonc) SW846 3510

Sulfur Cleanup: (Y/N) N Date Extracted: 07/27/09

Date Analyzed (1): 07/28/09 Date Analyzed (2): 07/28/09

Time Analyzed (1): 1159 Time Analyzed (2): 1159

Instrument ID (1): GC08 Instrument ID (2): GC08

GC Column (1): ZB-MULTIRESIDUE-1 ID: 0.53(mm) GC Column (2): ZB-MULTIRESIDUE-2 ID: 0.53(mm

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

	CLIENT SAMPLE ID	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED 1	DATE ANALYZED 2
01	WG66690-LCS	WG66690-2	8CG00270	07/28/09	07/28/09
02	WG66690-LCSD	WG66690-3	8CG00271	07/28/09	07/28/09
03	WG66690-TCLPBLANK	WG66690-4	8CG00272	07/28/09	07/28/09
04	CONC-TCLP-95	SC4086-1	8CG00273	07/28/09	07/28/09
05					
06					
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24					

COMMENTS: _____

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client:
Project: Site 95
PO No:
Sample Date:
Received Date:
Extraction Date: 07/27/09
Analysis Date: 28-JUL-2009 11:59
Report Date: 07/28/2009
Matrix: WATER
% Solids: NA

Lab ID: WG66690-1
Client ID: WG66690-Blank
SDG: SC4086
Extracted by: CB
Extraction Method: SW846 3510
Analyst: JLP
Analysis Method: SW846 8151A
Lab Prep Batch: WG66690
Units: ug/L

Compound	Flags	Results	DF	PQL	Adj.PQL
2,4-D	U	15	1.0	15	15
Silvex	U	15	1.0	15	15
2,4-Dichlorophenylacetic Acid		66%			

KATAHDIN ANALYTICAL SERVICES
Report of Analytical Results

Client:
Project: Site 95
PO No:
Sample Date:
Received Date:
Extraction Date: 07/27/09
Analysis Date: 28-JUL-2009 13:23
Report Date: 07/28/2009
Matrix: WATER
% Solids: NA

Lab ID: WG66690-4
Client ID: WG66690-TclpBlank
SDG: SC4086
Extracted by: CB
Extraction Method: 3510/1311
Analyst: JLP
Analysis Method: SW846 8151A
Lab Prep Batch: WG66690
Units: ug/L

Compound	Flags	Results	DF	PQL	Adj.PQL
2,4-D	U	15	1.0	3.0	15
Silvex	U	15	1.0	3.0	15
2,4-Dichlorophenylacetic Acid		83%			

KATAHDIN ANALYTICAL SERVICES
LAB CONTROL SAMPLE

Client:
Project: Site 95
PO No:
Sample Date:
Received Date:
Extraction Date: 07/27/09
Analysis Date: 07/28/09
Report Date: 07/28/2009
Matrix: WATER

Lab ID: WG66690-2 & WG66690-3
Client ID: WG66690-LCS & WG66690-LCSD
SDG: SC4086
Extracted by: CB
Extraction Method: SW846 3510
Analyst: JLP
Analysis Method: SW846 8151A
Lab Prep Batch: WG66690
Units: ug/L

COMPOUND	LCS SPIKE	LCSD SPIKE	SAMPLE CONC.	LCS CONC.	LCSD CONC.	LCS %REC.	LCSD %REC.	%RPD	%RPD LIMIT	QC. LIMITS
2,4-D	5.0	5.0	NA	4.2	4.4	83	89	7	30	82-141
Silvex	5.0	5.0	NA	4.5	4.8	90	96	6	30	77-125

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ANALYTICAL SERVICES

PREPARATION BLANK REPORT

Sample ID: PBWZG24ICW1 **Batch ID:** ZG24ICW1

Element Name	Result	Units	Flag	PQL	File
ALUMINUM	0.03	mg/L	U	0.30	IZG27A
ANTIMONY	0.002	mg/L	U	0.008	IZG27A
ARSENIC	0.002	mg/L	U	0.008	IZG27A
BARIUM	0.0006	mg/L	U	0.0050	IZG27A
BERYLLIUM	0.0001	mg/L	U	0.0050	IZG27A
BORON	0.0008	mg/L	J	0.100	IZG27A
CADMIUM	0.00007	mg/L	U	0.0100	IZG27A
CALCIUM	0.02	mg/L	U	0.05	IZG27A
CHROMIUM	0.0006	mg/L	U	0.0150	IZG27A
COBALT	0.0002	mg/L	U	0.0300	IZG27A
COPPER	0.0008	mg/L	U	0.0250	IZG27A
IRON	0.004	mg/L	U	0.100	IZG27A
LEAD	0.002	mg/L	J	0.005	IZG27A
MAGNESIUM	0.019	mg/L	J	0.050	IZG27A
MANGANESE	0.001	mg/L	U	0.005	IZG27A
MOLYBDENUM	0.0014	mg/L	J	0.0100	IZG27A
NICKEL	0.0003	mg/L	U	0.0400	IZG27A
POTASSIUM	0.07	mg/L	J	1.00	IZG27A
SELENIUM	0.002	mg/L	U	0.010	IZG27A
SILICON	0.05	mg/L	J	0.20	IZG27A
SILVER	0.0006	mg/L	U	0.0150	IZG27A
SODIUM	0.03	mg/L	U	1.00	IZG27A
STRONTIUM	0.0003	mg/L	U	0.100	IZG27A
THALLIUM	0.001	mg/L	U	0.015	IZG27A
TIN	0.0008	mg/L	U	0.100	IZG27A
TITANIUM	0.0004	mg/L	U	0.0150	IZG27A
VANADIUM	0.0007	mg/L	U	0.0250	IZG27A
ZINC	0.0003	mg/L	U	0.0250	IZG27A

U The analyte was not detected in the sample at a level greater than the instrument detection limit.

J The analyte was detected in the sample at a concentration greater than the instrument detection limit, but less than the laboratory's Practical Quantitation Level.

H The analyte was detected in the sample at a concentration greater than the laboratory's acceptance limit.

Katahdin
ANALYTICAL SERVICES

LABORATORY CONTROL SAMPLE REPORT

Sample ID: LCSWZG24ICW1 **Batch ID:** ZG24ICW1

Element Name	True Value	Result	Units	Recovery(%)	Flag	Limits (%)		File
ALUMINUM	2.00	2.09	mg/L	104.5%		80.	120.	IZG27A
ANTIMONY	0.500	0.526	mg/L	105.2%		80.	120.	IZG27A
ARSENIC	0.500	0.526	mg/L	105.2%		80.	120.	IZG27A
BARIUM	2.00	2.06	mg/L	103.0%		80.	120.	IZG27A
BERYLLIUM	0.0500	0.0483	mg/L	96.6%		80.	120.	IZG27A
BORON	0.500	0.535	mg/L	107.0%		80.	120.	IZG27A
CADMIUM	0.250	0.270	mg/L	108.0%		80.	120.	IZG27A
CALCIUM	2.50	2.54	mg/L	101.6%		80.	120.	IZG27A
CHROMIUM	0.200	0.194	mg/L	97.0%		80.	120.	IZG27A
COBALT	0.500	0.540	mg/L	108.0%		80.	120.	IZG27A
COPPER	0.250	0.251	mg/L	100.4%		80.	120.	IZG27A
IRON	1.00	1.01	mg/L	101.0%		80.	120.	IZG27A
LEAD	0.500	0.555	mg/L	111.0%		80.	120.	IZG27A
MAGNESIUM	5.00	5.10	mg/L	102.0%		80.	120.	IZG27A
MANGANESE	0.500	0.512	mg/L	102.4%		80.	120.	IZG27A
MOLYBDENUM	0.300	0.328	mg/L	109.3%		80.	120.	IZG27A
NICKEL	0.500	0.522	mg/L	104.4%		80.	120.	IZG27A
POTASSIUM	10.0	10.1	mg/L	101.0%		80.	120.	IZG27A
SELENIUM	0.500	0.534	mg/L	106.8%		80.	120.	IZG27A
SILICON	5.23	5.29	mg/L	101.1%		80.	120.	IZG27A
SILVER	0.0500	0.0507	mg/L	101.4%		80.	120.	IZG27A
SODIUM	7.50	7.48	mg/L	99.7%		80.	120.	IZG27A
STRONTIUM	0.500	0.499	mg/L	99.8%		80.	120.	IZG27A
THALLIUM	0.500	0.548	mg/L	109.6%		80.	120.	IZG27A
TIN	0.500	0.523	mg/L	104.6%		80.	120.	IZG27A
TITANIUM	1.00	1.02	mg/L	102.0%		80.	120.	IZG27A
VANADIUM	0.500	0.511	mg/L	102.2%		80.	120.	IZG27A
ZINC	0.500	0.526	mg/L	105.2%		80.	120.	IZG27A

H Laboratory control sample recovery is greater than the laboratory's acceptance limit.

L Laboratory control sample recovery is less than the laboratory's acceptance limit.

Katahdin
ANALYTICAL SERVICES

PREPARATION BLANK REPORT

Sample ID: PBWZG27HGW1 **Batch ID:** ZG27HGW1

Element Name	Result	Units	Flag	PQL	File
MERCURY	0.02	ug/L	U	0.20	HZG28A

U The analyte was not detected in the sample at a level greater than the instrument detection limit.

J The analyte was detected in the sample at a concentration greater than the instrument detection limit, but less than the laboratory's Practical Quantitation Level.

H The analyte was detected in the sample at a concentration greater than the laboratory's acceptance limit.

Katahdin
ANALYTICAL SERVICES

LABORATORY CONTROL SAMPLE REPORT

Sample ID: LCSWZG27HGW1 **Batch ID:** ZG27HGW1

Element Name	True Value	Result	Units	Recovery(%)	Flag	Limits (%)		File
MERCURY	5.00	5.28	ug/L	105.6%		80.	120.	HZG28A

H Laboratory control sample recovery is greater than the laboratory's acceptance limit.

L Laboratory control sample recovery is less than the laboratory's acceptance limit.

Katahdin
ANALYTICAL SERVICES

EXTRACTION FLUID BLANK REPORT

Sample ID: PBT909A

Element Name	Result	Units	Flag	PQL	File
ALUMINUM	0.08	mg/L	J	0.30	IZG27A
ANTIMONY	0.005	mg/L	J	0.008	IZG27A
ARSENIC	0.004	mg/L	J	0.008	IZG27A
BARIUM	0.005	mg/L	J	0.0050	IZG27A
BERYLLIUM	0.0005	mg/L	J	0.0050	IZG27A
CADMIUM	0.00007	mg/L	U	0.0100	IZG27A
CALCIUM	0.1	mg/L	H	0.05	IZG27A
CHROMIUM	0.0006	mg/L	U	0.0150	IZG27A
COBALT	0.0002	mg/L	U	0.0300	IZG27A
COPPER	0.002	mg/L	J	0.0250	IZG27A
IRON	0.02	mg/L	J	0.100	IZG27A
LEAD	0.002	mg/L	J	0.005	IZG27A
MAGNESIUM	0.04	mg/L	J	0.050	IZG27A
MANGANESE	0.002	mg/L	J	0.005	IZG27A
MERCURY	0.02	ug/L	U	0.20	HZG28A
NICKEL	0.001	mg/L	J	0.0400	IZG27A
POTASSIUM	0.2	mg/L	J	1.00	IZG27A
SELENIUM	0.002	mg/L	U	0.010	IZG27A
SILVER	0.002	mg/L	J	0.0150	IZG27A
SODIUM	2.7	mg/L	H	1.00	IZG27A
THALLIUM	0.003	mg/L	J	0.015	IZG27A
TIN	0.002	mg/L	J	0.100	IZG27A
VANADIUM	0.0007	mg/L	U	0.0250	IZG27A
ZINC	0.0080	mg/L	J	0.0250	IZG27A

U The analyte was not detected in the sample at a level greater than the instrument detection limit.

J The analyte was detected in the sample at a concentration greater than the instrument detection limit, but less than the laboratory's Practical Quantitation Level.

H The analyte was detected in the sample at a concentration greater than the laboratory's acceptance limit.

Katahdin Analytical Services, Inc. **Sample Receipt Condition Report**

Client:	Rhea	KAS PM:	AJC	Sampled By:	Client
Project:		KIMS Entry By:	DD	Delivered By:	Fed Ex
KAS Work Order#:	SC4086	KIMS Review By:	JC	Received By:	DD
SDG #:		Cooler:	1 of 1	Date/Time Rec.:	7-22-09 1015

Receipt Criteria	Y	N	EX*	NA	Comments and/or Resolution
1. Custody seals present / intact?	✓				
2. Chain of Custody present in cooler?	✓				
3. Chain of Custody signed by client?	✓				
4. Chain of Custody matches samples?	✓				
5. Temperature Blanks present? If not, take temperature of any sample w/ IR gun.	✓				Temp (°C): 3.9
Samples received at <6 °C w/o freezing?	✓				Note: Not required for metals analysis.
Ice packs or ice present?	✓				The lack of ice or ice packs (i.e. no attempt to begin cooling process) may not meet certain regulatory requirements and may invalidate certain data.
If temp. out, has the cooling process begun (i.e. ice or packs present) and sample collection times <6hrs., but samples are not yet cool?				✓	Note: No cooling process required for metals analysis.
6. Volatiles free of headspace: **Aqueous:** No bubble larger than a pea				✓	
Soil/Sediment: Received in airtight container?				✓	
Received in methanol?				✓	
Methanol covering soil?				✓	
7. Trip Blank present in cooler?				✓	
8. Proper sample containers and volume?	✓				
9. Samples within hold time upon receipt?	✓				
10. Aqueous samples properly preserved? Metals, COD, NH3, TKN, O/G, phenol, TPO4, N+N, TOC, DRO, TPH – pH <2				✓	
Sulfide - >9				✓	
Cyanide – pH >12				✓	

* Log-In Notes to Exceptions: document any problems with samples or discrepancies or pH adjustments

Katahdin ANALYTICAL SERVICES
600 Technology Way
Scarborough, ME 04074
Tel: (207) 874-2400
Fax: (207) 775-4029

CHAIN of CUSTODY

PLEASE BEAR DOWN AND PRINT LEGIBLY IN PEN

Client: Rhea | Contact: T. Grzejka | Phone #: (724) 443-4111 | Fax #: ( )

Address: 4975 William Flynn Hyway #14 | City: Gibsonia | State: PA | Zip Code: 15044

Purchase Order # | Proj. Name / No.: Site 95 | Katahdin Quote #

Bill (if different than above) | Address

Sampler (Print / Sign): Ben Grosser | Copies To: T. Grzejka

LAB USE ONLY

WORK ORDER #: SC4086

KATAHDIN PROJECT NUMBER

REMARKS:

SHIPPING INFO: ❒ FED EX ❒ UPS ❒ CLIENT

AIRBILL NO:

TEMP°C ❒ TEMP BLANK ❒ INTACT ❒ NOT INTACT

ANALYSIS AND CONTAINER TYPE PRESERVATIVES

*	Sample Description	Date / Time coll'd	Matrix	No. of Cntrs.	Filt. ❒Y ❒N	Filt. ❒Y ❒N	Filt. ❒Y ❒N	Filt. ❒Y ❒N	Filt. ❒Y ❒N	Filt. ❒Y ❒N	Filt. ❒Y ❒N	Filt. ❒Y ❒N	Filt. ❒Y ❒N	Filt. ❒Y ❒N
	Conc-TCLP-95	7/21/09 1100	Conc.	2	X									
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Full TCLP

COMMENTS: 1 week TAT

Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)
	7/22/09 1015				
Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)

Katahdin
ANALYTICAL SERVICES

Katahdin Analytical Services

Login Chain of Custody Report (lno1)

Jul. 22, 2009
03:16 PM

Login Number: SC4086

Account: RHEA001 NoWeb
Rhea Engineers and Consultants, Inc.

Project:

Primary Report Address:
Toby Grzejka
Rhea Engineers and Consultants, Inc.
4951 William Flynn Hwy
Suite 12
Gibsonia,PA 15044
toby@rhea.us

Primary Invoice Address:
Accounts Payable
Rhea Engineers and Consultants, Inc.
4951 William Flynn Hwy
Suite 12
Gibsonia,PA 15044

Report CC Addresses:
Invoice CC Addresses:

Login Information

ANALYSIS INSTRUCTIONS	:	
CHECK NO.	:	
CLIENT PO#	:	
COOLER TEMPERATURE	:	
DELIVERY SERVICES	:	Fedex
EDD FORMAT	:	
PM	:	AJC
PROJECT NAME	:	Site 95
QC LEVEL	:	II
REGULATORY LIST	:	
REPORT INSTRUCTIONS	:	Email PDF, no hc.
SDG ID	:	
SDG STATUS	:	

Laboratory Sample ID	Client Sample Number	Collect Date/Time	Receive Date	PR	Verbal Date	Due Date	Mailed
SC4086-1	CONC-TCLP-95	21-JUL-09 11:00	22-JUL-09		**29-JUL-09**	29-JUL-09	

Matrix		Product	Hold Date (shortest)	Bottle Type	Bottle Count	Comments
Solid	P	TCLP-HERB8151				**Sample results due 7/29/09 AM.**
SW1311-EXT-HERB		TCLP-SW8151				
Solid	P	TCLP-METALS			1	
SW1311-EXT		SW3010-PREP		TCLP-ARSENIC		
TCLP-BARIUM		TCLP-CADMIUM		TCLP-CHROMIUM		
TCLP-LEAD		TCLP-MERCURY		TCLP-SELENIUM		
TCLP-SILVER						
Solid	P	TCLP-PEST				
SW1311-EXT-PEST		TCLP-SW8081				
Solid	P	TCLP-SVOA				
SW1311-EXT-SVOA		TCLP-SW8270				
Solid	P	TCLP-VOA			1	
SW1311-EXT-VOA		TCLP-SW8260				

Total Samples: *1* ***Total Analyses:*** *5*