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FINAL

Preliminary Assessment/Site Investigation

Volume I of II
Text and Figures

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

NAVFAC
Naval Facilities Engineering Command

Prepared for

Department of the Navy
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Mid-Atlantic Division
Norfolk, Virginia

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Prepared by

CH2MHILL

QC Review Page

Preliminary Assessment/Site Investigation

MCB Camp Lejeune

Jacksonville, North Carolina

Contract Task Order Number - 190
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LIST OF ACRONYMS AND ABBREVIATIONS

AST	Above Ground Storage Tank
AWQC	Ambient Water Quality Criteria
Baker	Baker Environmental, Inc.
BEHP	bis(2-ethylhexyl)phthalate
bgs	Below Ground Surface
BTV	Background Threshold Value
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Protocol
CS	Characterization Study
CTO	Contract Task Order
1,2-DCE	1,2-Dichloroethene
DEM	Division of Environmental Management
DoN	Department of the Navy
DRMO	Defense Reutilization and Marketing Office
EMD	Environmental Management Division
EPIC	Environmental Photographic Interpretation Center
ESE	Environmental Science and Engineering
FFA	Federal Facilities Agreement
FMF	Fleet Marine Force
FS	Feasibility Study
ft/ft	feet per foot
ft/day	feet per day
ft^2/day	square feet per day
gal/day/ft	gallons per day per foot
gpd	gallons per day
gpm	gallons per minute
HPIA	Hadnot Point Industrial Area
HPFF	Hadnot Point Fuel Farm
HQW	High Quality Waters
IAS	Initial Assessment Study
IMAC	Interim Maximum Allowable Concentration
IRA	Interim Remedial Action
IR	Installation Restoration
LANTDIV	Atlantic Division Naval Facilities Engineering Command
LTM	Long Term Monitoring
LUCIP	Land Use Control Implementation Plan
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCL	Maximum Contaminant Level

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

MCLG	Maximum Contaminant Level Goal
MEK	methyl ethyl ketone
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
msl	mean sea level
NA	Natural Attenuation
NAE	Natural Attenuation Evaluation
NAVFAC	Naval Facilities Engineering Command
NC DENR	North Carolina Department of Environment and Natural Resources
NCWQS	North Carolina Water Quality Standards
NPL	National Priorities List
NREA	Natural Resources and Environmental Affairs
NSW	Nutrient Sensitive Waters
NWI	National Wetland Inventory
OU	Operable Unit
PA	Preliminary Assessment
PCB	Polychlorinated Biphenyl
POL	Petroleum-Oil-Lubricants
ppb	Parts Per Billion
PVC	Polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SA	Esturaine Waters
SC	Secondary Recreation Waters
SCS	Soil Conservation Service
SDWA	Safe Drinking Water Act
SFSA	Steel Foundries Society of America
SI	Site Investigation
SMP	Site Management Plan
SVOC	Semi-Volatile Organic Compounds
SWMU	Site Waste Management Unit
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TCLP	Toxicity Characteristics Leaching Procedure
TS	Treatability Study
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USMC	United States Marine Corps
UST	Underground Storage Tank

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

VOC	Volatile Organic Compound
WAR	Water and Air Research
WRS	Wilcoxon Rank Sum

EXECUTIVE SUMMARY

INTRODUCTION

This project was performed under the direction of the Atlantic Division Naval Facilities Engineering Command (NAVFAC, formerly known as LANTDIV). The final report presents the Preliminary Assessment (PA) completed for twelve areas/buildings and Site Investigation (SI) for seven of the twelve areas located within the Marine Corps Base (MCB), Camp Lejeune. MCB, Camp Lejeune is located on the coastal plain of North Carolina in Onslow County and is a training base for the United States Marine Corps. The work was performed under the Comprehensive Long-Term Environmental Action Navy (CLEAN) II Program, Contract Task Order Number 0190 (CTO - 0190) for LANTDIV.

This PA and initial SI activities follow Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) guidelines. It focuses on potential risks posed by possible uncontrolled releases of hazardous substances, pollutants, or contaminants into the environment that may have occurred at sites or facilities which used or created hazardous materials. The criteria and priorities are based upon relative risk or danger to public health, welfare, or the environment, taking into account the population at risk, the types of hazardous substances at such facilities, the potential for contamination of drinking water supplies, the potential for direct human contact, and the potential for destruction of sensitive ecosystems.

Discovery and initiation of the PA Sites was performed by the Base, in keeping with their efforts of a proactive approach to the investigation of environmental contamination. Initially, 20 sites were discovered through the "Plants Account Facilities Inventory Listing of Buildings and Structures, June 30 1990, MCB, Camp Lejeune, North Carolina" based on their listed identifications of operations. These 20 sites were listed as six laundry/dry cleaning facilities, an eight-vehicle maintenance shop, five automotive hobby shops, and one furniture repair shop. The buildings were chosen because other buildings where similar operations occurred were previously investigated and found to have resulted in releases of contamination into the environment. After preliminary investigation into the 20 sites, sufficient information was gathered to preliminarily remove eight sites from further investigation through the PA process as describe in the letter from the Environmental Management Division (EMD) of Camp Lejeune to the United States Environmental Protection Agency (USEPA) and the North Carolina Department of Environment and Natural Resources (NC DENR) (Appendix D). The eight Sites are buildings HP438, HP1500,

HP1502, AS118, BB16, BB71, M602, and TT2467. Once approval was granted from the USEPA and NC DENR to remove the eight sites, the PA proceeded to investigate the remaining twelve sites of concern.

The purpose of the PA process is to identify areas (or sites) which may have used, stored or handled potentially hazardous materials, and to determine the potential risk to human health and the environment from previous site activities. Sites that require additional investigation at the conclusion of the PA will be recommended for further activities including a SI.

SITE DESCRIPTION, OPERATIONAL HISTORY AND WASTE CHARACTERISTICS

The following PA Sites were researched within this report by performing an Environmental Literature Review (Dolph, October 2001), field reconnaissance, Underground Storage Tank (UST) Section of Camp Lejeune information search, and Installation Restoration (IR) program information search:

Hadnot Point
HP902, HP908, HP1120, HP1124, HP1409, HP1512;

Air Station
TC830, SAS113, AS116, AS119; and,

Montford Point
M119 and SM173.

The site description, operational history, waste characteristics and estimated waste quantity were described for each site of concern. Waste characteristic descriptions are mainly based on the findings of the historical reviews, and the knowledge of typical wastes generated by the processes that took place in the buildings, keeping in mind that what are now typical waste handling procedures and regulations were not developed when the Base generated most of the waste materials. Based on descriptions of documented operations at the Base, the typical hazardous wastes generated may have included; vehicle repair related wastes including waste oils, solvents such as carbon tetrachloride, trichloroethene (TCE), mineral spirits, toluene, and acetone for cleaning; solvents and metals, including lead, chromium, cadmium, and arsenic used in paint-

spraying; and other substances, such as gun preservation materials. Other sources of potential concern include petroleum products housed in storage tanks above and below ground.

PATHWAY AND ENVIRONMENTAL HAZARD ASSESSMENT

The sites included within this report were evaluated for potential migration and exposure pathways with regard to possible receptors. Specifically, each site was evaluated for: groundwater migration pathways, surface water migration pathways, soil exposure pathways, and air migration pathways.

SUMMARY OF FINDINGS

Of the twelve sites investigated, five sites were determined to be included in ongoing investigations which are being conducted in and around their immediate vicinity under various remedial investigation programs. The seven remaining sites had no known remedial investigations performed and presented insufficient evidence for concluding that they present no potential environmental and/or human risk.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of the Preliminary Assessment, the following seven sites are recommended for additional investigation:

HPIA Sites:

- Building HP1120
- Building HP1409
- Building HP1512

Air Station Sites:

- Building SAS113
- Building AS116
- Building AS119

Monford Point Site:

- Building M119

The five following sites are recommended for no additional action:

HPIA Sites:

Building HP902

Building HP908

Building HP1124

Air Station Site:

Building TC830

Montford Point Site:

Building SM173

PA SITES FIELD INVESTIGATION

Based on the conclusions and recommendations of this PA Report, it was decided by the Camp Lejeune Partnering Team in April 2002 to further investigate the HPIA PA Sites (Buildings HP1120, HP1409, and HP1512) during a field investigation at Site 78 that was performed in June 2002. Likewise, the Partnering Team decided at the April 2004 meeting to further investigate the Air Station and Montford Point PA Sites (SAS113, AS116, AS119, M119, and M315). Building M315 was added as a site to be investigated since it was thought that the facility operated as a dry cleaner. No records were found to indicate dry cleaner operations; however, the building was used as a laundry pick-up facility until around the 1980s. It was also decided to document the findings of the PA Sites investigation within this PA/SI Report. The objectives of the Partnering Team were followed throughout the investigation, including locations for sampling and laboratory analytical parameters.

The PA Sites field investigation activities consisted of a soil and groundwater investigation. The focus of the investigation was in the soil and groundwater immediately adjacent to Buildings 1120, 1409 and 1512 within the HPIA; Buildings SAS113, AS116, and AS119 within the Air Station; and Buildings M119 and M315 within Montford Point. Field activities were conducted over two field events. The HPIA field event took place from July 1 to 2, 2002, while the Air Station and Montford Point field activities took place June 7 to 11, 2004.

Surface and subsurface soil analytical data was screened using the North Carolina soil-to-groundwater concentrations (Section 6.3.4) to assess which contaminants require further consideration. Inorganic compounds are further screened using base background data. Inorganic

compound concentrations exceeding both North Carolina soil-to-groundwater concentrations and base background would require further consideration. For the Air Station and Montford Point PA Sites, two background comparison tests were run for the inorganic surface soil data. In cases where both tests indicated that a compound exceeded background data, the compound was identified for further consideration.

Groundwater organic analytical data is screened using the NCWQS and USEPA Region IV MCLs for positive detections of VOCs in groundwater. Groundwater inorganic analytical data is screened using the NCWQS and base background groundwater data. Groundwater inorganic compound concentrations exceeding both NCWQS and base background would require further consideration.

In summary and as determined during the October 2002 Partnering Meeting, Buildings 1120, 1409 and 1512 require no further investigation. There is no evidence from the data to suggests that these areas have been impacted from past site operations. Buildings SAS113, AS116, AS119, M119, and M315 require additional groundwater investigation for inorganics. It is recommended to install one monitoring well in the location of the highest screening results and to sample using low-flow methods at each site. Buildings AS119 and M315 require further investigation of soil.

SECTION 1.0

1.0 INTRODUCTION

This Preliminary Assessment (PA)/Site Investigation (SI) Report of twelve sites of concern at Marine Corps Base (MCB) Camp Lejeune, North Carolina was prepared under direction of the Atlantic Division Naval Facilities Engineering Command (LANTDIV). The work is being performed under the Comprehensive Long-Term Environmental Action Navy (CLEAN) II Program, Contract Task Order Number 0190 (CTO - 0190) for LANTDIV.

MCB, Camp Lejeune was placed on the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) National Priorities List (NPL) effective November 4, 1989 (54 Federal Register 41015, October 4, 1989). Subsequent to this listing, the United States Environmental Protection Agency (USEPA) Region IV; the North Carolina Department of Environment and Natural Resources (NC DENR); the Department of the Navy (DoN); and the Marine Corps entered into a Federal Facilities Agreement (FFA) on March 1, 1991 (effective date) for MCB, Camp Lejeune. The primary purpose of the FFA was to ensure that environmental impacts associated with past and present activities at the Base were thoroughly investigated, and that appropriate CERCLA response and Resource Conservation and Recovery Act (RCRA) corrective action alternatives were developed and implemented as necessary to protect the public health and welfare, and the environment (MCB, Camp Lejeune FFA, 1989).

1.1 MCB, Camp Lejeune Location and History

This section summarizes information concerning the general location and history of MCB, Camp Lejeune. More detailed information is provided in future sections of this report as appropriate. The tables and Figures for Section 1.0 are presented at the end of the section.

Located in Onslow County, North Carolina, MCB, Camp Lejeune is a training base for the United States Marine Corps (USMC). The facility is bisected by the New River and encompasses approximately 236 square miles, of which approximately 40 square miles is water (New River and its tributaries). The New River flows in a southeasterly direction and forms a large estuary before entering the Atlantic Ocean. The southeastern border of MCB, Camp Lejeune is the Atlantic Ocean shoreline. The western and northeastern boundaries of the facility are U.S. Route 17 and State Route 24, respectively. The City of Jacksonville borders the facility to the North. Figure 1-1 provides a map of the Base.

Construction of MCB, Camp Lejeune began in April 1941 at the Hadnot Point Industrial Area (HPIA), where major functions of the Base are centered today. The facility was designed to be the "World's Most Complete Amphibious Training Base". The MCB, Camp Lejeune complex consists of six geographical and operational locations under the jurisdiction of the Base Command. These areas include Camp Geiger, Montford Point (which includes Camp Johnson), Courthouse Bay, Mainside, the Rifle Range Area, and the Greater Sandy Run Area. Marine Corps Air Station (MCAS) New River is operationally under the control of MCAS Cherry Point. However, MCB, Camp Lejeune is responsible for the facilities and environmental management of MCAS New River.

The MCAS New River, which is a tenant organization, encompasses 2,772 acres and is located in the northwestern section of the complex and lies approximately five miles south of Jacksonville. The MCAS includes air support activities, troop housing and personnel support facilities, all of which immediately surround the aircraft operations and maintenance areas.

1.2 Purpose of the Preliminary Assessment and Site Investigation

The purpose of the PA process is to identify areas (or sites) which may have used, stored or handled potentially hazardous materials, and to determine the potential risk to human health and the environment from previous site activities. Sites that require additional investigation at the conclusion of the PA would generally be recommended for further activities including a Site Investigation (SI). The CERCLA defined PA and SI processes are illustrated in Appendix A (DoN, 2001).

The purpose of the PA Report is to present information and data obtained during the PA Environmental Literature Review (Dolph, October 2001), and the field reconnaissance (Appendix I). Based on these findings, information from previous investigations at the sites, and qualitative evaluations of the migration of contamination, recommendations are presented regarding the need, if any, for future activities at the site. The following documentation types were sought and reviewed when preparing the Environmental Literature Review (Dolph, October 2001):

- Station (Activity) maps
- Building and structure plans

- Property record cards
- Contracts
- Environmental reports
- Annual command chronologies
- Oil and hazardous materials spills contingency plans
- Photographs
- Master shore stations development plans
- World War II administrative histories
- Command chronologies
- General activity histories
- Above Ground Storage Tank/Underground Storage Tank (AST/UST) documentation

Research for the Environmental Literature Review (Dolph, October 2001) was also performed at the following repositories:

- Naval Archives I, Pennsylvania Avenue, Washington, D.C.
- National Archives II, Adelphi Road, College Park, MD
- Operational Archives, Naval Historical Center, Washington Navy Yard, Washington, D.C.
- Washington National Records Center, 4205 Suitland Road, Suitland, MD
- Aviation History, Naval Historical Center, Washington Navy Yard, Washington, D.C.
- Navy Library, Naval Historical Center, Washington Navy Yard, Washington, D.C.
- Photographic Section, Naval Historical Center, Washington Navy Yard, Washington, D.C.
- USMC Research Center, USMC University, Marine Corps Base, Quantico, VA
- Archives, USMC Historical Center, Washington Navy Yard, Washington, D.C.
- Library, USMC Historical Center, Washington Navy Yard, Washington, D.C.
- Naval Facilities Engineering Command, Service Center & Seabee Museum (Old NAVFAC Archives), Port Hueneme, CA
- MCB, Camp Lejeune, Jacksonville, NC
  - Environmental & Safety Office
  - Resident Officer in Charge of Construction
  - Library
  - Public Works

- Fuels Department
- Public Affairs Office
- Photographic Laboratory
- Cultural Resource Office

- MCAS, New River, Jacksonville, NC
  - Environmental & Safety Office
  - Resident Officer in Charge of Construction
  - Library
  - Public Works
  - Fuels Department
  - Public Affairs Office
  - Photographic Laboratory

These sources of information were used to evaluate the past and current sites conditions. In addition to the above sources of information, Installation Restoration (IR) program reports were referenced as appropriate for areas of the Base previously studied under the IR program. The UST Section of Camp Lejeune was also contacted to obtain information on any UST Sites in the areas of the PA Sites being investigated. Areas that are being studied under UST Program were excluded from this report, due to the CERCLA exclusion of sites that potentially contain crude oil, fractions of crude oil, or refined crude oil products. Appendix C provides information from UST Program areas that are nearby the PA Sites. The locations of all PA Sites were also visited to evaluate the present site conditions.

The following documents were used to conduct and guide the PA process of identifying sites of concern:

- "Guidance for Performing Preliminary Assessments under CERCLA", EPA/540/G-91/013, September 1991; and
- "Navy/Marine Corps IR Manual", March 2000.

Following the guidance of the above documents, all data was compiled and qualitatively reviewed by assessing hazardous substance exposure routes called pathways. Three pathways refer to migration (groundwater, surface water, and air) and one pathway pertains to exposure(soil exposure). Each pathway represents a means by which hazardous substances may impact human

health and/or the environment. Each of these pathways qualitatively reviewed the following three categories:

- Likelihood of Release - The relative likelihood of a hazardous substance migrating from the site through the specific pathway medium (soil, groundwater, surface water and air).
- Targets - The presence of people, physical resources (drinking water wells or surface water intakes), and environmental resources (sensitive environments, fisheries) that might be threatened by release of a hazardous substance from the site.
- Waste Characteristics - An estimation of the type and quantity of hazardous wastes at the site.

These were qualitatively evaluated during the PA process by applying "professional judgment" and providing explanations for the appropriate hypothesis throughout the report. Critical PA professional judgments take the form of hypotheses that (1) a release of a hazardous substance is or is not suspected to have occurred; and (2) specific targets are or are not suspected to have a relatively high likelihood of exposure to released substances (USEPA, September 1991).

1.3 History of the PA Sites

Discovery and initiation of the PA Sites was performed by the Base, in keeping with their efforts of a proactive approach to the investigation of environmental contamination. MCB Camp Lejeune is on the NPL, and with the signing of the FFA that specifies requirements for the remediation of IR sites, the Base had identified 20 additional sites of potential concern. The 20 sites discovered are listed in the "Plants Account Facilities Inventory Listing of Buildings and Structures, June 30 1990, MCB, Camp Lejeune, North Carolina" as six laundry/dry cleaning facilities, an eight-vehicle maintenance shop, five automotive hobby shops, and one furniture repair shop. The reason these 20 facilities were chosen for PA investigation was based on other buildings where similar operations occurred were previously investigated and found to have resulted in releases of contamination into the environment. The PA process would discover any potential historical contamination and investigate it properly through the CERCLA process of discovery and investigation as illustrated in Appendix A.

The first step through the PA process was to conduct an Environmental Literature Review that would provide historical information for the 20 sites of potential concern, as prepared by the Navy Historian (Dolph, October 2001). The Environmental Literature Review Report along with

additional information gathered from the UST Section at Camp Lejeune and IR Site information provided sufficient detail to preliminary remove eight sites that would not require further investigation throughout the PA process. The eight Sites are Buildings HP438, HP1500, HP1502, AS118, BB16, BB71, M602, and TT2467 as illustrated on Figure 1-1. [The "HP" prefix designates those buildings that are located within the Hadnot Point area to prevent confusion with other buildings reviewed on the Base; the building number used by the Base does not include the "HP" prefix. The "HP" prefix is used throughout this report to help identify the area and building under review.] The rational for the removal of these eight sites are presented in Table 1-1. To remove the eight sites from further investigation, the Environmental Management Division (EMD) of Camp Lejeune prepared a letter in January 2002 to the USEPA stating the reasons for removal. A copy of this letter is included in Appendix D. Once the USEPA and the NC DENR granted approval to remove the eight sites, the PA proceeded to investigate the remaining twelve sites of concern.

The next step in the PA process is a field reconnaissance to visually assess the current environmental status of the sites. The EMD of Camp Lejeune would provide the necessary field reconnaissance for compilation into the PA Report. Baker provided EMD with PA Field Inspection Checklists for the field reconnaissance to verify all conditions at the sites, with existing information answered. The checklists were used as directed by the "Guidance for Performing Preliminary Assessments Under CERCLA" (USEPA, September 1991). The completed PA Field Inspection Checklists are provided in Appendix I.

The final step in the PA process is compiling and assessing all information gathered about the sites throughout the preparation of the PA Report. The PA Report will determine if additional investigations are warranted through the SI process (Appendix A).

1.4 Previous Investigations

Presented below are summaries of previous investigations performed at the Base. Investigative activities at the Base began in 1983 with an Initial Assessment Study (IAS) conducted by Water and Air Research (WAR, April 1983). Sites requiring further investigation were advanced to additional studies and characterization, and were presented in the Site Summary Report (ESE, 1990). Currently, the fiscal year 2002 Site Management Plan (SMP) for MCB, Camp Lejeune, a primary document referenced in the FFA, identifies 42 sites that require Remedial Investigation/Feasibility Study (RI/FS) activities. These 42 sites have been divided into 21

Operable Units (OUs). Operable units are formed as an incremental step toward addressing individual site concerns and to simplify the specific problems associated with a site or group of sites.

The UST Section of the Base has also been involved with all areas where UST contamination is present as noted below for each area of the Base.

1.4.1 Hadnot Point Industrial Area

The HPIA consists of IR Sites 21, 24, 78, and 94 and collectively compromise OUs 1 and 18. Numerous investigations have been performed at these OUs since the IAS, and are currently being performed under the IR and UST programs. The HPIA PA Sites that are being investigated for this report are within OU No. 1. The PA Sites are associated with the following buildings as illustrated on Figure 1-1: HP902, HP908, HP1120, HP1124, HP1409 and HP1512. These buildings have not been investigated under the following studies, however, previous investigations at Site 78 surrounding the PA Sites will provide valuable information for this PA Report. The following sections describe the previous investigations at Site 78 and its' present environmental status.

A two-part Confirmation Study was conducted by Environmental Science and Engineering, Inc. (ESE) from 1984 through 1986 (ESE, September 1990). The purpose of the Confirmation Study was to investigate potential contaminant source areas identified in the IAS Report. Site 78 was evaluated and consequently was determined to warrant further investigation. Supplemental Characterization Steps were performed by ESE from 1990 through 1991, and in 1991 a Characterization Study (CS) / RI was performed for the shallow soils and the Castle Hayne (deep) aquifer. A Final Interim Remedial Action (IRA) Record of Decision (ROD) was prepared for the surficial aquifer in 1992 by Baker Environmental, Inc. (Baker). A RI/FS was prepared by Baker from 1993 through 1994. The Final ROD for OU No. 1 was prepared by Baker in 1994 and stipulated remedial objectives for Site 78 including a pump and treat system and a Long Term Monitoring (LTM) program for groundwater. Pump and treat operations (North Plant only) and LTM have been ongoing at this site and continue today. Preliminary Natural Attenuation (NA) studies have been completed and Treatability Studies (TS) are planned for the groundwater at Site 78 in 2002 and 2003. The Northern Pump and Treat System is in operation near PA Site HP902.

There are a number of Site Waste Management Units (SWMUs) being investigated within OU No. 1 under the RCRA program, two of which (SWMUs 292 and 293) are in close proximity to PA Site HP1124 as illustrated on Figure 1-1.

There are also a number of UST Sites that are being investigated within the HPIA that are in close proximity to PA Sites HP902, HP1409 and HP1512 as presented in Appendix C.

1.4.2 Air Station

Numerous investigations have been performed on the air station portion of the Base, including Camp Geiger. The air station and Camp Geiger areas of the Base have been studied under the IR program including IR Sites 35, 36, 43, 44, 48, 54, 75, 76, 86, 87, 89 and 93. The PA Sites located on the air station portion of the Base consist of the following buildings/areas as illustrated on Figure 1-1: TC830, SAS113, AS116 and AS119. These buildings have not been investigated under the IR program, however, there are IR Sites in close proximity to the PA Sites including IR Sites 75, 76, 86, 89 and 93.

There are a number of SWMUs that are being investigated at the air station, one of which (SWMU 299) is in close proximity to PA Site AS116 as presented on Figure 1-1.

There are also a number of UST Sites that are being investigated at the air station, that are in close proximity to PA Sites SAS113, AS116, and AS119 as presented in Appendix C.

1.4.3 Montford Point

Investigations have been performed on the Montford Point area of the Base, including IR Sites 7, 16, and 85. The PA Sites located on the Montford Point area of the Base consist of the following buildings/areas as illustrated on Figure 1-1: M119 and SM173. These buildings have not been investigated under the IR program, however, SWMU 314 may be located in the same area as SM173. There is also one UST site that is located at Building M-90 in this area of Montford Point.

1.5 Report Organization

This PA/SI Report is divided into six sections, including:

- Section 1.0 - Introduction
- Section 2.0 - Site Description, Operational History and Waste Characteristics
- Section 3.0 - Pathway and Environmental Hazard Assessment
- Section 4.0 - Summary of Findings
- Section 5.0 - Conclusions and Recommendations
- Section 6.0 – PA Sites Field Investigation
- Section 7.0 – References

Tables and figures are located after the text portion of the above sections. Supporting information is contained within the appendices referenced throughout the document, which include Appendices A through L. All of these appendices are included in Volume II of the PA report.

TABLES

TABLE 1 - 1
PRELIMINARY INVESTIGATION
SITES REMOVED FROM FURTHER INVESTIGATION, 20 SITES LIST
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB CAMP LEJEUNE, NORTH CAROLINA

Site	Rational for Removal
HP438	Noted as a "Dry Cleaning Plant" but only laundry operations were performed here, not dry cleaning operations. Also, no known hazardous substances were used or stored here.
HP1502	This building is already being studied under the UST and SWMU Programs.
M602	Noted as a "laundry" no dry cleaning operations were performed here. Also, no known hazardous substances were used or stored here.
BB16	Noted as a "Clean & Press Shop and Laundromat" but only laundry operations were performed here, not dry cleaning operations. Also, no known hazardous substances were used or stored here.
BB71	This building is already being studied under the UST Program.
TT2467	This building is already being studied under the UST Program.
AS118	This building is already being studied under the UST and SWMU Programs.
HP1500	Noted as a "laundry" no dry cleaning operations were performed here. Also, no known hazardous substances were used or stored here. There are two wells that border the building (78-GW07 and 78-GW08 which is included in the regular monitoring program), and both wells have had consistent non-detections. Data is in the LTM Reports for Site 78 (Baker, 1997-2001).

Notes:

(1) Criteria for removing a site from the original list of the 20 Sites included the following informational sources:

Dolph, E. Jim. October 25, 2001. Twenty Potential Sites Environmental Literature Search, MCB, Camp Lejeune, North Carolina. Prepared for the Department of the Navy, Naval Facilities Engineering Command - Atlantic Division, Norfolk, Virginia.

Baker 2001. Site Waste Management Unit Investigations, MCB, Camp Lejeune, North Carolina. Prepared for the Department of the Navy, Naval Facilities Engineering Command - Atlantic Division, Norfolk, Virginia.

Lowder, Bob. 2001. Underground Storage Tank Program Status, Twenty New Sites of Potential Concern CTO-190, MCB, Camp Lejeune, North Carolina.

Baker 1997-2001. Long Term Monitoring Report, OU No. 1 (Site 78), MCB, Camp Lejeune, North Carolina. Prepared for the Department of the Navy, Naval Facilities Engineering Command - Atlantic Division, Norfolk, Virginia.

(2) According to the 1982 Draft and 1983 Final Initial Assessment Studies, there were numerous laundry distribution centers throughout Camp Lejeune, however, all dry cleaning operations were performed in Buiilding 25. This was verified by reviewing the 1976 Naval Environmental Protection Support Service Air Emission Master File Summary. (Dolph, E. Jim, October 2001)

FIGURES

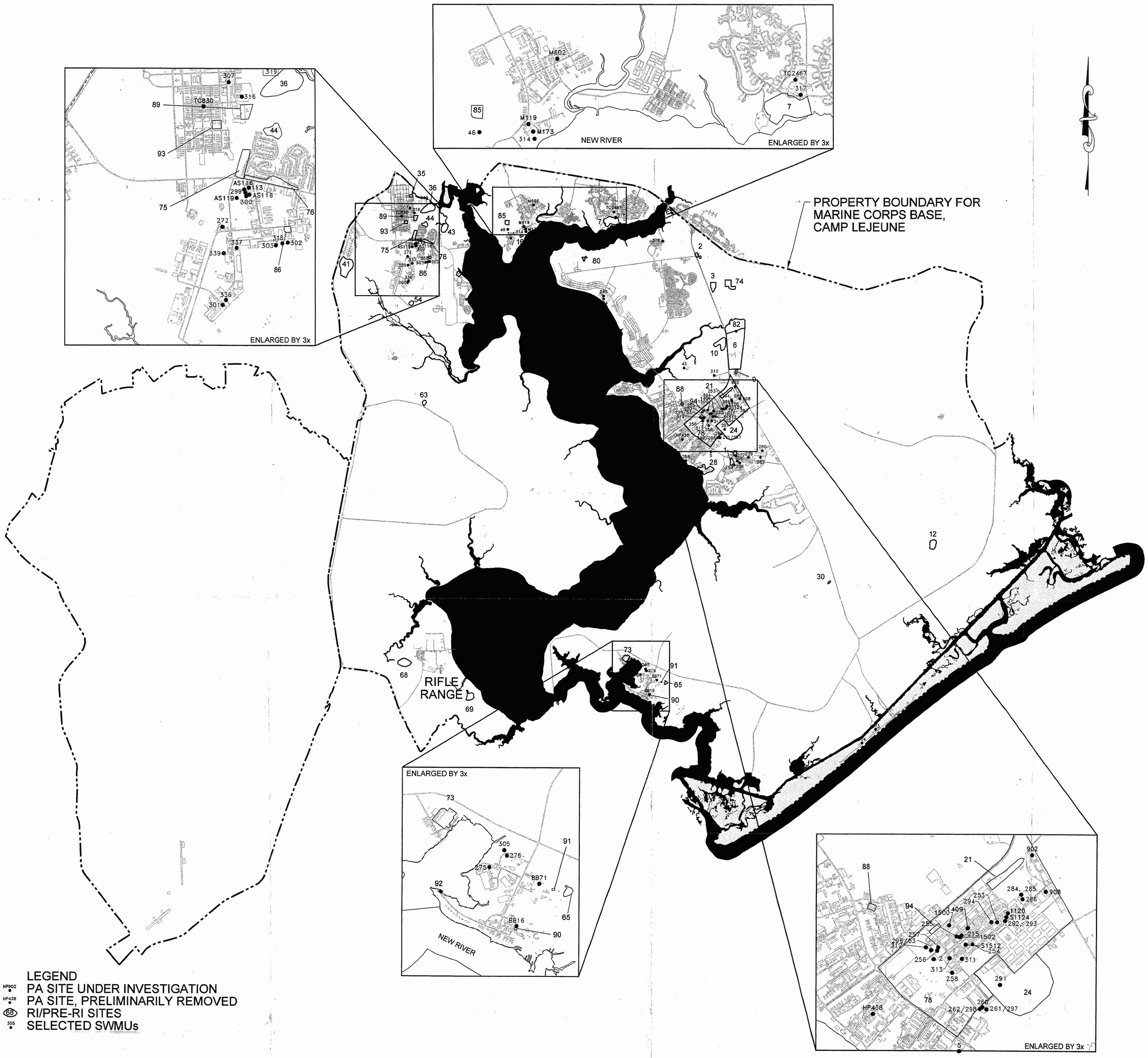

FIGURE 1-1
PA SITE LOCATION MAP
MARINE CORPS BASE, CAMP LEJEUNE
PA SITES, CTO-190

Baker

SCALE 1" = 4000'
CAD DWG. NO. K:\26007\190PHASE\DRAFTPA\CADFIGURES\2190700P.DWG

SECTION 2.0

2.0 SITE DESCRIPTION, OPERATIONAL HISTORY AND WASTE CHARACTERISTICS

The following sections include information obtained through the Environmental Literature Review (Dolph, October 2001), field reconnaissance, and other sources of information as referenced throughout. The tables and figures for Section 2.0 are presented at the end of the section.

2.1 Sites of Concern

The following sections describe the specific sites of concern which are presented by areas on the Base (i.e. Hadnot Point, Air Station, Montford Point). The areas of concern are discussed below and are viewed as separate sites within Camp Lejeune. Appendix B contains photographic documentation of the areas of concern and Appendix C contains information on non-CERCLA areas including USTs. Historical drawings of the facilities that document operations at the sites are included in Appendix E. For additional historical drawings refer to the Environmental Literature Review (Dolph, October 2001). Appendix F details previous investigations that were performed on or near the PA Sites and information including findings from previous reports, monitoring well construction details, and analytical data. Appendix H provides information on SWMU investigations that were performed on or near the PA Sites. Appendices are referenced throughout the report as appropriate.

The site description, operational history, waste characteristics, and estimated waste quantities are described for each site of concern. Waste characteristic descriptions are mainly based on knowledge of typical wastes generated by the processes that took place in the buildings, keeping in mind that what are now typical waste handling procedures and regulations were not developed when the Base generated most of the waste materials through manufacturing processes. Based on descriptions of documented operations at the Base, the typical hazardous wastes generated may have included; vehicle repair related wastes including waste oils, solvents such as carbon tetrachloride, trichloroethene (TCE), mineral spirits, toluene, and acetone for cleaning; solvents and metals, including lead, chromium, cadmium, and arsenic used in paint-spraying; and other substances, such as gun preservation materials. Other sources of potential concern include petroleum products housed in storage tanks above and below ground.

Waste quantities were estimated for each site considering a worse case scenario. Because the amount of waste materials that potentially could have migrated into the environment could not be determined, the foundation or footprint of a building or a selected perimeter area was determined for use in qualitatively assessing the areas.

2.2 Hadnot Point Industrial Area Sites

As mentioned previously OU No. 1, Site 78, has been studied extensively through the IR and UST programs. Currently, there is a pump and treat system operating in the northern portion of Site 78 and an LTM program in place for the entire OU as stipulated in the Final ROD for OU No. 1 (Baker, September 1994). The PA Sites within Site 78 are associated with buildings HP902, HP908, HP1120, HP1124, HP1409 and HP1512 as illustrated on Figure 2-1.

The HPIA which houses the industrial area of the mainside portion of MCB Camp Lejeune, is located between Sneads Ferry Road, Holcomb Boulevard, Duncan Street, and Main Service Road. The site covers an area of approximately 590 acres, the majority of which is paved. However, there are many lawn areas associated with individual buildings within the sites, and there are several acres of woods in the southern portion of the site.

The land within Site 78 is relatively flat. The installation of drainage ditches, storm sewers, and extensive paving typically have altered natural drainage. Surface runoff not intercepted by a manmade structure from the southern portions of the site may drain to Codgels Creek (Baker, June 1994). Surface runoff from some areas in the northwestern portions of the site may drain to the Beaver Dam via storm water sewers (Baker, June 1994). Previous investigations show groundwater to generally flow from east to west across Site 78.

The HPIA, constructed in the late 1930s, was the first facility at MCB Camp Lejeune. The area is comprised of maintenance shops, warehouses, painting shops, auto body shops, and other similar facilities. Due to the industrial nature of the area, many spills and leaks have occurred over the years. Most of these spills and leaks have consisted of petroleum-related products and solvents from USTs, drums, and uncontained waste storage areas. Provided on Figure 2-2 are locations of possible source areas within OU No. 1, based on past operations at buildings, locations of USTs and ASTs, and wash rack areas. Presently, there are no known uncontrolled waste disposal activities related to the site.

Historical aerial photographs from 1956, 1964, 1984, and 1996 are illustrated on Figures 2-3, 2-4, 2-5, and 2-6, respectively. An analysis of aerial photography was performed for Site 78 by the Environmental Photographic Interpretation Center (EPIC) (EPIC, 1992). The study covered the period between 1938 and 1990. The analysis included a review of historical aerial photographs and stereoscopic viewing. Stereoscopic viewing creates a perceived three-dimensional effect which, when combined with viewing at various magnifications, enables the analyst to identify spectral or tonal signatures associated with different features and environmental conditions on the ground. The study concluded that possible staining dating back to 1944 was evident near numerous equipment maintenance/wash racks throughout the site at motor pools and maintenance areas. From the 1949 aerial, liquid and/or stains were visible emanating from buildings. The following sections describing the characteristics that were recognized at the HPIA PA Sites as shown by handwritten notes and drawings on the aerial photographs in the EPIC Report for the HPIA. Drawings from the EPIC Report are included in the Site 78 RI as Appendix A (Baker, June 1994).

- 1949

  Drawings from EPIC for 1949 in the area of Building HP1512 are noted as having staining and an equipment maintenance/wash rack. Directly south of Buildings HP1120 and HP1124 there is liquid discharged noted near Buildings HP1107 and HP1106.

- 1956

  Drawings from EPIC for 1956 in the area of Building HP1512 again note staining and an equipment maintenance/wash rack.

- 1964

  Drawings from EPIC for 1964 do not indicate any notes by Building HP1512 during this period. Equipment maintenance/wash racks, and staining are noted west of Building HP902.

- 1984

  Drawings from EPIC for 1984 show liquid staining directly south of Building HP1409 in the center of the block between Building HP1401 and HP1410. Liquid discharge is also noted at Building HP1124 during this period. Equipment maintenance/wash racks and staining are again noted west of Building HP902.

Currently, there are land use restrictions in place for groundwater and soils within OU No. 1. Except for monitoring purposes, use of groundwater within 1,000 feet of OU No.1 is prohibited (i.e., installation of new water supply wells), as stipulated in the Land Use Control Implementation Plan (LUCIP) for OU No. 1 (Baker, June 2001). Therefore, potential groundwater use will not be evaluated for the HPIA PA Sites.

2.2.1 Building HP902

2.2.1.1 Site Description

Building HP902 is located in the northern most portion of Site 78, bordering Sneads Ferry Road as shown on Figures 1-1 and 2-1. It is a one-story brick building (Appendix B, Photos 1 through 7) with dimensions of 360 ft x 180 ft. Adjacent areas consist of paved and unpaved roads, parking lots, storage areas for heavy equipment, dumpsters and drums, and other buildings.

Monitoring Wells

South of Building HP902 are a number of monitoring wells and a network of recovery wells associated with the Northern Treatment Plant as shown on Figure 2-1. Four monitoring wells are located between Buildings HP902 and HP903 as follows: IR78-GW24-1, IR78-GW24-2, IR78-GW24-3, and IR78-GW44. Recovery well IR78-RW11 is located on the south side of Building HP902.

Aboveground and Underground Storage Tanks

There is one former UST site located south of Building HP902 at Building HP903, with associated monitoring wells (Appendix C, HPIA).

One UST suspected in the area of Building HP902 was found during the Environmental Literature Search; however, no records could be located (Dolph, October 2001) regarding its specific usage. A UST has already been investigated during the CS and supplemental reports for this area, and was determined to have contained TCE and was associated with Building HP903.

An AST and drums were identified inside a fenced storage area during the site visit, as shown in Appendix B, Photo 1. The capacity of the AST is approximately 250 gallons and contains used oil. The drums are approximately 55 gallons each and contain used oil. Other storage containers that were identified include containers of a capacity of 17.55 gallons, containing oil, and were described as being in excellent condition. No evidence of release was identified for any of the storage containers.

2.2.1.2 Operational History

The following sections describe the past and present use at Building HP902, and are also summarized in Table 2-1.

Building HP902 is one of four Ordnance Warehouses constructed in 1948 (blueprints of the building layout are presented in Appendix E, Figure HP902-1). Plans indicate that a Small Arms Shop, including parkerizing facilities had been installed in the building by the early 1950s. Parkerizing is the process by which guns are coated for protection. In addition to parkerizing, blueprints indicate that a bluing tank was also located in the shop.

The Steel Foundries Society of America (SFSA) define parkerizing as a proprietary method of producing a protective phosphate coating on ferrous metals. Parker A treatment involves immersing in a bath of acid manganese phosphate. The Parker D is a modification using acid zinc phosphate with a nitrate ion as an accelerator. Bluing is the formation of a thin film of oxide on polished steel to improve its appearance and protect its surface.

The procedures involved to refinish a firearm were provided by a gun refinishing service as follows (Hot Flash, March 2002) :

> "The process of refinishing a firearm by bluing and parkerizing usually begins by disassembling the firearm and cleaning the parts to remove any rust, if necessary. The parts are then sanded to remove any pitting and the metal is polished to any type of finish desired. After the parts are chemically cleaned and rinsed, they are usually placed in a hot bluing tank at 290^0 to 310^0 F or into a parkerizing tank at 200^0 F to apply the finish. When the finish has taken to the metal, the parts are removed, rinsed in water, and then put into a neutralizer tank to remove any traces of the bluing salts. The parts are then transferred to a rinse water tank to

remove the neutralizer prior to being placed in a water displacing oil, which displaces any molecules of water left on the metal. Finally, the firearm is reassembled, checked for function and a curing oil is applied."

This process of gun refinishing was most likely performed at Building HP902, where a monorail was constructed to move the weapon parts from one area of the process to another.

It is important to understand the general process of gun refinishing that took place at this building and the chemicals that were potentially used. As outlined on historical blueprints of the building from 1950 (Appendix F, Figures HP902-2 through HP902-3), drainage sumps are noted on the drawings for capturing waste from the parkerizing tanks on the south end of the building, closest to neighboring Building HP903. These drainage sumps may have emptied to a tank or, most likely, to waste water lines that lead southwest through Site 78. There is the possibility that these lines were/are broken or cracked, resulting in potential contamination throughout the area of Building HP902. The waste water lines and the storm sewer lines generally run southeast across the area of the HPIA. The 1948 and 1950 blueprints (Appendix E, Figures HP902-1 through HP902-3) of the floor layout indicate that the following equipment was used in this building:

Small Gun Shop - Parkerizing Facilities

- Paint Spray Booth
- Parkerizing Unit & Five Tanks
- Penetrate Process Tanks
- Drain Tanks
- Vapor Degreaser
- Solvent Drum & Pump
- Sandblast Cleaner
- Air Compressor
- Lead Lined Acid Tank 6' x 3' x 3'
- Water Tank 6' x 3' x 3'
- Monorail

Small Gun Shop

- Bluing Tank
- Riveter
- Grinder
- Lathes
- Skill Saw

By the 1960s a portion of the building was utilized for equipment maintenance. A 1965 plan of the building (Appendix E, Figure HP902-4) indicated that the floor layout included the following areas:

- Storage Areas
- Small Engine Repair
- Welding and Machine Shop Area
- Battery Shop
- Tool Room
- Offices
- Diesel Generator Repair Area

In the mid-1980s an armory was installed in the building. According to a 1986 Environmental Survey conducted by ESE, organics were used to clean the weapons. A blueprint (Appendix E, Figure HP902-5) detailing the armory addition areas depicts:

- Armory Storage
- Warehouse Storage
- Offices

A 1996 historical drawing of the building shows that the armory areas had been replaced with mainly warehouse storage areas and mechanical areas (Appendix E, Figure HP902-6).

A 1998 historical drawing indicates a vehicle maintenance pit was constructed for vehicle repair (Appendix E, HP902-7). The Base currently lists the building as a Construction/Weight Handling Equipment Shop. The most recent site visit indicated that the building provides maintenance for

heavy equipment (graders, backhoes and generators) including painting. The heavy equipment is stored near Building HP902 as shown in Appendix B, Photo 2. Miscellaneous solid waste and debris was also identified near the facility as shown on Photos 1 and 6.

2.2.1.3 Waste Characteristics

The following are known chemicals/compounds that were used or stored in Building HP902 (Dolph, October 2001):

- Wastewater from Vehicle Washing
- Waste Oil
- Safety Kleen Solvent
- Paint Thinner
- Mineral Sprits (Stock Number 8010-00-242-2089)
- Motor Oil (OHD/30 -WT, Stock Number 9150-00-189-6729)
- Motor Oil (OHD/90 -WT, Stock Number 9150-01-035-5394)
- Penetrating Oils
- Parkerizing Chemicals
- Bluing Chemicals

The following are potential chemicals/compounds that were used or stored in Building HP902 (Dolph, October 2001):

- Small Arms Cleaning Chemicals (solvents, organics)

Previous Investigations

As mentioned earlier, numerous environmental investigations were conducted throughout the HPIA. Information detailing previous investigations performed in the area of Building HP902 is included in Appendix F HP902, and are summarized below:

Soil Gas Investigation

- Soil gas samples were collected around the perimeter of Building HP902 during the CS investigation due to the suspected UST in this area (ESE, May 1988 and April 1992). The analytical results indicated detections of TCE at 1,497 parts per billion (ppb) in the area of the suspected UST that reportedly contained TCE between Buildings HP902 and HP903. Findings of the soil gas investigation including a figure of sampling points and analytical results are presented in Appendix F.2. It should be noted that soil gas sample locations MW24, MW24-2, and MW24-3 are shown in the incorrect location on the CS report figure included in Appendix F.2. The correct location of these borings are near Building HP903 where the tank and associated monitoring wells (IR78-GW24-1, IR78-GW24-2 and IR78-GW24-3) are located (Figure 2-1).

Soil Borings

- Soil borings were advanced around the perimeter of Building HP902 during the CS investigation (ESE, April 1992). The soils were analyzed for target compound list (TCL) volatile organic compounds (VOCs), pesticides, polychlorinated biphenyls (PCBs), and toxicity characteristic leaching procedure (TCLP) metals. The analytical results indicated only one boring with detections of VOCs, near the area of the suspected UST. The sample contained concentrations of 1,2-dichloroethene (1,2-DCE) (55 milligrams per kilogram [mg/kg] and 120 mg/kg), and TCE (120 mg/kg). No pesticides or PCBs were detected in any of the borings. Inorganics were detected throughout the samples. Select metals (Aluminum, calcium, and iron) were abundant in all samples in concentrations greater than 1,000 mg/kg. Many other metals were also detected, but at concentrations below the certified detection limits. Findings of the soil borings collected during the CS, including a figure of sampling points and analytical results, are included in Appendix F.3.

- Soil borings were also installed during the RI performed by Baker (Baker, June 1994) based on areas of concern identified from previous analytical data, a geophysical investigation, and historical records. The soils were analyzed for TCL VOCs, Semi-Volatile Organic Compounds (SVOCs), pesticides and PCBs. PCBs were not detected in any samples, while VOCs, SVOCs, and pesticides were detected. One VOC was detected at low concentrations (16 micrograms per kilogram [ug/kg] or less) in only the subsurface soils, while SVOCs were detected more greatly in the surface soils including

the following detection ranges: naphthalene 81 J to 1,400 ug/kg; phenanthrene 770 to 9,000 ug/kg; fluoranthene 2,100 to 8,000 ug/kg; and pyrene 1,500 to 7,600 ug/kg. Pesticides were also only detected at low concentrations in the surface samples, probably as the result of spraying activities instead of direct disposal. The overall pesticide concentrations ranged from 5.4 J ug/kg to 37 J ug/kg. Findings of the soil borings collected during the RI, including a figure of sampling points and analytical results, are included in Appendix F.4.

Monitoring Well Installation and Sampling

- Monitoring well HPGW24 (also referred to as IR78-GW24-1) was installed and sampled in the area of the suspected UST during the CS investigation (ESE, April 1992). The well was sampled three times, and compounds detected include oil and grease (100 micrograms per liter [ug/L]), benzene (2 ug/L), dichloroethane (12 ug/L), 1,2-DCE (4,000 to 6,400 ug/L), TCE (57 ug/L), and chloride (190 to 250 ug/L). These detected analytes are consistent with the use of TCE and the maintenance of equipment documented to have occurred in this area. Findings from the CS investigation, including well construction records and analytical results, are presented in Appendix F.5.

  Other investigations have also analyzed the monitoring wells in the area of Buildings HP902 and HP903. These investigations include the following:

  - Site 78 RI performed for groundwater
  - LTM at OU No. 1
  - Site 78 North Natural Attenuation Evaluation (NAE)

Geophysical Survey

- In June 1992, a geophysical survey was conducted for the Pre-Investigation Study for the RI/FS to investigate several suspected UST areas, one being in the area between Buildings HP902 and HP903. A potential UST, suspected of being the former TCE tank, was identified near Building HP903 from the geophysical findings. Findings of the geophysical investigation, including geophysical figures, are presented in Appendix F.6.

- Currently, there are a number of monitoring wells and recovery wells in the area of Building HP902 to monitor contamination and recover the contamination through the pump and treat system as stipulated in the ROD for OU No. 1 (Baker, September 1994). Monitoring wells IR78-GW24-1, IR78-GW24-2, IR78-GW24-3, and IR78-GW44 are located south of Building HP902 where the UST was determined to be located and contamination is present. These monitoring wells are regularly sampled through the LTM program at Site 78. Recovery well IR78-RW11 located south of Building HP902 is also sampled regularly through the LTM program at Site 78. Information including analytical data, static water level elevations, and well construction details for the above mentioned monitoring wells and recovery well is included in Appendix F.1, HPIA. It should be noted that a new remedial action plan is in process to replace the pump and treat system with another technology to address the VOC plume near Building HP902. The new treatment technology will be implemented through a treatability study anticipated to start in Fiscal Year 2003.

2.2.1.4 Waste Quantity

Known disposal practices with estimated waste quantities are listed on Table 2-2. As shown, all records indicate that waste from Building HP902 was taken to an AST, or to the Defense Reutilization and Marketing Office (DRMO) except for some waste water from vehicles that was discharged onto the ground, or from oils that were sprayed on unimproved roads all over the Base. This list may not include all wastes that were generated at this facility. There are no records of waste disposal before 1971 when gun refinishing processes were used in this building. Some chemicals that may have been used in the process of gun refinishing at Building HP902 are included in Appendix G.

2.2.2 Building HP908

2.2.2.1 Site Description

Building HP908 is located in the northeastern portion of Site 78, near Michael Road and Sneads Ferry Road as shown on Figures 1-1 and 2-1. It is a one story corrugated iron - prefabricated steel building (Appendix B, Photos 8 through 12) with dimensions of 100 ft x 40 ft. Adjacent areas consist of pavement, concrete, some storage areas, structures and other buildings.

Monitoring Wells

There is one shallow monitoring well (IR78-GW33) that was installed during the RI, adjacent to Building HP908 (Figure 2-1). This monitoring well is located upgradient of Building HP908, considering that the general groundwater movement at Site 78 is east to west across the site.

Underground and Above Ground Storage Tanks

A former above ground acid tank, and a below ground sludge trap and grease trap were found during the Environmental Literature Review on historical blueprints. These tanks were located between Buildings HP908 and HP909 as shown in Appendix E, Figure HP908-6.

There are no known UST program sites on or directly adjacent to Building HP908.

2.2.2.2 Operational History

The following sections describe the past and present use at building HP908 and are also summarized in Table 2-3.

Building HP908 was constructed as a Standard Butler Building in 1948. It was originally used as a storage building for electronic equipment. Shortly after its construction, plans were drawn proposing to convert the building into a Vehicle Paint and Undercoat Shop (Appendix E, Figures HP908-1 and HP908-2). In 1952 the building was converted into a Paint Shop with a paint spray booth and a bake oven, during which time an addition was added onto the existing building (Appendix F, Figure HP908-3). The original plans included an undercoating facility, however, it is unknown if the undercoating facility was included in the building. Prior to this time there was no central paint shop on the Base. Paint spraying operations were conducted in Buildings HP1201, HP1401, HP1502 and HP1601. In 1982 paint-spraying operations in the HPIA were performed in Buildings HP908, HP1103 and HP1202. In 1989 the work performed in Building HP908, then referred to as the Central Paint or Body Shop, was described as consisting of vehicle painting and general body repair.

As shown on drawings from 1951, a bake oven was installed and building plans indicate a new acid tank, new sludge trap, and a new sewer between Buildings HP908 and HP909 (Appendix E, Figures HP908-4, through HP908-6). The acid tank, new sludge tank and existing grease trap are

drawn in more detail on Figure HP908-7, and show that the acid tank is above ground while the sludge trap and grease pit are below ground.

Building plans indicated that in the 1960s there was a small metal building located between Buildings HP908 and HP909 that was used for paint stripping. This building may be the small metal building in the vicinity of Building HP908 that was used to store chemicals and paint, as documented during a 1986 inspection of the area by ESE. During the most recent site visit a paint locker was identified on the north side of the building as shown in Appendix B, Photo 11.

Building HP908 was totally renovated in 1992. A drawing of the floor layout from 1992 (Appendix E, Figure HP908-8) shows that the baking oven was to be removed, while the spray booth was to remain. The current use of this building is an automotive/vehicle shop.

According to the above mentioned drawings and the Environmental Literature Review (Dolph, October 2001), the following equipment was used in Building HP908:

- Spray Painting Equipment
- Spray Booth
- Baking Oven
- Air Compressor
- Acid Tank
- Sludge Trap
- Grease Trap

According to the above mentioned drawings and the Environmental Literature Review (Dolph, October 2001), the following operations were conducted in Building HP908:

- Storage
- Paint Spraying
- Vehicle Body Repair

During the site visit a small structure was identified as storing paint, as shown in Appendix B, Photos 11 and 12. There was no visual evidence of a release from this storage structure. Miscellaneous debris and storage and raised structures were also identified during the site visit as shown in Appendix B, Photo 8. The raised structures are probably a ventilation system for the building.

2.2.2.3 Waste Characteristics

The following are known chemicals/compounds that were used or stored in Building HP908 (Dolph, October 2001):

- Paint (estimated one ton annually)
- Lacquer Thinner - Stock Number 8010-00-165-55401
- Mineral Spirits - Stock Number 8010-00-2089
- Contaminated Waste Water
- Solvents

2.2.2.4 Waste Quantity

Known disposal practices with estimated waste quantities are listed on Table 2-4. As shown, all records indicate that waste was taken to the Base Chemical Landfill, the Hadnot Point Burn Dump, or to the DRMO. This list may not include all wastes that were generated at this facility. There are no records of waste disposal before 1976 when painting chemicals were used in this building, and therefore, it is unknown exactly how wastes were disposed of at this building. During the site visit a dumpster was identified west of the building and described as containing solid waste.

Previous Investigations

As mentioned earlier, numerous environmental investigations were conducted throughout the HPIA. Information detailing previous investigations performed in the area of Building HP908 is included in Appendix F.3, HP908 and is summarized below:

Soil Gas Investigation

- Soil borings were advanced surrounding the perimeter of Building HP908 during the RI (Baker, June 1994). The analytical results indicated detections of total VOCs ranging from non-detect to 3.3 ppb. Findings of the soil gas investigation, including a figure of sampling points and analytical data, are presented in Appendix F.7.

Monitoring Well Installation and Sampling

- One monitoring well (IR78-GW33) was installed along the perimeter of Building HP908 during the RI (Baker, June 1994), and groundwater was sampled and analyzed for TCL VOCs and Target Analyte List (TAL) inorganics (total and dissolved metals and cyanide). VOCs were not detected, while inorganics were detected. Select inorganics including aluminum, calcium, and iron were detected at concentrations exceeding 10 mg/L, while other inorganics were detected at lower concentrations, or below the required detection limit. This monitoring well is currently not sampled under the LTM program, however, static water levels are regularly measured at this well. Positive detection summaries in groundwater from the RI, and well construction records for monitoring well IR78-GW33 are presented in Appendix F.8.

Subsurface Soil Samples

- Subsurface soil samples (i.e., below one-foot) were collected from the boring advanced for monitoring well IR78-GW33 during the RI, and were analyzed for VOCs, SVOCs, pesticides, PCBs and inorganics (Baker, June 1994). SVOCs, pesticides and PCBs were not detected in soils. TAL inorganics were detected in the samples, with select inorganics including aluminum and iron exceeding concentrations of 1,000 mg/kg, while other inorganics were detected at lower concentrations, or below the required detection limits. Acetone was detected, but was determined in the RI report to be a laboratory contaminant. Findings of the soil borings, including analytical results, are presented in Appendix F.8.

2.2.3 Building HP1120

2.2.3.1 Site Description

Building HP1120 is located in the middle of Site 78 near the northern portion of the site, between Hammond Road, Birch Street, and Ash Street as shown on Figures 1-1 and 2-1. It is a one story metal and concrete building surrounded by fencing, and has several bays (Appendix B, Photos 13 through 17) with dimensions of approximately 375 ft. X 30 ft. Adjacent areas consist of pavement, asphalt, grass, storage areas, and other buildings including PA Site HP1124. During the site visit, debris and miscellaneous storage were identified as shown in Appendix B, Photo 13.

Monitoring Wells

There is one monitoring well (IR78-GW16) located northwest of Building HP1120 as shown on Figure 2-1. This monitoring well is located somewhat downgradient of Building HP908, considering that the general groundwater movement at Site 78 is east to west across the site. Monitoring well IR78-GW16 was installed during the CS to monitor Building HP1202 after a soil gas investigation identified high levels of TCE in the vicinity of Building HP1202.

Aboveground and Underground Storage Tanks

One AST was found during the Environmental Literature Review and is also described as being installed pre-1972, having a capacity of 1,000 gallons, and to have contained waste oil. No ASTs were identified surrounding the building during the most recent site visit.

There are two former UST Sites (1106 and S1213/1205) and one active UST Site [Hadnot Point Fuel Farm (HPFF)] in the vicinity of Building HP1124. (Refer to Appendix C for UST information in the area of Building HP1124.)

2.2.3.2 Operational History

The following sections describe the past and present use at building HP1120 and are summarized in Table 2-5.

Building HP1120 was constructed as an Automobile Hobby Shop in 1955. According to original as-built drawings, the building was configured with the following work areas (Appendix E, Figure HP1120-1):

- Repair Shop
- Tool Room
- Parts Room
- Equipment Room

An addition was constructed in 1964 (Appendix E, Figure HP1120-2) and again in 1969 (Appendix E, Figure HP1120-3) to serve as a classroom.

Operations conducted in this building include automotive repair and painting. Known machinery used in the building are grease racks and vehicle lifts.

Previous Investigations

As mentioned earlier, numerous environmental investigations were conducted throughout the HPIA. Information detailing previous investigations performed in the area of Building HP1120 is included in Appendix F.4, HP1120 and summarized below:

Monitoring Well Installation and Sampling

As mentioned previously, monitoring well IR78-GW16 is located near Building HP1120. Monitoring well IR78-GW16 was analyzed during the RI for TCL VOCs and TAL inorganics (Baker, June 1994). The data from the RI indicates that VOCs were not detected, while a number of total and dissolved inorganics were detected. Select total inorganics including calcium, iron, magnesium, and potassium exceeded 10 mg/L, and aluminum was detected at 341 mg/L, while other inorganics were detected at lower concentrations or below the required detection limit. Select dissolved inorganics including calcium, magnesium, and sodium were detected at concentrations above 1 mg/L, while other dissolved inorganics were detected at lower concentrations, or were not detected. Although this monitoring well is currently inactive, static water level elevations are taken during the LTM program. Monitoring well IR78-GW16 construction details and analytical data from the RI are included in Appendix F.9.

2.2.3.3 Waste Characteristics

Known chemicals/compounds used in this building are as follows (Dolph, October 2001):

- Automotive Grease
- Oil
- Waste Oil
- Paint

This list may not include all wastes that were generated at this facility. Other compounds that may have been used or stored in this building include paint thinners, parts cleaning wastes (solvents and parts washers), automotive batteries, and shop cleaning wastes (floor cleaning

wastes, absorbents used for spills or leaks and shop rags). During the most recent site visit materials that were identified include paints, oils, lubes, and hydraulic fluids.

2.2.3.4 Waste Quantity

Known disposal practices with estimated waste quantities are listed on Table 2-6. As shown, the records indicate that the AST was pumped out by Base Maintenance, except for waste oil (including solvents) that was reportedly sprayed on unimproved roads all over the Base. However, there are no records of waste disposal before 1976, and therefore, it is unknown exactly how all wastes were disposed of at this building.

2.2.4 Building HP1124

2.2.4.1 Site Description

Building HP1124 is located in the middle of Site 78 near the northern portion of the site, between Hammond Road, Birch Street, and Ash Street as shown on Figures 1-1 and 2-1. It is a metal and concrete open bay garage located inside a fenced compound (Appendix B, Photos 18 through 23) with dimensions of approximately 96 ft. X 40 ft. Adjacent areas consist of pavement, asphalt, debris and other buildings including PA Site HP1120.

Monitoring Wells

As discussed previously for Building HP1120, the closest monitoring well is IR78-GW16, located northwest of Building HP1124. This monitoring well is located somewhat downgradient of Building HP1124, considering that the general groundwater movement at Site 78 is east to west across the site.

Aboveground and Underground Storage Tanks

As discussed previously for Building HP1120, there are two former UST Sites (1106 and S1213/1205) and one active UST Site (HPFF) in the vicinity of Building HP1124. (Refer to Appendix C for UST program information in this area.)

A 500 gallon AST containing waste oil and antifreeze was studied inside Building HP1124 by the SWMU Program (Baker, November 2001). During a site visit conducted by Baker in 1996 for the SWMU investigation, spills/stains were noted on the concrete flooring of the open-bay garage structure housing the AST. An oil/water separator was also studied by neighboring Buildings 1106 and 1107.

2.2.4.2 Operational History

The following sections describe the past and present use at Building HP1124, and are also summarized in Table 2-7.

Building HP1124 was constructed in 1970 as an automobile repair shop (Appendix E, Figure HP1124-1). The structure basically consists of open bays. During the site visit, a paint spray booth and hydraulic lifts were identified, as shown in Appendix B, Photos, 19 and 23. A metal structure labeled hazardous waste storage was also identified in the parking lot near Buildings HP1120 and HP1124, as shown in Appendix B, Photo 22. Some staining is noticed on the asphalt around the hazardous waste storage structure.

Previous Investigations

Site Waste Management Units

As mentioned previously, a 500 gallon AST containing waste oil and antifreeze was investigated in Building HP1124 under the SWMU Program (SWMU No. 292) and an oil/water separator was studied near Buildings 1106 and 1107 (SWMU No. 293). Four soil borings were advanced around the perimeter of the buildings and analyzed for VOCs, SVOCs, and RCRA metals. In the soil sample set closest to Building HP1124 the following was detected: VOCs (acetone 860 ug/kg and methylene chloride 2J to 6.1 ug/kg), SVOC (bis(2-ethylhexyl)phthalate 120 J ug/kg), and metals (chromium 4.1 to 6.2 ug/kg, lead 2.2 to 4 ug/kg, mercury 0.071 ug/kg and selenium 0.64 ug/kg). The SWMU report determined that the detections were all below the screening criteria, and no further investigations were warranted for SWMU No. 292. For complete SWMUs 292 and 293 investigation information, including analytical results, refer to Appendix H.1.

2.2.4.2 Waste Characteristics

No records were found during the Environmental Historical Review to document known wastes used in this building. From the SWMU investigation, however, it is known that oil and antifreeze was stored in this building (Baker, November 2001). Used oils may contain heavy metals, and antifreeze contains ethylene glycol and lead.

It is suspected that other compounds may have been used/stored in this building including automotive batteries, parts cleaning wastes (solvents and parts washers), and shop cleanup wastes (floor cleaning wastes, absorbents used for spills or leaks and shop rags). During the site visit a number of materials were identified including paints, oils, lubes, and hydraulic fluids.

2.2.4.3 Waste Quantity

It is known that the AST in Building HP1124 can hold 500 gallons of waste oil and antifreeze. The amount of wastes (oil, antifreeze) generated at this facility over a period of time is unknown.

2.2.5 Building HP1409

2.2.5.1 Site Description

Building HP1409 is located in the southern area of Site 78, between Buildings HP1404 and HP1403 on Gibb Road, as shown on Figures 1-1 and 2-1. It is a one story concrete and cinder block building that is fenced inside a compound, and has open bays (Appendix B, Photos 24 through 26) with dimensions of approximately 157 ft. X 28 ft. Adjacent areas consist of pavement, concrete, grass, open storage, and other buildings.

Monitoring Wells

There are no monitoring wells located in the area of Building HP1409. The closest monitoring well is IR78-GW10 located near Building 1502 on Elm Street (Figure 2-1). This monitoring well is located somewhat downgradient of Building HP1409, considering that the general groundwater movement at Site 78 is east to west across the site.

Aboveground and Underground Storage Tanks

There are no known USTs in the area of Building HP1409. There is an active UST Site associated with Building 1502 located southwest of Building HP1409 across Elm Street. There are several monitoring wells associated with Building HP1502 near Elm Street. (Refer to Appendix C for UST Program information.)

During the site visit several ASTs were identified adjacent to Building HP1409 as shown in Appendix B, Photo 26. As shown, there is a small shed with fencing surrounding the area that stores ASTs. The contents and capacity of the ASTs and containers are unknown; however, they appear to be rusting as shown on Photo 26.

2.2.5.2 Operational History

The following sections describe the past and present use at Building HP1409 and are also summarized in Table 2-9:

Building HP1409 was constructed in 1943 as a Storage Building. In the late 1940s, it housed the Upholstery and Carpenter Shop and was operated by the Reclamation and Salvage Division. The Upholstery Shop handled the repair of upholstery and re-upholstering of all government furniture located in officers' quarters and other buildings within the Base. Slipcovers were manufactured and canvas and leatherwork was performed in this building. The Carpenter Shop repaired office furniture, household furniture, barracks boxes, mess tables and benches. The Upholstery and Carpenter Shop were relocated from Building HP1409 in 1951 (WAR, April 1983). The floor layout from 1943 is illustrated in Appendix E, Figure HP1409-1.

The 1959 Base lists Building HP1409 as a decontamination building. Plans could not be located to describe the use of decontamination. The building was most likely used to store material for defense operations.

In the years to follow, Building HP1409 was used as a Classroom, a Public Works Storage facility and a Furniture Repair Shop (Appendix E, HP1409-2). The Furniture Repair Shop contained a 550-gallon vat of paint stripper that was used to remove clear finishes (lacquer and varnish) on wood (WAR, April 1983). The paint stripper was disposed of by being placed in 55 gallon drums and then transported to the Fly Ash Dump where it was poured on the ground (WAR, 1983).

Currently, the building houses a military Boat Shop where small boats are repaired, including minor hull repair, and inboard and outboard engine repair as shown in Appendix B, Photo 25.

The following is a list of known machinery used in Building HP1409 in the past (Dolph, October 2001):

Carpenter Shop

- Circular Saws
- Band Saws
- Joiners
- Grinders
- Boat Engine Repair Related Tools

The following is a list of known operations conducted in Building HP1409 (Dolph, October 2001):

- Furniture Repair
- Upholstery Work
- Carpenter Work
- Instruction
- Storage
- Administrative
- Boat and Engine Repair

Previous Investigations

As mentioned earlier, numerous environmental investigations were conducted throughout the HPIA. Previous investigations were conducted at neighboring buildings during the CS and RI, however, no known investigations or samples were analyzed near Building HP1409. These investigations were performed at Buildings HP1502, HP1601 and HP1602 which have been vehicle maintenance and repair facilities since initial construction at the Base (circa 1942 - 1943). The following is a list of investigations that have been performed at these neighboring buildings.

Soil Gas Investigation

A soil gas investigation was performed during the CS to study the area of Buildings HP1502, HP1601 and HP1602 (ESE, April 1992). Soil gas borings were advanced around these buildings and TCE was detected in several samples with levels as high as 73,000 ug/L. Findings of the soil gas investigation including a figure of sampling points and analytical results are presented in Appendix F.10.

Soil Borings

Soil borings were advanced around the area of Buildings HP1502, HP1601 and HP1602 during the CS and analyzed for VOCs, SVOCs, inorganics, pesticides and PCBs (ESE, April 1992). VOCs, including TCE, were found in the majority of the samples surrounding these buildings. Findings of the soil boring investigation are presented in Appendix F.11.

Monitoring Well Installation and Sampling

There are no known monitoring wells located in the area of Building HP1409. The closest monitoring well is IR78-GW10 located near Building 1502 on Elm Street (Figure 2-1), approximately 800 feet away. This monitoring well is located somewhat downgradient of Building HP1409 considering that the general groundwater flow is east to west across Site 78. Monitoring well IR78-GW10 was sampled during the CS for VOCs, SVOCs, inorganics, pesticides and PCBs. VOCs, SVOCs, pesticides and PCBs were not detected, while inorganics were detected in monitoring well IR78-GW10. Select inorganics that were detected above 10 mg/L include calcium, magnesium and potassium, while aluminum and iron were detected in excess of 100 mg/L. Analytical results from the CS are included in Appendix F.12.

Monitoring well IR78-GW10 is also sampled regularly through the LTM Program for VOCs. This well has shown consistent non-detections of VOCs since January 1999, previous to this date there have been minor detections of VOCs. Analytical results from the LTM Program and well construction details for monitoring well IR78-GW10 are presented in Appendix F.1.

2.2.5.3 Waste Characteristics

The following is a list of known chemicals/compounds used or stored in Building HP1409 (Dolph, October 2001):

- Paint Stripper
- Hydraulic Fluid (Stock Number 9159-00-698-2382)
- Penetrating Fluid (Stock Number 6859-00-985-7180)
- Gear Case Oil

Fuels and oils were identified at this building during the site visit.

2.2.5.4 Waste Quantity

Known disposal practices are listed on Table 2-10. As shown, the records indicate that in 1945 trash was collected Base wide (general refuse) daily and hauled to incinerators or open burning dumps. In addition, paint stripper was disposed of in the Fly Ash dump during 1982. It is unknown, however, how waste oil was disposed of at this facility. During the period of 1945 to 1949 this facility was a carpentry shop, and waste oils may have been potentially produced from the use of machines.

2.2.6 Building HP1512

2.2.6.1 Site Description

Building HP1512 was supposedly located between Buildings HP1504 and HP1503 on Hammond Road, however, during a recent visual inspection this structure could not be located. The former location of this building is shown on Figures 1-1 and 2-1. It is assumed that HP1512 was most likely an automotive repair support structure because Buildings HP1503 and HP1504 are part of a series of vehicle maintenance buildings with parts cleaning tanks and wash racks located between them. The area where HP1512 was located is now a concrete staging pad and is being used as a storage area for drums and tires. Fencing surrounds the area of former Building HP1512. Adjacent areas consist of pavement, concrete, grass and other buildings (Appendix B, Photos 27 and 28).

Monitoring Wells

There is one monitoring well (IR78-GW11) located south of the former structure HP1512, across Hammond Road, approximately 100 feet away. This monitoring well is located somewhat downgradient of former Building HP1512 considering that the general groundwater flow is east to west across Site 78. This monitoring well is sampled regularly through the LTM program for VOCs. Analytical data from this well show consistent non-detections. Well construction details and analytical results for monitoring well IR78-GW11 are presented in Appendix F.1, HPIA.

Underground and Aboveground Storage Tanks

There are no known USTs in the area of former structure HP1512. There is an active UST Site at Building HP1502 located north of former structure HP1512 with associated monitoring wells as outlined in Appendix C. Drums were identified during the site visit, as described below.

2.2.6.2 Operational History

Operational history is unknown for this structure, however, it is assumed that it was used as an automotive repair support structure for the series of vehicle maintenance buildings in this area (Table 2-11).

As shown in Appendix B, Photos 27 and 28, this area is being used as open storage for drums and tires and as vehicle maintenance support. As identified during the site visit, there are approximately seventy-five tires in this area, and fifteen, fifty-five gallons drums. The drums are described as being empty, with no visual evidence of a release. A drainage swale is also immediately adjacent to the concrete pad staging area for the drums and tires.

2.2.6.3 Waste Characteristics

Waste characteristics are unknown for this structure. It is assumed that this was some type of vehicle support structure, either a vehicle wash rack, cleaning tank, or possibly a storage area. If this structure was a vehicle support area, it could have the potential for a number of wastes including waste oils, waste water from vehicles or cleaning parts, or solvents for cleaning parts. During the site visit Petroleum-Oil-Lubricants (POLs) were identified at this area.

Previous Investigations

Previous investigations were conducted at neighboring buildings of the former structure HP1512 during the CS and the RI; however, no known samples were analyzed near structure HP1512. These investigations were performed for Buildings HP1502, HP1601 and HP1602, which have been vehicle maintenance and repair facilities since initial construction at the Base (circa 1942 - 1943). (Refer to the previous section for Building HP1409 that discusses the soil gas investigation and soil borings performed during the CS.)

Monitoring Well Installation

Monitoring well IR78-GW11 is located south of the former structure HP1512 across Hammond Street. Monitoring well IR78-GW11 was sampled during the CS and analyzed for VOCs, SVOCs, inorganics, pesticides and PCBs. SVOCs, pesticides, and PCBs were not detected, while one VOC was detected (carbon disulfide 11 ug/L), and inorganics were detected. Select inorganics that exceeded 10 mg/L include aluminum, iron and magnesium, while other inorganics were detected at lower concentrations, or below the required detection limit. Analytical data for monitoring well IR78-GW11 from the CS is included in Appendix F.12.

This well is also regularly sampled during the LTM program for VOCs and has historically shown non-detections of VOCs. Analytical results from the LTM Program are presented in Appendix F.1, HPIA.

2.2.6.4 Waste Quantity

Former Building HP1512 operational history, waste characteristics and waste disposal are relatively unknown.

2.3 Air Station Sites

The PA Sites located on the Air Station portion of the Base are associated with Buildings TC830, SAS113, AS118, AS116 and AS119 as illustrated on Figure 2-7. As mentioned previously, these PA Sites have not been investigated under the IR program and are not located within an existing OU. IR Sites 44, 75, 76, 89 and 93, however, are located north of the PA Sites.

SWMU No. 299 is an AST near Buildings AS114 and PA Site AS116. The SWMU program is currently investigating an AST in this area.

There are also a number of UST Program Sites under investigation at the Air Station, that are in close proximity to PA Sites SAS113, AS116 and AS119 as presented in Appendix C.

The land within the Air Station PA Sites is relatively flat. The installation of drainage ditches, storm sewers, and extensive paving typically have altered natural drainage. Surface runoff from the sites not intercepted by a manmade structure may drain to Edwards Creek. Previous investigations at nearby IR Sites 75 and 76 indicate that groundwater in this area generally flows towards Edwards Creek. Topographic contour elevations are illustrated on Figure 2-7 for the Air Station PA Sites. A recent aerial photo is illustrated on Figure 2-8 and shows the land features of the PA Sites. As shown, the area surrounding the PA buildings is paved and there are drainage ditches that surround the area.

2.3.1 Building TC830

2.3.1.1 Site Description

Building TC830 is located north of IR Site 93, on the corner of Eighth Street and C Street as shown on Figures 1-1 and 2-7. It is a one story concrete cinder block building (Appendix B, Photos 29 through 32) with dimensions of 108 ft x 24 ft. Adjacent areas consist of pavement, gravel, grass and other buildings.

Monitoring Wells

There are no known monitoring wells in close proximity to Building TC830. However Site 93 is located directly south of Building TC830 where several monitoring wells are located.

Aboveground and Underground Storage Tanks

There are no known ASTs or USTs in close proximity to Building TC830.

2.3.1.2 Operational History

The following sections describe the past and present use at Building TC830 and are also summarized in Table 2-12.

Building TC830 was constructed in 1943 as a Storehouse, as illustrated on blueprints included in Appendix E, Figure TC830-1. This building was constructed from standardized plans and consists of a metal frame and siding. Over the years this building has been listed as a storage building, a classroom, and a dry cleaning plant for the Marine Corps Exchange. This building was listed as a Laundry and Dry Cleaning Plant. The IAS states that numerous laundry distribution centers were located throughout the Base that did not perform dry cleaning operations, and all dry cleaning operations were performed at Building 25 (WAR, April 1993). The Environmental Literature Review verified that all dry cleaning operations at the Base were performed at Building 25 by reviewing the 1976 Naval Environmental Protection Support Service Air Emission Master File Summary (Dolph, October 2001).

2.3.1.3 Waste Characteristics

No information was found during the Environmental Literature Review or field reconnaissance to indicate that any hazardous wastes were used or disposed of at Building TC830. There are also no known environmental investigations that were performed in the vicinity of Building TC830. The Environmental Literature Review verified that this facility did not perform dry cleaning operations, and therefore, dry cleaning chemicals are not suspected at this building. However, it is not clear as to what was stored in this building during the 1940's and during the 1970's when the building is listed as providing open storage.

2.3.1.4 Waste Quantity

The only known disposal practice at Building TC830 was the daily trash removal that was taken to incinerators or open burn dump for disposal as presented on Table 2-13. Dry cleaning operations were not performed at this building, and therefore, there are no potential dry cleaning waste quantities.

2.3.2 Building SAS113

2.3.2.1 Site Description

Building SAS113 is located south of IR Sites 75 and 76, between Buildings AS114 and AS118 west of Bancroft Road as shown on Figures 1-1 and 2-3. It is an four bay open metal structure erected on a 6 inch slab (Appendix B, Photos 33 through 36) with dimensions of 100 ft x 24 ft. Fencing surrounds the building, and some debris was noticed during the site visit as shown in Appendix B, Photo36. Run-off from the building was also identified during the site visit, as shown on Photos 33 and 34. Adjacent areas consist of pavement, asphalt, and other buildings.

Monitoring Wells

There are no known IR program monitoring wells located in this area of the Base, however, there are UST Program monitoring wells in this area.

Underground and Aboveground Storage Tanks

There are no known ASTs or USTs associated with Building SAS113, however, there are UST Program Sites in this area of the Base as presented in Appendix C.

2.3.2.2 Operational History

The following sections describe the past and present use at Building SAS113 and are also summarized in Table 2-14.

Building SAS113 was constructed in 1986 when surrounding Buildings AS114, AS116 and AS118 were converted into automotive hobby shops. Building SAS113 primarily serves as an outside work and storage area for the automobile hobby shops. Known machinery used at Building SAS113 are small vehicle jacks to provide vehicle repair support.

2.3.2.3 Waste Characteristics

Records of chemical/compounds used or stored in Building SAS113 were not found during the Environmental Literature Review. Since this is a vehicle support area, it is suspected that any number of automobile repair wastes are used or stored here and may include the following: waste oil, antifreeze, parts cleaning wastes (solvents and parts washers), automotive batteries, and shop cleaning wastes (floor cleaning wastes, absorbents used for spills or leaks and shop rags). During the site visit POLs were identified at the building.

2.3.2.4 Waste Quantity

No records were found during the Environmental Literature Review to document wastes or disposal practices at Building SAS113. It is uncertain how the vehicle repair related wastes are used and disposed of at this structure.

2.3.3 Building AS116

2.3.3.1 Site Description

Building AS116 is located south of IR Sites 75 and 76, west of Bancroft Road near Building AS114 as shown on Figure 1-1 and 2-3. It is a one story metal frame building with siding that has four bays, and is attached to a brick structure (Appendix B, Photos 37 through 42) with dimensions of approximately 70 ft x 51 ft. Fencing surrounds the building, with access from Bancroft Street only. Adjacent areas consist of pavement, asphalt, and other buildings.

Monitoring Wells

There are no known IR program monitoring wells located in this area of the Base, however, there are UST Program monitoring wells in this area.

Underground and Aboveground Storage Tanks

There are no known USTs associated with Building AS116, however, there are UST Program Sites in this area of the Base as presented in Appendix C.

During the site visit, an open storage area (shed) was identified as storing drums and equipment, as shown in Appendix B, Photos 39 and 40. The storage area contains approximately fifteen drums that are described as being in good condition and are currently empty, with no visual evidence of a release.

2.3.3.2 Operational History

The following sections describe the past and present use at Building AS116 and are also summarized in Table 2-15.

Building AS116 was constructed in 1954 to provide the Air Station with vehicle maintenance facilities. A floor plan drawing of AS116 is illustrated in Appendix E, Figure AS116-1. This building replaced a temporary wooden building.

From 1979 to 1981 Building AS116 served as a Hazardous and Flammables storage area.

In the early 1980s, a new complex was constructed for the Combat Vehicle Maintenance Shop, and Building AS116 was converted into an automotive hobby shop along with Buildings AS113 and AS114. During the site visit a paint booth was identified inside Building AS116.

Previous Investigations

Site Waste Management Unit

No known investigations have been performed at Building AS116 or surrounding buildings, however, SWMU No. 299 is near Building AS116. SWMU No. 299 is an AST associated with Building AS114. Samples collected in the area of the AST detected VOCs ranging from 71 to 4,300 ug/L, SVOCs ranging from 640 J to 16,000 ug/L, and inorganics. The concentrations were detected in excess of the SWMU screening criteria and are currently being investigated further. Findings of the SWMU No. 299 investigation are presented in Appendix H.2.

2.2.3.3 Waste Characteristics

Records of chemicals/compounds used or stored in Building AS116 were not found during the Environmental Literature Review. Since this is a vehicle support area, it is suspected that any number of automobile repair wastes are used or stored here and may include the following: waste oil, antifreeze, parts cleaning wastes (solvents and parts washers), automotive batteries, and shop cleaning wastes (floor cleaning wastes, absorbents used for spills or leaks and shop rags). This building is also listed as a paint shop and may include the following wastes associated with painting: paint thinners and waste paint. Paint and POLs were identified at this building during the site visit.

In addition to supplying vehicle support, this area was also used to store hazardous and flammable materials. There are no records of the types of hazardous and flammable materials stored in Building AS116.

2.2.3.4 Waste Quantity

No records were found during the Environmental Literature Review to document wastes or disposal practices at Building AS116. It is uncertain how the vehicle repair related wastes, and potentially hazardous and flammables materials were used and disposed of at this structure.

2.2.4 Building AS119

2.2.4.1 Site Description

Building AS119 is located south of IR Sites 75 and 76 and west of Bancroft Road, as shown on Figures 1-1 and 2-7. It is a one story metal frame building with siding (Appendix B, Photos 43 through 49) with dimensions of approximately 120 ft x 24 ft. Fencing surrounds the area of the building. Adjacent areas consist of grass, pavement, asphalt, and other buildings.

Monitoring Wells

There are no known IR program monitoring wells located in this area of the Base, however, there are UST Program monitoring wells in this area as shown in Appendix C.

Underground and Aboveground Storage Tanks

An AST used for the heating system was discovered during the Environmental Literature Review. There are also UST Program Sites in this area of the Base as presented in Appendix C. This AST was verified during the site visit as shown in Appendix B, Photo 43.

2.2.4.2 Operational History

The following sections describe the past and present use at Building AS119 as summarized in Table 2-16.

Building AS119 was constructed in 1963 as an Automotive Vehicle Maintenance Facility. Plans indicate that the floor layout included the following areas:

- Office
- Toilet
- Parts Storage
- Service Bays
- Exterior Service or Wash Rack

In 1988 the building was configured with the following areas (Appendix E, Figure AS119-1 through AS119-3):

- Weight Room
- Licensing Room
- Lounge
- Office
- Duty Office
- Toilet
- Tire Shop
- Exterior Service or Wash Rack

During the work performed in 1988, a number of structures were removed from the building or updated as shown in Appendix E, Figure AS119-1. An existing oil heater and associated piping and valves were replaced with a new fuel oil storage tank with a capacity of 250 gallons (Appendix E, Figure AS119-2). The new AST is on a concrete pad as shown in Appendix E, Figure AS119-3 and Appendix B, Photo 43.

Currently, the area is described as a storage facility and no maintenance work was identified during the site visit. A wash rack was identified during the site visit with run-off, as shown in Appendix B, Photos 44 and 45.

2.4.2.3 Waste Characteristics

Records of chemicals/compounds used or stored in Building AS119 were not found during the Environmental Literature Review. Since this is a vehicle support area it is suspected that any number of automobile repair wastes are used or stored in this building and may include the following: waste oil, antifreeze, paints, paint thinners, parts cleaning wastes (solvents and parts washers), automotive batteries, and shop cleaning wastes (floor cleaning wastes, absorbents used for spills or leaks and shop rags).

2.4.2.4 Waste Quantity

No records were found during the Environmental Literature Review to document wastes or disposal practices at Building AS119. It is uncertain how the vehicle repair related wastes, were used and disposed of at this structure. During the site visit a number of trash dumpsters were identified as shown in Appendix B, Photo 49. There are approximately eight to ten dumpsters and are described as empty and in good condition, there was also no visual evidence of a release during the site visit. The site visit also verified that currently, any waste oil generated at this facility is transported to Building AS114 (Auto Hobby Shop).

2.5 Montford Point Sites

The PA Sites located on the Montford Point portion of the Base are associated with Buildings M119 and SM173 as illustrated on Figures 1-1 and 2-9. As mentioned previously, these PA Sites have not been investigated under the IR program and are not located within an existing OU. However, IR Sites 7, 16 and 85 are located in this area of the Base.

There is a one UST Program Site associated with Building M90 in this area of the Base as presented in Appendix C.

The land within the area of the PA Sites is relatively flat. The sites are located west of Northeast Creek. Surface runoff from the sites drains to this creek, and eventually flows to the New River. Topographic contour elevations are illustrated on Figure 2-9 for the Montford Point PA Sites. A recent aerial photo is illustrated on Figure 2-10 and shows the land features of the PA Sites. As shown, the area surrounding the PA buildings is paved and woods surround the area to the south and west.

2.5.1 Building M119

2.5.1.1 Site Description

Building M119 is located at the intersection of Landing Road and Wilson Drive as shown on Figure 1-1 and 2-9. It is a one story concrete and wood building and has three bays (Appendix B, Photos 50 through 53) with dimensions of 133 ft x 46 ft. Adjacent areas consist of paved and unpaved roads, grass, and other buildings.

Monitoring Wells

There are no known monitoring wells located in close proximity to Building M119.

Underground and Aboveground Storage Tanks

There is one AST and one UST that were discovered during the Environmental Literature Review (Dolph, October 2001). The AST is described as being constructed of steel, containing fuel oil, and used for heating purposes. The UST is described as being installed before 1967, constructed of steel, having a capacity of 1,000 gallons and contained regular gasoline in 1974 and unleaded gasoline. The purpose of the UST was for vehicle fuel. Reportedly, in 1989 the UST could not be located and it was believed to be located at structure SM193. Plans and specifications to remove the tank and dispensing pump were prepared in 1991 as shown in Appendix E, Figures M119-1 and M119-2.

In addition to the fuel oil AST, a diesel AST was identified on the west side of the building as shown in Appendix B, Photo 51. The capacity of the tank is 500 gallons, and appears to be new.

2.5.1.2 Operational History

The following sections describe the past and present use at Building M119 as summarized in Table 2-17.

Building M119 was constructed in 1943 as one of four Gun Sheds that were constructed adjacent to each other on Wilson Drive, as shown in Appendix E, Figure M119-3. The types of guns stored in the buildings were most likely Howitzers. Over the years the building has been renovated, and has been used as a classroom and vehicle repair shop. As shown on historical drawings from 1988, (Appendix E, Figure M119-4) there are a number of fuel oil tanks that are used for heating this building.

Operations conducted in Building M119 includes:

- Parts Cleaning
- Classroom
- Vehicle Repair
- Gun Preservation

Previous Investigations

There are no known previous investigations that have been performed at this building.

2.5.1.3 Waste Characteristics

The following are known chemicals/compounds that were used or stored in Building M119 (Dolph, October 2001):

- Safety Kleen Solvent
- Waste Oil
- Vehicle Repair Related
- Gasoline

Potential chemicals/compounds that were used or stored at this building during the time that it stored guns may be gun preservation materials. Vehicle repair related materials may include: paint and paint thinners, parts cleaning wastes (solvents and parts washers), automotive batteries, automotive oils, and shop cleaning wastes (floor cleaning wastes, absorbents used for spills or leaks and shop rags).

2.5.1.4 Waste Quantity

Known disposal practices, with estimated waste quantities, are listed on Table 2-18. As shown, the records indicated that in 1945 trash was collected Base wide (general refuse) daily and hauled to incinerators or open burn dumps. Waste oils (including solvents) were sprayed on unimproved roads on the Base, and the solvents used in Building M119 were disposed of via the Safety Kleen Company. In addition, waste oils from both Buildings M119 and M120 were deposited into a UST at an estimated rate of 2,045 gallons annually. The location and status of the waste oil UST is uncertain, and this is probably not the same UST that was planned for removal as mentioned earlier. The UST plans from 1991 specify that the tank being removed contained gasoline for the vehicles in the area. Historical documentation dating back to August 1976 revealed that a spill occurred while filling a UST at Building M119. Approximately 200 gallons of gasoline overflowed during a fuel transfer operation. It was also reported that the spill was contained in a nearby ditch and cleaned up by Base maintenance personnel by removing the contaminated soil and subsequently back-filled and seeded. Refer to Appendix F.13 for the spill report from the Base.

2.5.2 Building SM173

2.5.2.1 Site Description

Building SM173 was located west of Landing Road as shown on Figures 1-1 and 2-9. It was a small shed with dimensions of 14 ft x 10 ft. This area currently houses a concrete wash rack that is used to wash vehicles (Appendix B, Photos 54 and 55). Adjacent areas consist of pavement, and grass.

Monitoring Wells

There are no known monitoring wells in close proximity to the area of former Building SM173.

Aboveground and Underground Storage Tanks

There are no known ASTs or USTs in close proximity to former Building SM173.

2.5.2.2 Operational History

The following sections summarize the operational history of former Building SM173 as summarized on Table 2-19.

Former structure SM173 was constructed in 1962 by Base personnel to house a Steam Generator, also known as a Steam Jenny. Steam Jennys were used to assist with washing vehicles throughout the Base.

Previous Investigations

No known investigations have been performed for former structure SM173. However, the SWMU program is currently investigating the wash rack and oil/water separator in this location. Findings from the SWMU investigation are presented in Appendix H, SM173.

2.5.2.3 Waste Characteristics

No known chemicals/compounds were found during the Environmental Literature Review. However, it is suspected that power source for the Steam Jenny was either gas or diesel engine driven with propane or diesel heat. There may have been contamination due to the gas or diesel fuel used to power the Steam Jenny. Contamination may also result from the wastewater from the vehicles that were washed in this area.

2.5.2.4 Waste Quantity

No records were found during the Environmental Literature Review to document wastes or disposal practices at Building SM173. It is uncertain how the vehicle washing related wastes, were used and disposed of at this structure. It is assumed that the wastewater from the vehicles ran off through the existing wash rack and oil/water separator in this area.

TABLES

TABLE 2-1

BUILDING HP902
HISTORY OF USE
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Usage
1948	Building Constructed
1948	Ordnance Warehouse Number 3
1950 - 51	Small Arms (Parkerizing) Shop
1962	Administration Building/Small Arms Shop/General Warehouse
1963	Construction Engineer Shop
1967 - c1990	Construction Equipment Maintenance Shop/Weapons Maintenance Shop
January 31, 1985	Plans were drawn to install an Armory in Building 902
1986	Maintenance Facility/Armory
October 16, 2001	Construction/Weight Handling Equipment Shop

Notes:
Parkerizing = Is the process by which guns are coated for protection.

Source:
Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

TABLE 2-2

BUILDING HP902
KNOWN DISPOSAL PRACTICES
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Description
1971 - 1972	Waste oil (including solvents) was reportedly sprayed on unimproved roads on the Base with an 800-Gallon Distributor Truck.
1983	Wastewater from vehicle washing discharged onto ground
1989	Waste oil was deposited into an AST, estimated 3100 gallons (mixed with water) generated annually
1989	Paint thinner, disposed of through Defense Reutilization and Marketing Office, estimated 2.5 – 5 gallons annually
1989	Mineral spirits, disposed of through Defense Reutilization and Marketing Office, estimated 2.5 – 5 gallons annually
1989	Solvents, disposed of through Safety Kleen and Defense Reutilization and Marketing Office

Source:
Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

TABLE 2-3

BUILDING HP908
HISTORY OF USE
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Usage
1948	Building Constructed
1948	Electronic Equipment Storage Building
1949	MCSD Electronics Supply Division Storage
1952 – 1963	Central Paint Shop
1963-1965	Tank – Automotive Maintenance Shop / Central Paint Shop
1970	Combat Vehicle Maintenance Facility
2001	Automotive/Vehicle Shop

Source:
Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

TABLE 2-4

BUILDING HP908
KNOWN DISPOSAL PRACTICES
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Description
1976	A Miscellaneous Point Source Survey stated that all wastes were collected from the paint shops, (paint, contaminated wastewater and solvents), and disposed of in the Base Chemical Landfill.
1982	Beginning in 1964 some paint was burned at the Hadnot Point Burn Dump (WAR, April 1993).
1989	Generated 78 gallons of waste dope and lacquer thinner annually – Disposed of through the DRMO.
1989	Generated 40 gallons of Mineral Sprits contaminated with waste paint annually – Disposed of through the DRMO.

Source:
Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

TABLE 2-5

BUILDING HP1120
HISTORY OF USE
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Usage
1956-1976	Automobile Hobby Shop
1976	Hobby Shop Paint Shop
1976 – 1996	Automobile Hobby Shop

Source:
Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

TABLE 2-6

BUILDING HP1120
KNOWN DISPOSAL PRACTICES
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Description
1971 - 1972	Waste oil (including solvents) was reportedly sprayed on unimproved roads on the base with an 800-Gallon Distributor Truck.
1972	Waste oil was deposited into a 1000 gallon AST that was pumped out by Base Maintenance.

Source:
Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

TABLE 2-7

BUILDING HP1124
HISTORY OF USE
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Usage
1970	Building Constructed
1970-1997	Automobile Repair Shop (Open Shed Building)
2001	Exchange Service Station

Source:
Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

TABLE 2-8

BUILDING HP1124
KNOWN DISPOSAL PRACTICES
PRELIMINARY ASSESMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Description
1996	Waste oil and antifreeze disposed of in a 500 gallon AST

Source:
Baker. November 2001. Revised Final Phase I, SWMU Confirmatory Sampling Report, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy, Naval Facilities Engineering Command Atlantic Division, Norfolk Virginia.

TABLE 2-9

BUILDING HP1409
HISTORY OF USE
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Usage
1944	Storage Building
1945 - 1949	Upholstery and Carpentry Shop
1959	Decontamination Building / Storage
1965-1970	Public Works Maintenance Storage
1971	Applied Instruction Building
1972	Training Support Center
1976	Administrative
1982	Administrative / Furniture Repair Shop
1997 – 2001	Boat Shop

Source:
Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

TABLE 2-10

BUILDING HP1409
KNOWN DISPOSAL PRACTICES
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Year	Description
1945	Trash was collected Base wide (general refuse) daily and hauled to the incinerators or open burning dumps.
1982	Paint stripper from the Furniture Repair Shop was disposed of in the Fly Ash Dump

Source:

Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

Water and Air Research (WAR). April, 1983. Initial Assessment Study of Marine Corps Base Camp Lejeune, North Carolina. Marine Corps Base, North Carolina. Prepared for the Naval Energy and Environmental Support Activity.

TABLE 2-11

FORMER BUILDING HP1512
HISTORY OF USE
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Usage
Unknown	Most likely an automotive support structure

Source:
Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

TABLE 2-12

BUILDING TC830
HISTORY OF USE
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Usage
1943	Building Constructed
1943-1949	Storehouse
1965-1974	Academic Instruction Building
1975	Open Storage
1980 – 2000	Laundry / Exchange Dry Cleaning Plant
2001	Storage

Source:
Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

TABLE 2-13

BUILDING TC830
KNOWN DISPOSAL PRACTICES
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Description
1945	Trash was collected Base wide (general refuse) daily and hauled to the incinerators or open burning dumps.

Source:
Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

TABLE 2-14

BUILDING SAS113
HISTORY OF USE
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Usage
1986	Building Constructed
1986 – 2001	Automobile Hobby Shop

Source:
Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

TABLE 2-15

BUILDING AS116
HISTORY OF USE
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Usage
1954	Constructed
1954 – 1979	Combat Vehicle Maintenance Shop
1979-1981	Hazardous/Flammable Storehouse
1983-1987	Automobile Hobby Shop
1993-	Automobile Hobby Shop / Paint Shop
2001	Auto Hobby / Paint Shop

Source:
Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

TABLE 2-16

BUILDING AS119
HISTORY OF USE
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Usage
1963	Building Constructed
1963 – 1985	Automotive Vehicle Maintenance Facility
2000	Automotive Maintenance Facility

Source:
Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

TABLE 2-17

BUILDING M119
HISTORY OF USE
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Usage
1943	Building Constructed
1943	Gun Shed
1945	Garage
1951-1976	School / Applied Instruction Building
1988	Vehicle Maintenance Shop
1991	Driving School
2001	Automotive Vehicle Maintenance Shop

Source:
Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

TABLE 2-18

BUILDING M119
KNOWN DISPOSAL PRACTICES
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Description
1945	Trash was collected base wide (general refuse) daily and hauled to the incinerators or open burning dumps.
1971 - 1972	Waste oil (including solvents) was sprayed on unimproved roads on the base with an 800-Gallon Distributor Truck.
1976	A gasoline spill occurred during a fuel transfer of an UST at Building M119. Approximately 200 gallons of gasoline overflowed into a nearby ditch where it was then cleaned up by Base Maintenance.
1989	Solvent disposed of via Safety Kleen Company
1989	Waste oil from Buildings M119 and M120 was deposited in an underground storage tank, estimated 2045 gallons annually.

Source:
Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

TABLE 2-19

BUILDING SM173
HISTORY OF USE
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Date	Usage
1962	Building Constructed
1962	Used to House a Steam Generator

Source:
Dolph, Jim. October 2001. Draft Twenty Potential Sites Environmental Literature Search, Marine Corps Base, Camp Lejeune, North Carolina. Prepared for the Department of the Navy Atlantic Division Naval Facilities Engineering Command, Norfolk Virginia.

FIGURES

K:\28007\190PHASE\DRAFTPA\CADFIGURES\219701P.DWG

SITE 21 BOUNDARY

SOUTHERN TREATMENT PLANT

NORTHERN TREATMENT PLANT

APPROXIMATE SITE BOUNDARY

SITE 78

SITE 24

NOTE:
- WELLS SHOWN IN BLACK REGULAR FONT ARE NOT INCLUDED IN THE MONITORING PROGRAM.
- RECOVERY WELLS SHOWN IN BLACK REGULAR FONT ARE OFF-LINE.

LEGEND

- PA SITE
- RW-1 RECOVERY WELL
- 78-GW24-1 SHALLOW MONITORING WELL
- 78-GW24-2 INTERMEDIATE MONITORING WELL
- 78-GW24-3 DEEP MONITORING WELL
- APPROXIMATE DIRECTION OF SURFACE WATER FLOW
- APPROXIMATE SITE BOUNDARY

SOURCE: MCB, CAMP LEJEUNE, MARCH 2000

500 0 250 500
1 inch = 500 ft.

Baker Environmental, Inc.

FIGURE 2-1
LOCATION MAP
HPIA PA SITES
OPERABLE UNIT NO. 1 - SITE 78
PRELIMINARY ASSESSMENT SITES, CTO - 0190
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

K:\26007\190PHASE\DRAFTPA\CADFIGURES\219702P.DWG

HOLCOMB BOULEVARD

WEST ROAD

CENTER GIBB EAST HAMPTON MICHAEL STREET

GUM STREET

FIR STREET

ELM STREET

DOGWOOD STREET

CEDAR ROAD

BIRCH ROAD

SUGAR CREEK

APPROXIMATE SITE BOUNDARY

SITE 78

LOUIS ROAD

FRANKLIN STREET

ASH STREET

HICKORY STREET

DUNCAN STREET

SITE 24

500 0 250 500

1 inch = 500 ft.

Baker

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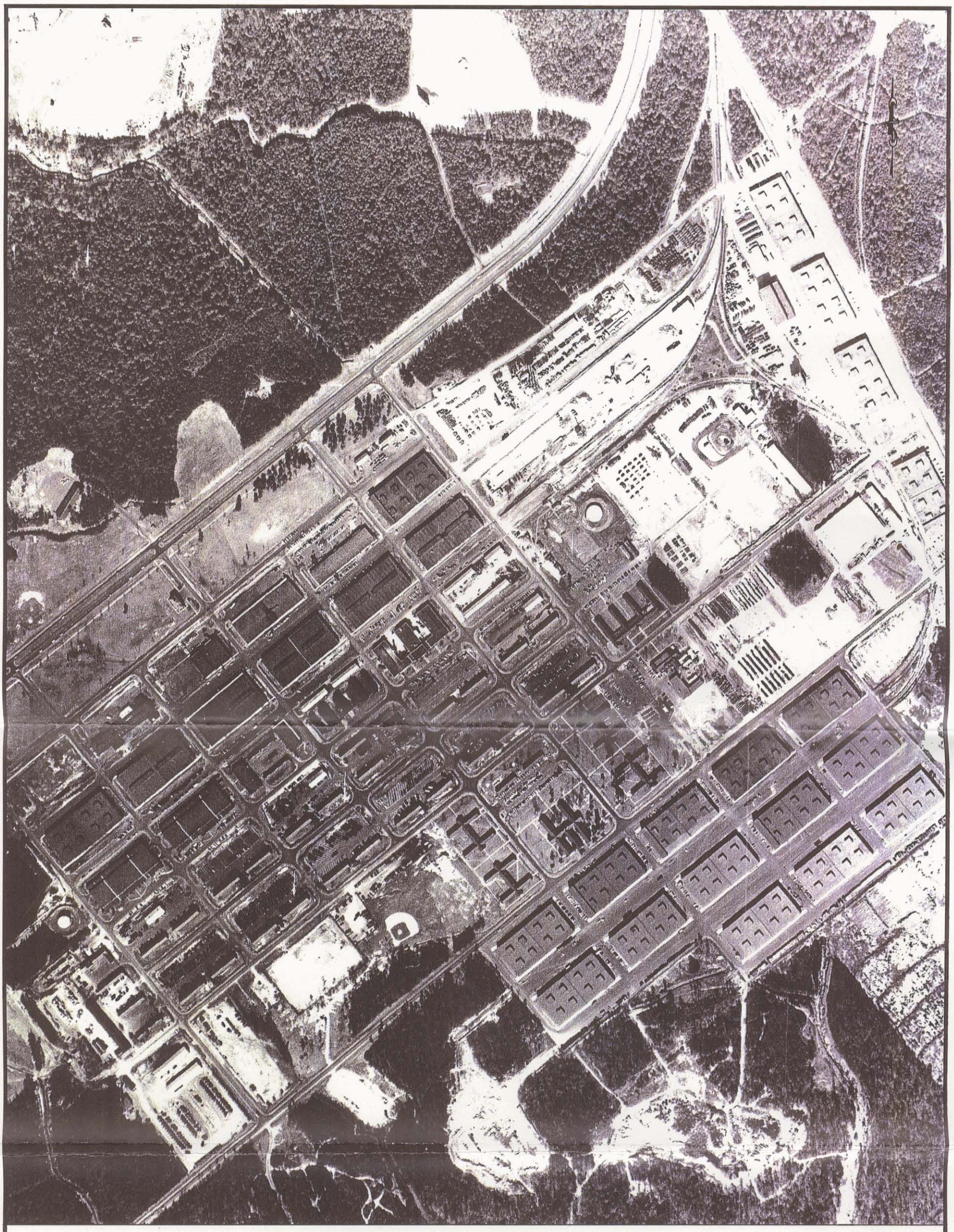
LEGEND

- MAINTENANCE, MOTOR POOL, AND/OR HOBBY SHOP
- UST / AST
- WASH RACK

SOURCE: MCB, CAMP LEJEUNE, MARCH 2000

FIGURE 2-2
LOCATION OF POSSIBLE SOURCE AREAS
HPIA PA SITES
OPERABLE UNIT NO. 1, SITE 78
PRELIMINARY ASSESSMENT SITES, CTO - 0190
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

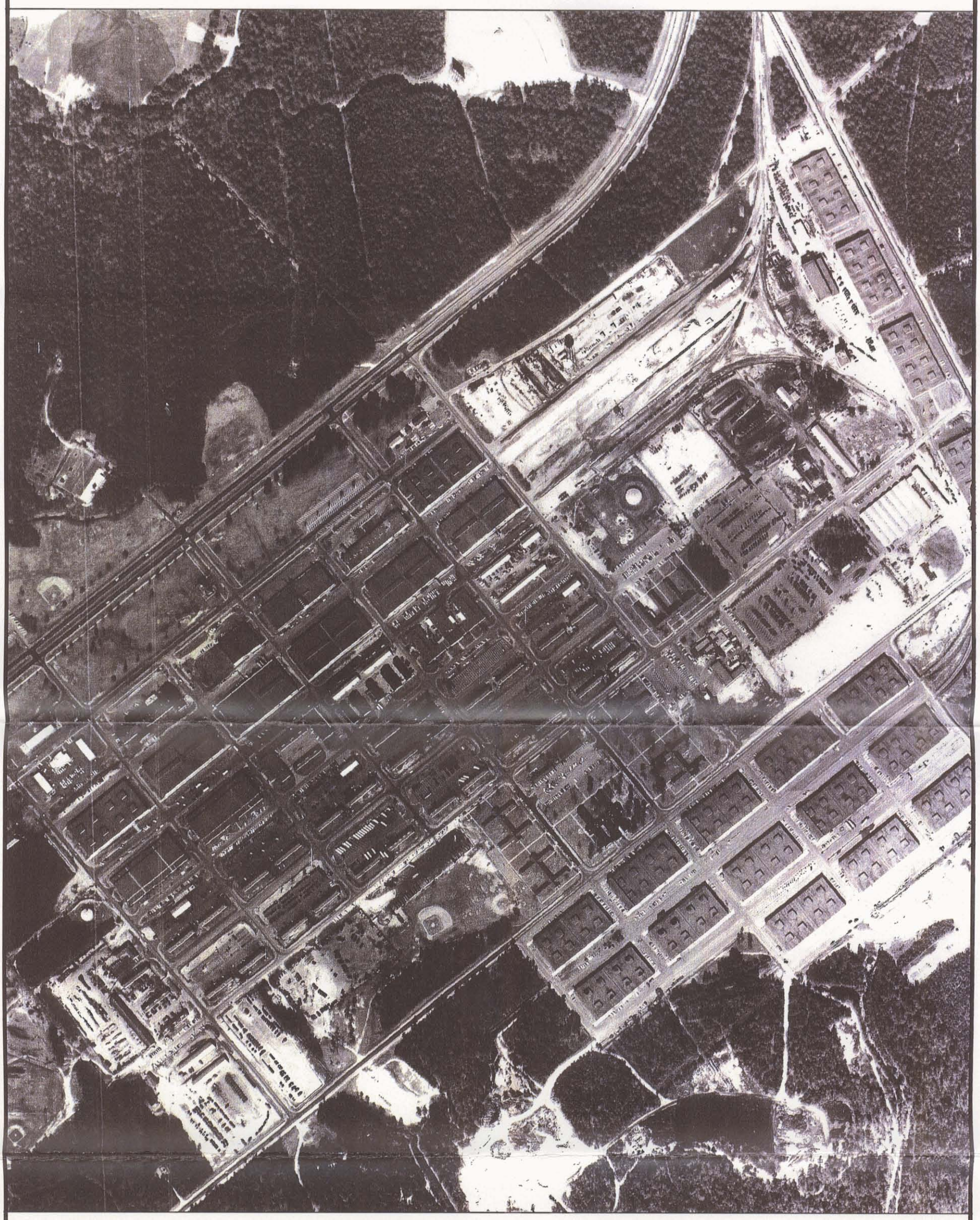


K/26007/190PHASE/DRAFTPA/CADFIGURES/SITE78AERIALS (AERIAL 1)

Baker

FIGURE 2-3
HISTORICAL AERIAL PHOTO 1956
HPIA PA SITES
OPERABLE UNIT NO. 1 - SITE 78
PRELIMINARY ASSESSMENT SITES, CTO - 0190
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SOURCE: USEPA, 1992

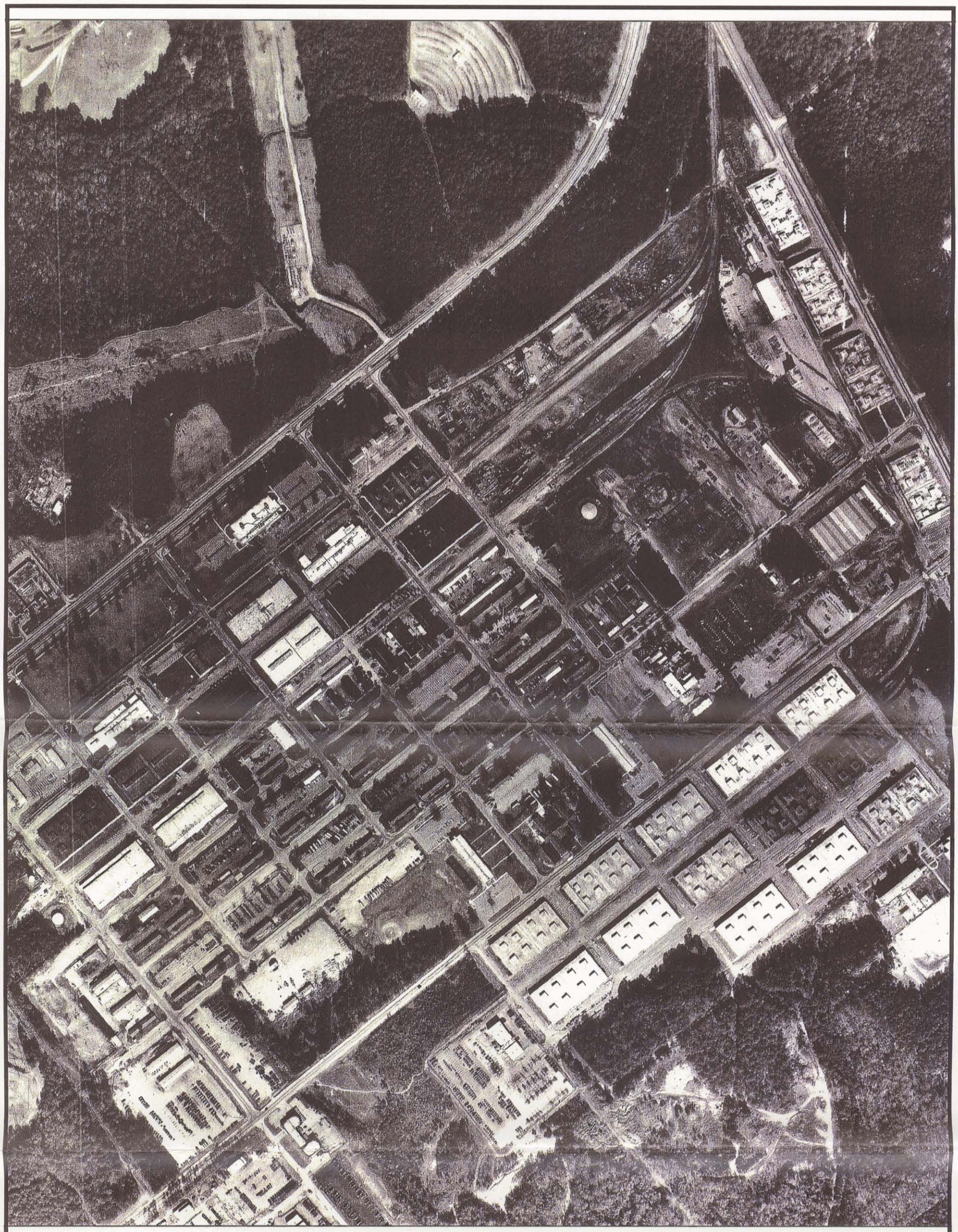


K/26007/190PHASE/DRAFTPA/CADFIGURES/SITE78AERIALS (AERIAL 2)

Baker

FIGURE 2-4
HISTORICAL AERIAL PHOTO 1964
HPIA PA SITES
OPERABLE UNIT NO. 1 - SITE 78
PRELIMINARY ASSESSMENT SITES, CTO - 0190
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SOURCE: USEPA, 1992

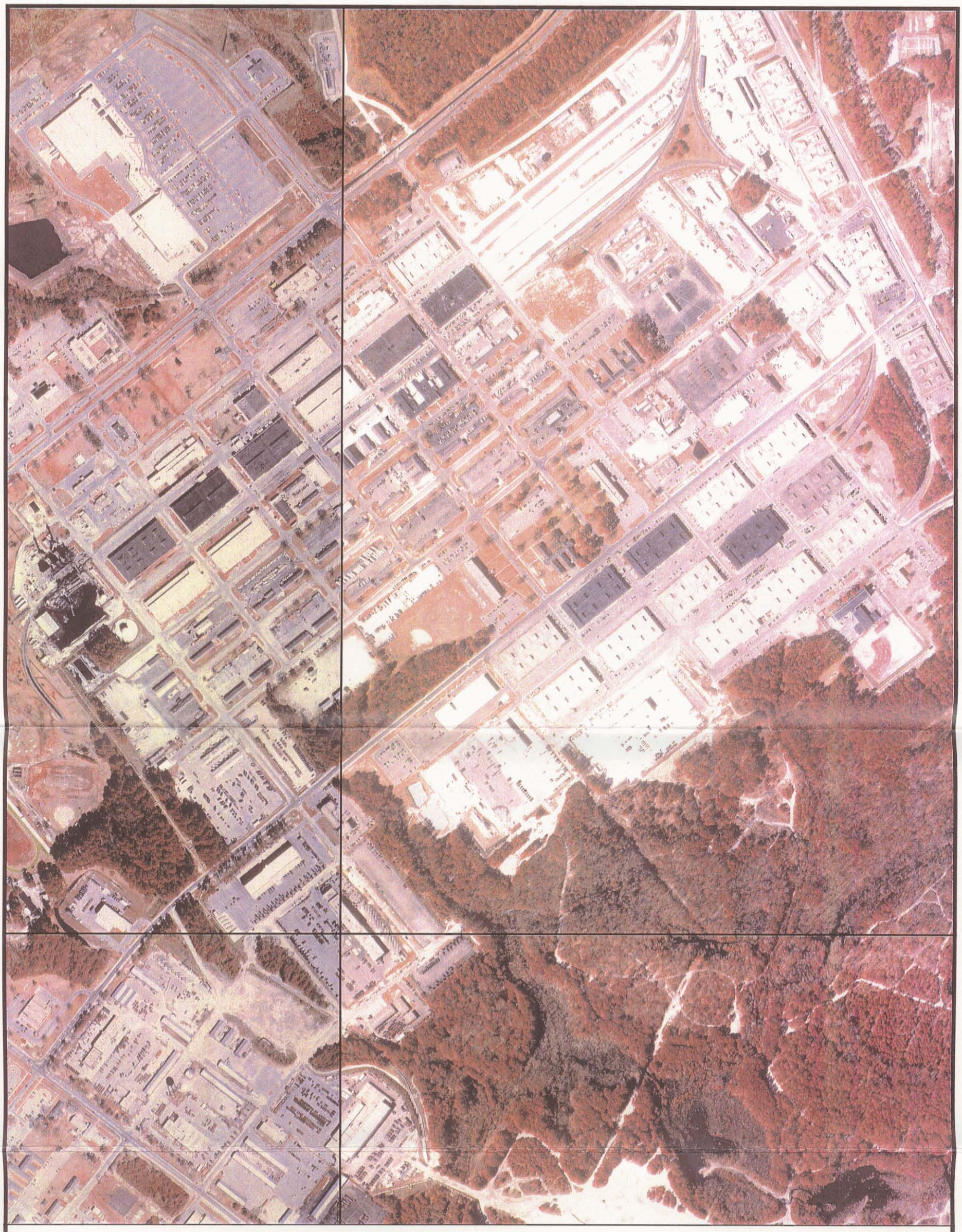


K/26007/190PHASE/DRAFTPA/CADFIGURES/SITE78AERIALS (AERIAL 3)

Baker

FIGURE 2-5
HISTORICAL AERIAL PHOTO 1984
HPIA PA SITES
OPERABLE UNIT NO. 1 - SITE 78
PRELIMINARY ASSESSMENT SITES, CTO - 0190
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SOURCE: USEPA, 1992

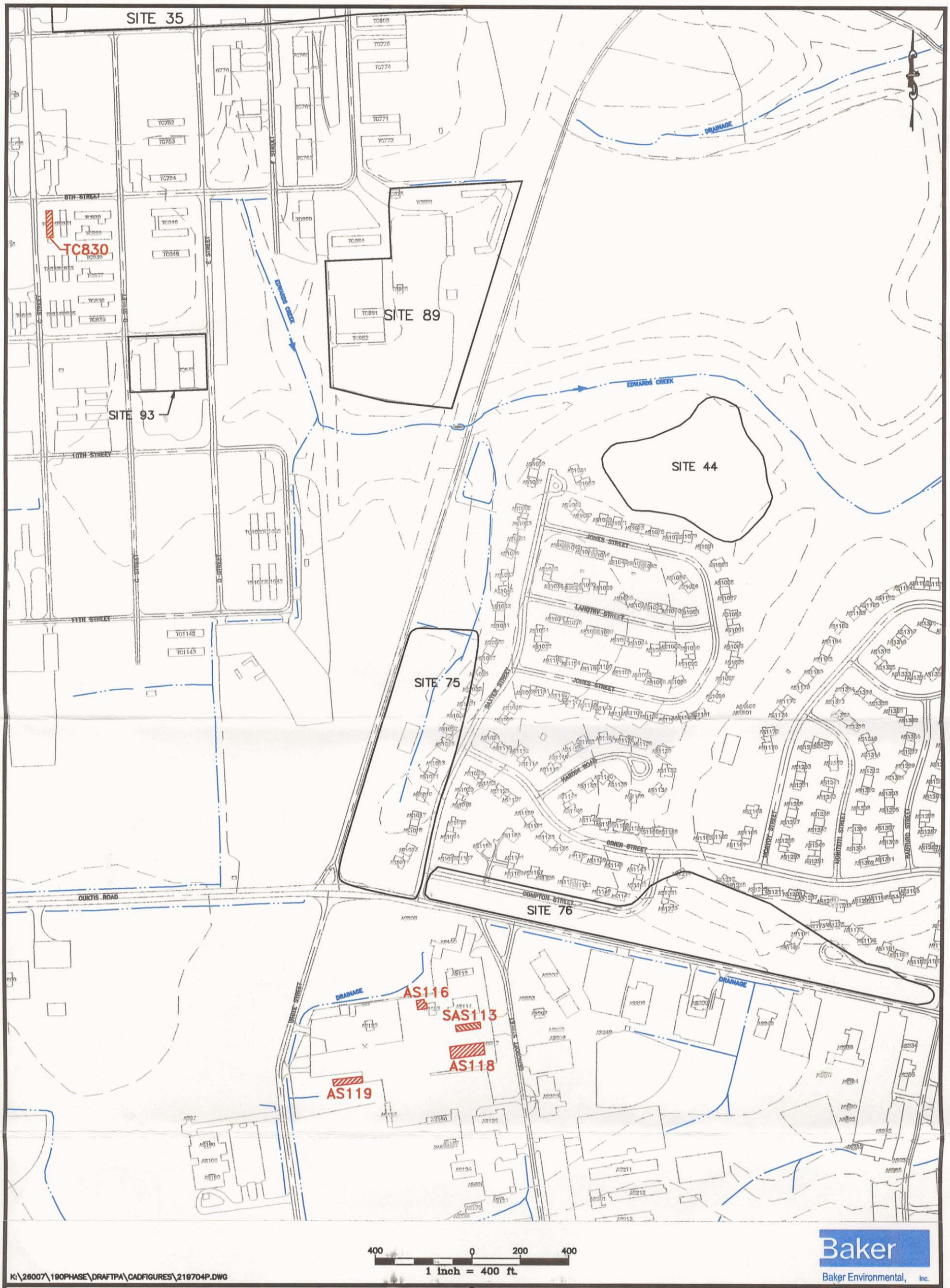


K/26007/190PHASE/DRAFTPA/CADFIGURES/SITE78AERIALS (AERIAL 4)

Baker

FIGURE 2-6
HISTORICAL AERIAL PHOTO 1996
HPIA PA SITES
OPERABLE UNIT NO. 1 - SITE 78
PRELIMINARY ASSESSMENT SITES, CTO - 0190
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SOURCE: USEPA, 1996



LEGEND

- PA SITE
- APPROXIMATE SITE BOUNDARY
- GROUND ELEVATION CONTOUR
- DIRECTION OF SURFACE WATER FLOW

SOURCE: MCB, CAMP LEJEUNE, MARCH 2000

FIGURE 2-7
LOCATION MAP
AIR STATION PA SITES
PRELIMINARY ASSESSMENT SITES, CTO - 0190

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

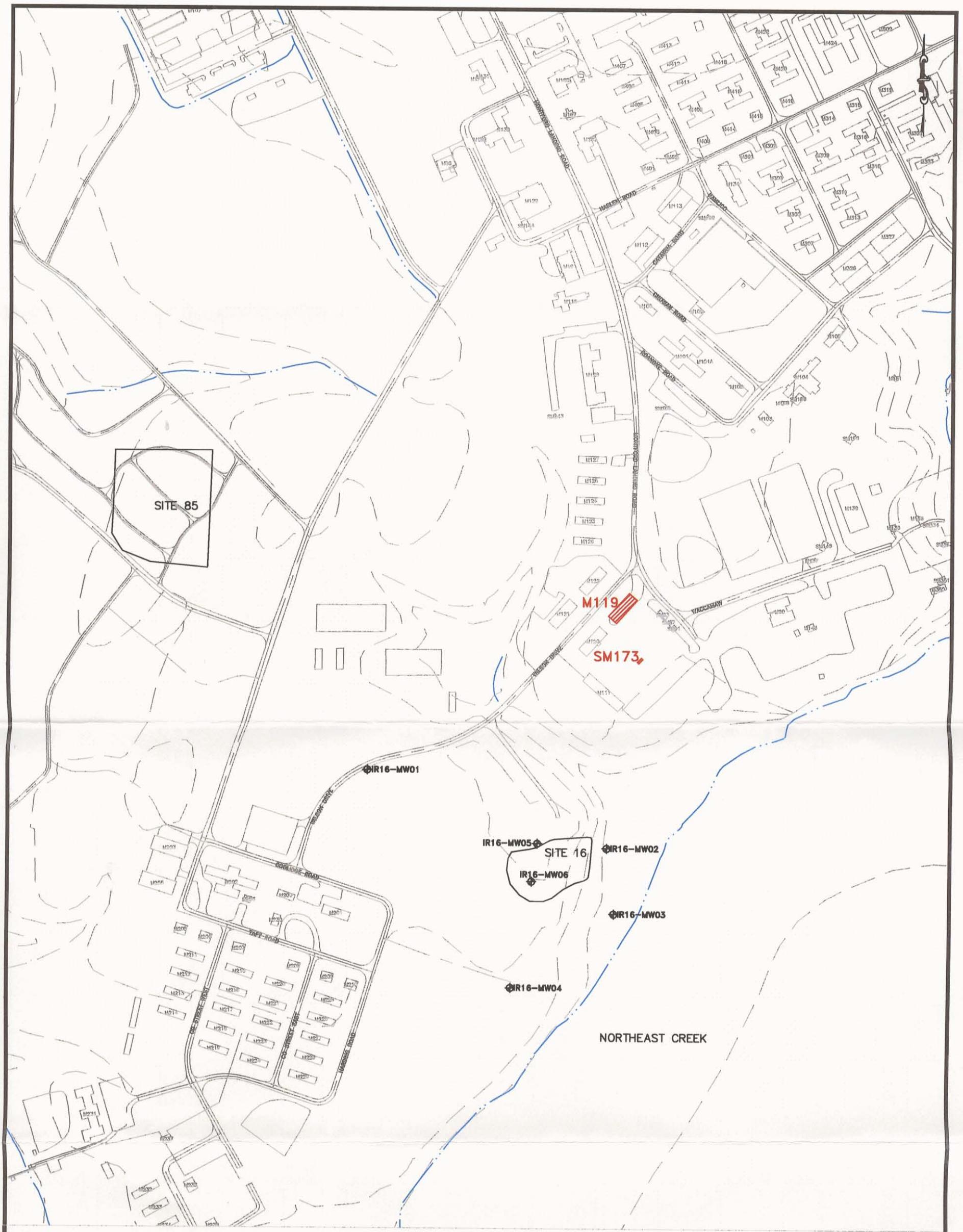
LEGEND

- PA SITE
- APPROXIMATE SITE BOUNDARY
- GROUND ELEVATION CONTOUR
- DIRECTION OF SURFACE WATER FLOW

SOURCE: MCB, CAMP LEJEUNE, MARCH 2000
AERIAL PHOTOGRAPH WAS TAKEN 1996

FIGURE 2-8
AERIAL PHOTOGRAPH
AIR STATION PA SITES
PRELIMINARY ASSESSMENT SITES, CTO - 0190

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



Baker

Baker Environmental, Inc.

LEGEND

- PA SITE
- APPROXIMATE SITE BOUNDARY
- IR16-MW01 – MONITORING WELL LOCATION

SOURCE: MCB, CAMP LEJEUNE, MARCH 2000

FIGURE 2-9
LOCATION MAP
MONTFORD POINT PA SITES
PERLIMINARY ASSESSMENT SITES, CTO – 0190

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

K:\26007\190PHASE\DRAFTPA\CADFIGURES\219708P.DWG

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LEGEND

▨ – PA SITE

——— – APPROXIMATE SITE BOUNDARY

SOURCE: MCB, CAMP LEJEUNE, MARCH 2000
AERIAL PHOTOGRAPH TAKEN IN 1996

FIGURE 2–10
AERIAL PHOTOGRAPH
MONTFORD POINT PA SITES
PRELIMINARY ASSESSMENT SITES, CTO – 0190

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

3.0 PATHWAY AND ENVIRONMENTAL HAZARD ASSESSMENT

This section provides the potential impact of each site, if any, on the surrounding human population and nearby environment. Four pathways were assessed; groundwater, surface water, soil, and air. The qualitative evaluation of the pathways addresses:

- The groundwater pathway evaluates the migration of hazardous substances to, and within, an aquifer and evaluates the potential impacts to drinking water supplies. The CERCLA recommended target distance limit for the groundwater pathway is a 4 - mile radius around the site, however, for this PA/SI Report a 2- mile radius was evaluated.

- The surface water pathway focuses on the migration of hazardous substances to surface water bodies. It assesses the potential impacts to drinking water supplies, the human food chain, and sensitive environments. The CERCLA recommended target distance limit for the surface water pathway is 15 miles downstream from the probable point of entry to surface water, however, for this PA/SI Report a 5-mile downstream probable point of entry was evaluated.

- The soil exposure pathway evaluates the potential threat to people on or near the site who may come into contact with exposed wastes or areas of suspected contamination. This includes both soil ingestion and dermal exposure. The target distance limit for the soil exposure varies between resident population impact and nearby population impact. The target distance limit for the resident population impact is 200 feet, where the target distance limit for the nearby population impact is one mile.

- The air pathway assesses the migration of hazardous substances, in gaseous or particulate form, through air. The primary impacts are to people and sensitive environments. The CERCLA recommended target distance limit for the air pathway is the same 4 - mile radius around the site as the groundwater pathway, however for this PA/SI Report a 1 - mile radius was evaluated.

Ultimately, the CERCLA PA process is designed to differentiate the sites that pose little or no potential impact to human health and the environmental receptors from sites that warrant further investigation.

The following subsections describe the present regional and local climate, topography, soil associations, surface hydrology and drainage, water supplies, geology, hydrogeology, natural resources and ecological features for MCB Camp Lejeune. These environmental characteristics will provide pertinent background information for qualitatively evaluating the sites. Discussions for each pathway are general unless site-specific information is available. The tables and figures for Section 3.0 are presented at the end of the section.

3.1 Regional Environmental Setting

This section presents a discussion of the physical characteristics of MCB Camp Lejeune. The discussion details the topography and surface features, hydrology, geology, hydrogeology, land usage, climatology, water supply, ecology, wetlands, and threatened and endangered species. This information was obtained from the available literature about MCB Camp Lejeune.

3.1.1 Climatology

Although coastal North Carolina lacks distinct wet and dry seasons, there is some seasonal variation in average precipitation. July receives the most precipitation and rainfall amounts during summer are generally the greatest. Daily showers during the summer are common, and so are periods of one or two weeks without rain. Convective showers and thunderstorms also contribute to the variability of precipitation during the summer months. October receives the least amount of precipitation, on average. Throughout the winter and spring months precipitation occurs primarily as migratory low pressure storms. MCB Camp Lejeune's average yearly rainfall is approximately 52 inches. Table 3-1 presents a climatic summary of data collected during 35 years (January 1955 to December 1990) of observations at MCAS New River.

MCB Camp Lejeune experiences hot and humid summers, however, ocean breezes frequently produce cooling effects. The winter months are mild, with occasional brief cold spells. Average daily temperatures range from 38°F to 58°F in January and 72°F to 86°F in July. The average relative humidity, between 75 and 85 percent, does not vary greatly from season to season.

3.1.2 Topography and Surface Features

The generally flat topography of MCB Camp Lejeune is typical of the North Carolina Coastal Plain. Elevations on the Base vary from sea level to 72 feet above mean sea level (msl); however, the elevation of most of MCB Camp Lejeune is between 20 and 40 feet msl.

Drainage at Camp Lejeune is generally toward the New River, except in areas near the coast that drain through the Intracoastal Waterway. In developed areas, natural drainage has been altered by asphalt cover, storm sewers, and drainage ditches. Approximately 70 percent of Camp Lejeune is in broad, flat interstream areas. Drainage is poor in these areas and the soils are often wet (WAR, 1983). The U.S. Army, Corps of Engineers has mapped the limits of 100-year floodplain at Camp Lejeune at 7.0 feet above msl in the upper reaches of the New River increasing downstream to 11 feet above msl near the coastal area (WAR, 1983).

3.1.3 Surface Soil Associations

The soil survey report for MCB Camp Lejeune was prepared by the Soil Conservation Service (SCS) in 1984. Since that time, an updated report for Onslow County was issued by the SCS in 1992. Information provided in this section was obtained from these two reports.

Figure 3-1 shows the general soil associations in Onslow County, which includes MCB Camp Lejeune. A soil association is a landscape that exhibits a distinctive pattern based on soils, drainage and relief. These associations consist of one or more major soil types and at least one minor soil type. The association is then named for the major soil(s). A soil type from one association can exist in other associations, but commonly in a different pattern or percentage.

The two terms, loam and muck, are specifically used to describe soils. A loam is a soil that contains less than 52 percent sand, 28 to 50 percent silt, and 7 to 27 percent clay. A muck is a dark, finely layered, well decomposed soil that contains organic plant material.

Six soil associations occur at MCB Camp Lejeune. The Baymeade-Foreston-Stallings soil association is the most widely distributed soil group at the Base. The other soil associations that are present are the Leon-Murville-Kureb, Muckalee-Dorovan, Wando-Pactolus, Norfolk-Goldsboro-Onslow and Bohicket-Newman. Two other soil associations occur in Onslow County but, not present at MCB Camp Lejeune (Croatan and Rains-Woodington-Torhunta Associations);

however, individual soil types from these last two associations are found at MCB Camp Lejeune. Detailed information on the specific associations are provided in Appendix B of the Background Study Report for Camp Lejeune (Baker, April 2001).

3.1.4 Subsurface Geology

MCB Camp Lejeune is within the Tidewater region of the Atlantic Coastal Plain physiographic province. The sediments of the Atlantic Coastal Plain consist mostly of interbedded sands, silts, clays, calcareous clays, shell beds, sandstone and limestone. These sediments are layered in interfingering beds and lenses that gently dip and thicken to the southeast to a combined thickness of approximately 1,500 feet. They were deposited in marine or near-shore environments and range in age from early Cretaceous to Quaternary time. Regionally, the sediments comprise 10 aquifers and nine confining units that overlie igneous and metamorphic basement rocks of the pre-Cretaceous age.

Seven of these aquifers and their associated confining units are present in the MCB Camp Lejeune area (Cardinell, et al., 1993). Table 3-2 presents a generalized stratigraphic column for Jones and Onslow Counties, North Carolina. Hydrogeologic section location plan and hydrogeologic cross-sections of the MCB Camp Lejeune area are presented in the Hydrogeologic Framework of U.S. Marine Corps Base at Camp Lejeune, North Carolina (Cardinell, et al, 1993). The following paragraphs provide a description of the lithology of the surficial, Castle Hayne, Beaufort, and Peedee aquifers as presented in Cardinell et al. 1993.

The surficial aquifer consists of interfingering beds of sand, clay, sandy clay, and silt of Quarternary and Miocene age that contain some peat and shells. The sand beds that make up the surficial aquifer are part of the Belgrade Formation (Table 3-2). The clay, sandy clay, and silt beds observed within the surficial aquifer are thin and discontinuous, and have limited lateral continuity. The general lithology of the surficial aquifer and the absence of any thick, continuous clay beds are indications of good vertical conductivity within the aquifer.

The confining unit for the Castle Hayne aquifer is composed of clay, silt, and sandy clay beds. These beds form a unit across the Base that may be represented by one or more geological units such as the Quaternary or Miocene deposits at the bottom of the surficial aquifer, the uppermost beds of the River Bend Formation or the uppermost beds of the Castle Hayne Formation. In general, the Castle Hayne confining unit at MCB Camp Lejeune may be described as a group of

less permeable beds at the top of the Castle Hayne aquifer that have been partly eroded. This confining unit may only be partly effective in retarding the vertical movement of groundwater between the surficial and Castle Hayne aquifers.

The Castle Hayne aquifer consists of soils from the Castle Hayne Formation of Eocene age and some lower beds of the River Bend Formation of Oligocene age. This aquifer primarily consists of sand, shell rock, and limestone beds. The upper part of the aquifer consists primarily of calcareous sand with some continuous and discontinuous thin clay and silt beds (generally 10 to 15 feet thick). The calcareous sand becomes more limey with depth. The lower part of the aquifer primarily consists of consolidated or poorly consolidated limestone and sandy limestone interbedded with clay and sand.

The Beaufort confining unit overlies the Beaufort aquifer and consists of clay, silt, and sandy clay or the uppermost sediments of the Beaufort Formation and the lowermost clay and silt beds of the overlying Castle Hayne Formation. The general silty character of this confining unit is very similar to the Castle Hayne confining unit. Although the deeper unit is slightly thicker and is not known to be discontinuous, it also is likely to be only partly effective in retarding the vertical exchange of groundwater between the Beaufort and Castle Hayne aquifers.

The Beaufort aquifer underlies the Beaufort confining unit and the Castle Hayne aquifer and is composed of Paleocene aged soils. These deposits consist of fine to medium glauconitic sand, clayey sand, and clay beds of marine origin, with a few thin (3 to 6 feet) shell and limestone beds. As with other hydrogeologic units, the Beaufort aquifer is not necessarily restricted to a single formation and may include permeable beds of older Cretaceous formations that are in hydraulic connection with the aquifer.

The confining unit for the Peedee aquifer is composed of clay, silt, and sandy clay beds that form the uppermost units of the Peedee Formation. In some places, the confining unit may also include the lowermost beds of the Beaufort Formation.

The Peedee aquifer underlies the Peedee confining unit and the Beaufort aquifer. It is composed primarily of sand of the Peedee Formation (Cretaceous age). A few thin beds of calcareous sandstone, limestone, clay and silt are interlayered with the sand within the Peedee Formation.

The Black Creek confining unit, which underlies the Pedee aquifer, is composed of clay, silty clay and sandy-clay beds. The confining unit's beds belong to the lowermost Pedee Formation and uppermost Black Creek Formation.

The Black Creek aquifer, primarily composed of units from the Black Creek Formation, is formed from thinly-laminated clays interlayered with sands, clean sands and clays and layers including lignitized wood. This aquifer occurs throughout the MCB Camp Lejeune area, but contains saltwater.

The Black Creek aquifer is underlain by the Upper Cape Fear confining unit and the Upper Cape Fear aquifer. The Upper Cape Fear confining unit is composed of clay and silt beds with local thin sand lenses from layers belonging to the lower Black Creek Formation and the Upper Cape Fear Formation.

The Upper Cape Fear aquifer is present throughout the MCB Camp Lejeune area and also contains saltwater. The Upper Cape Fear aquifer is composed of 3 to 5 foot layers of sand and clay. The sands in the aquifer range from fine to course with some gravel.

Below the Upper Cape Fear lies the Lower Cape Fear confining unit and the Lower Cape Fear aquifer. The Lower Cape Fear confining unit is beds of silt and clay from the Cape Fear Formation. However, the Upper and Lower Cape Fear aquifers are defined by a difference in head pressure and chloride content. The Lower Cape Fear confining unit may not completely separate these two aquifers.

The lower Cape Fear aquifer contains saltwater and underlies the entire MCB Camp Lejeune area. The sediments that form the lower Cape Fear aquifer are similar to those in the upper Cape Fear but include thin limestone beds.

3.1.5 Hydrogeology

The following paragraphs discuss the hydrogeologic conditions at MCB Camp Lejeune. The information presented within this section is from literature published by the United States Geological Survey (USGS) (Harned, et al., 1989 and Cardinell, et al., 1993). Additionally, information was collected from a technical memorandum prepared by Baker summarizing groundwater data and aquifer characteristics for MCB Camp Lejeune (provided as Appendix J). Table 3-3 provides a summary of estimated hydraulic properties for the Castle Hayne aquifer.

USGS studies at MCB Camp Lejeune indicate that the area is underlain by sand and limestone aquifers separated by confining units of silt and clay. These aquifers include the surficial (water table), Castle Hayne, Beaufort, Peedee, Black Creek, and upper and lower Cape Fear. Less permeable clay and silt beds function as confining units or semi-confining units that separate the aquifers and impede the flow of groundwater between aquifers.

The surficial unit consists of interfingering beds of sand, clay, sandy clay and silt that contain some peat and shells of Quaternary and Miocene age. These sediments commonly extend to depths of 50 to 100 feet below ground surface (bgs). Thickness of the surficial aquifer in the MCB Camp Lejeune area ranges from zero to 73 feet, and typically average 25 feet (Cardinell, et al., 1993). The aquifer is generally thickest in the interstream divide areas and may be absent where it is cut by the New River and its tributaries. The clay, sandy clay, and silt beds that occur in the surficial aquifer are thin and discontinuous throughout. A semi-confining unit is found in the surficial aquifer within some portions of MCB Camp Lejeune.

Recharge to the surficial aquifer is by rainfall. The aquifer receives more recharge in the winter than in the summer when much of the water evaporates or is transpired by plants before it can reach the water table. Most of the surficial groundwater is discharged to local streams, but some water passes through the underlying semiconfining unit. Recharge for the surficial aquifer is based on an average rainfall of 52 inches per year and an average recharge of 30 percent, or an annual recharge of approximately 16 inches per year. The remaining 70 percent of the rainfall is lost as surface runoff or evapotranspiration. Sixteen inches of recharge equates to 7,600,000 gallons per day (gpd) per square mile or approximately 114,000,000 gpd for all of MCB Camp Lejeune (based on 150 square miles of recharge area). Water levels in the wells tapping the surficial aquifer vary seasonally. The water table is generally highest in the winter and spring, and lowest in the summer and early fall. The lateral hydraulic conductivity for the surficial aquifer was estimated by the USGS at 50 feet per day (ft/day) based on a general soil composition of fine sand mixed with some silt and clay (Cardinal, et al., 1993).

A study of data from aquifer tests (pump tests) done at MCB Camp Lejeune was conducted by Baker in 1994 to evaluate aquifer characteristics and production capacities (Appendix J). The information contained in this memorandum pertains primarily to the surficial aquifer. Based on information available at the time the memorandum was written, the average pumping rates for the surficial aquifer are from 0.5 to three gallons per minute (gpm); transmissivity ranges from 7.1 to 7,100 square feet per day (ft^2/day); storativity ranged from 1.5×10^3 to 7.5×10^2; and hydraulic

conductivity ranges from approximately 0.5 to 1.4 ft/day. These data indicate that the estimated lateral hydraulic conductivity reported by USGS may be higher than actual conditions in the vicinity of MCB Camp Lejeune.

Although the aquifer is classified as GA (i.e., existing or a potential source of drinking water supply for humans), it is not used as a potable water source at MCB Camp Lejeune. The primary reason for it's non-use is because of its low yielding production rates which are typically less than three gpm.

The principal water supply aquifer for MCB Camp Lejeune is the Castle Hayne aquifer. This aquifer primarily resides within the River Bend Formation, which consists of sand, cemented shells and limestone. Buried paleostream channels containing various deposits exist within the aquifer. The top of the aquifer ranges from 10 feet above msl to 70 feet below msl and is irregular over most of the northern portion of MCB Camp Lejeune. The aquifer is more regular in areas southeast of the New River, where it slopes southeastward. The Castle Hayne thickens to the east, from 160 feet in the Camp Geiger area to more than 400 feet at the eastern boundary of MCB Camp Lejeune.

The vertical hydraulic conductivity of the Castle Hayne confining unit was estimated to range from 0.0014 to 0.41 ft/d. These values are comparable to those determined for silts and clays; therefore, this unit may only be partly effective at retarding the vertical movement of groundwater between the surficial and Castle Hayne aquifers (Cardinell, et al., 1993).

Estimated transmissivity, hydraulic conductivity and storage coefficient values (unitless) for the Castle Hayne aquifer range from 6,100 to 183,300 gpd/ft, 14 to 91 ft/d and 2×10^{-4} to 1.9×10^{-3}, respectively. An aquifer pump test conducted by ESE (1990) in the HPIA, using an existing water supply well (HP642), indicates an average transmissivity and storage coefficient of 9,600 gpd/ft and 8.8×10^{-4}, respectively (ESE, 1990). Table 3-3 summarizes the previously stated information.

Recharge of the Castle Hayne aquifer at MCB Camp Lejeune is primarily received from the surficial aquifer. Natural discharge is to the New River and its major tributaries. The Castle Hayne aquifer provides roughly seven million gallons of water to MCB Camp Lejeune. Groundwater pumping has not significantly affected natural head gradients in the aquifer.

MCB Camp Lejeune lies in an area where the upper part of the Castle Hayne aquifer contains freshwater. Saltwater is found in the bottom of the aquifer in the region and in the New River estuary; both are of concern in managing water withdrawals from the aquifer. Over pumping the deeper parts of the aquifer or in areas hydraulically connected to estuarine streams could cause saltwater intrusions. The aquifer underlying most of the area contains water having less than 120 milligrams per liter (mg/L) of chloride.

3.1.6 Water Supply

Potable water for MCB Camp Lejeune is supplied entirely by groundwater. Groundwater usage is roughly eight million gpd (Cardinell, et al., 1993). Groundwater is pumped from approximately 79 water supply wells located within the boundaries of MCB Camp Lejeune (Table 3-6). According to Base personnel, groundwater is treated at five plants located at Hadnot Point, Holcomb Boulevard, MCAS New River, Courthouse Bay, and Onslow Beach having a total capacity of 15.8 million gpd.

All of the water supply wells use the Castle Hayne aquifer. The Castle Hayne aquifer is a highly permeable, semi-confined aquifer that can yield several hundred to 1,000 gpm in municipal and industrial wells in the MCB Camp Lejeune area. The water supply wells at the Base average 162 feet in depth; eight inches in diameter (casing); and yield 174 gpm (Harned, et al., 1989). The water is typically a hard, calcium bicarbonate type. Information concerning the supply wells was gathered from the Wellhead Management Program Engineering Study 91-36 (Geophex, 1991), the Preliminary Draft Report Wellhead Monitoring Study 92-34 (Greenhorne and O'Mara, Inc., 1992), and interviews with Base personnel.

3.1.7 Surface Water Hydrology

The dominant surface water body at MCB Camp Lejeune is the New River which receives drainage from most of the Base. The river is short, with a course of approximately 50 miles on the central Coastal Plain of North Carolina. Over most of its course, the New River is confined to a narrow channel entrenched in Eocene and Oligocene limestones. South of Jacksonville, the river widens as it flows across less resistant sands, clays, and marls. At MCB Camp Lejeune, the New River flows in a southerly direction into the Atlantic Ocean through the New River Inlet. Several small coastal creeks that are not associated with the New River or its tributaries drain into the area of MCB Camp Lejeune. The New River, the Intracoastal Waterway, and the Atlantic Ocean converge at the New River Inlet (WAR, 1983).

Classifications for surface waters in North Carolina have been published under Title 15 of the North Carolina Administration Code. At MCB Camp Lejeune, the New River falls into three classifications. The portion of the river that passes from the Seaboard Coast Line railroad trestle (located south/southwest of where U.S. Route 17/North Carolina Route 24 crosses the New River) to Montford Point is classified as SC NSW HQW. This classification is defined as salt waters protected for secondary recreation, fishing, aquatic life including propagation and survival (SC) that are nutrient sensitive (NSW) and of high quality (HQW). The portion of the river that resides between Montford Point to a line extending across the river from Grey Point to a point of land approximately 2,200 yards downstream of the mouth of Duck Creek is classified as Class SC NSW. As previously described, these waters are similar to the waters upstream of Montford Point, however they are not considered high quality waters. The remaining portion of the New River is classified as estuarine water suited for commercial shell fishing and all other tidal saltwater uses (SA).

3.1.8 Ecological Characteristics

The Natural Resources and Environmental Affairs (NREA) Division of MCB Camp Lejeune, the U.S. Fish and Wildlife Service, and the North Carolina Wildlife Resource Commission have entered into an agreement for the protection of endangered and threatened species that might inhabit MCB Camp Lejeune. Habitats are maintained at MCB Camp Lejeune for the preservation and protection of rare and endangered species through the Base's forest and wildlife management programs. Full protection is provided to such species, and critical habitat is designated in management plans to prevent or mitigate adverse effects of Base activities. Special emphasis is placed on habitat and sightings of alligators, osprey, bald eagles, cougars, dusky seaside sparrows, and red-cockaded woodpeckers (WAR, 1983).

Camp Lejeune covers approximately 236 square miles, 84 percent of which is forested (USMC, 1987). Approximately 45 percent of this is pine forest, 22 percent is mixed pine/hardwood forest, and 17 percent is hardwood forest. Nine percent of the Base, a total of 3,587 acres, is wetland and includes pure pond pine stands, mixed pond pine/hardwood stands, marshes, pocosins, and wooded swamps. The Base also contains 80 miles of tidal streams, 21 miles of marine shoreline, and 12 freshwater ponds. Over half of the 153,000 acres located within the boundaries of MCB Camp Lejeune are under forestry management. Timber producing areas are under even-aged management with the exception of those areas along streams and swamps. These areas are managed to provide both wildlife habitat and erosion control. Forest management provides wood

production, increased wildlife populations, enhancement of natural beauty, soil protection, prevention of stream pollution, and protection of endangered species (WAR, 1983).

Because of the natural resources on the Base, forested areas are actively managed for timber. Game species are also managed for hunting, and ponds are maintained for fishing. Game species managed include wild turkey, white-tailed deer, black bear, grey and fox squirrels, bobwhite quail, eastern cottontail and marsh rabbits, raccoons, and wood ducks.

Aquatic ecosystems on MCB Camp Lejeune consist of small lakes, the New River estuary, numerous tributaries, creeks, and part of the Intracoastal Waterway. A wide variety of freshwater and saltwater fish species exist there. Freshwater ponds are under management to produce optimum yields and ensure continued harvest of desirable fish species (WAR, 1983). Freshwater fish in the streams and ponds include largemouth bass, redbreast sunfish, bluegill, chain pickerel, yellow perch, and catfish. Reptiles include alligators, turtles, and snakes (including venomous species). Both recreational and commercial fishing are practiced in the waterways of the New River and its tributaries (WAR, 1983).

Many natural communities are present in the coastal plain. Subcommunities and variations of these major community types are also present and alterations of natural communities have occurred in response to disturbance and intervention (i.e., forest cleared to become pasture). The natural communities found in the Camp Lejeune area are summarized as follows:

- Loblolly Pine Forest - a dominant forest type at Camp Lejeune. Pine forest often has a dense hardwood subcanopy and shrub understory because of clear-cutting and/or fire suppression. Dense shading results in a sparse ground layer of vegetation with little probability of rare species occurring (LeBlond et. al., 1994).

- Hardwood Forest - Found primarily in stream floodplains and on slopes and terraces next to stream valleys and estuarine features. Stream floodplain communities include cypress - gum swamp and coastal plain small stream swamp. Very few rare species are found in hardwood forests, but the communities themselves can be quite rare (LeBlond et. al., 1994).

- Loblolly Pine/Hardwoods Community - The predominant forest type at Camp Lejeune. Second growth forest that includes loblolly pine with a mix of hardwoods - oak, hickory, sweetgum, sour gum, red maple, and holly (oak is the predominant hardwood). These forests have a low probability for rare species because of the lack of herbaceous development and overall plant diversity (LeBlond et. al., 1994).

- Longleaf Pine Forest and Longleaf Pine/Hardwood Forests - Contain critical, fire maintained natural communities: Pine Savanna, Wet Pine Flatwoods, Mesic Pine Flatwoods, Pine/Scrub Oak Sanhill, and Zeric Sanhill Scrub. Some longleaf pine forests have developed in old fields and cut-over areas. The pine savannas and wet pine flatwood communities are particularly important habitats for several rare species (LeBlond et. al., 1994).

- Maritime Forest - Develop on the lee side of stable sands and dunes protected from the ocean. Live oak is an indicator species with pine, cedar, yaupon, holly, and laurel oak. Deciduous hardwoods may be present where forest is mature (USMC, 1987).

- Pond Pine Forest - These forests are primarily found in pocosins and are classified by Schafale and Wealkey (1990) as the Pond Pine Woodland natural community. Red bay, sweet bay, and loblolly bay are important components of this community. These forests frequently produce areas of high plant diversity and support several rare species. The Federal endangered loosestrife (*Lysimachia asperulifolia*) is found in this community (LeBlond et. al., 1994).

- Freshwater Marsh - Occurs upstream from tidal marshes and downstream from non-tidal freshwater wetlands. Cattails, sedges, and rushes are present. On the coast of North Carolina, swamps are more common than marshes (USMC, 1987).

- Salt Marsh - These areas occur in saline tidal areas protected from tidal action by barrier beach features. The barrier islands fronting the Atlantic Ocean support Brackish Marsh, Upper Beach, Dune Grass, and Maritime Wet and Dry Grassland communities. Regularly flooded, tidally influenced areas dominated by salt-tolerant grasses. Saltwater cordgrass is a characteristic species. Tidal mud flats may be present during low tide. These dynamic communities are critical to such Federal endangered species as the piping plover

(*Charadrius melodus*) and the Federal threatened American loggerhead turtle (*Caretta caretta*) and the green turtle (*Chelonia mydas*) (LeBlond et. al., 1994).

- Salt Shrub Thicket - High areas of salt marshes and beach areas behind dunes. Subjected to salt spray and periodic saltwater flooding. Dominated by salt resistant shrubs.

- Dunes/Beaches - Zones from the ocean shore to the maritime forest. Subjected to sand, salt, wind, and water.

- Ponds and Lakes - Low depressional areas where water table reaches the surface or where ground is impermeable. In ponds rooted plants can grow across the bottom, Fish populations managed in these ponds include redear, bluegill, largemouth bass, and channel catfish (USMC, 1987).

- Open Water - Marine and estuarine water and all underlying bottoms below the intertidal zone.

3.1.9 Wetlands

The NC DENR's Division of Environmental Management (DEM) has developed guidance concerning activities that may impact wetlands (NC DENR, 1992). In addition, certain activities affecting wetlands also are regulated by the U.S. Army Corps of Engineers. The U.S. Fish and Wildlife Service has prepared National Wetland Inventory (NWI) maps for the Camp Lejeune, North Carolina area by stereoscopic analysis of high altitude aerial photographs (USDI, 1982). Figures 3-5, 3-7, and 3-13 present the biohabitation map from the Site 78 RI (Baker, June 1994) for the HPIA and the NWI map for the Air Station, and Montford Point areas, respectively.

Wetland ecosystems at MCB Camp Lejeune can be categorized into five habitat types: (1) pond pine or pocosin; (2) sweet gum, water oak, cypress, and tupelo; (3) sweet bay, swamp black gum, and red maple; (4) tidal marshes; and, (5) coastal beaches. Pocosins provide excellent habitat for bear and deer because these areas are seldom disturbed by humans. The presence of pocosin-type habitat at MCB Camp Lejeune is primarily responsible for the continued existence of black bear in the area. Many of the pocosins are overgrown with brush and pine species that would not be profitable to harvest (WAR, 1983).

Sweet gum, water oak, cypress, and tupelo habitat is found in the rich, moist bottomlands along streams and rivers. This habitat extends to the marine shorelines. Deer, bear, turkey, and waterfowl are commonly found in this type of habitat (WAR, 1983).

Sweet bay, swamp black gum, and red maple habitat exist in the floodplain areas of MCB Camp Lejeune. Fauna including waterfowl, mink, otter, raccoon, deer, bear, and gray squirrel frequent this habitat (WAR, 1983).

The tidal marsh at the mouth of the New River is one of the few remaining North Carolina coastal areas relatively free from filling or other manmade changes. This habitat, which consists of marsh and aquatic plants such as algae, cattails, saltgrass, cordgrass, bulrush, and spikerush, provides wildlife with food and cover. Migratory waterfowl, alligators, raccoons, and river otter exist in this habitat (WAR, 1983).

Coastal beaches along the Intracoastal Waterway and along the outer banks of MCB Camp Lejeune are used for recreation and to house a small military command unit. Basic assault training maneuvers are also conducted along these beaches. Training regulations presently restrict activities that would impact ecologically sensitive coastal barrier dunes. The coastal beaches provides habitat for many shorebirds (WAR, 1983).

3.1.10 Threatened and Endangered Species

Certain species have been granted protection by the U.S. Fish and Wildlife Services under the Federal Endangered Species Act (16 United States Code (U.S.C.) 1531-1543), and/or by the North Carolina Wildlife Resources Commission, under the North Carolina Endangered Species Act (G.S. 113-331 to 113-337). The protected species fall into one of the following status classifications: Federal or state endangered, threatened, or candidate species; state special concern; state significantly rare; or state watch list. While only the Federal or state threatened or endangered and state special concern species are protected from certain actions, the other classified species have the potential for protection in the future.

Surveys have been conducted to identify threatened or endangered species at Camp Lejeune and several programs are underway to manage and protect them. Table 3-4 lists protected species present at the Base and their protected classifications. Of these species, the red-cockaded woodpecker, American alligator, and sea turtle are covered by specific protection programs.

The red-cockaded woodpecker is classified as state endangered. This species requires a specific habitat in mature, living longleaf or loblolly pine trees. The birds exist in family groups and young are raised cooperatively. At Camp Lejeune, 2,512 acres of habitat have been identified and marked for protection. Research on the bird at Camp Lejeune began in 1985 and information has been collected to determine home ranges, population size and composition, reproductive success, and habitat use. An annual roost survey is conducted and 36 colonies of birds have been located.

The American alligator is considered threatened in the northernmost part of its range, which includes North Carolina. The alligator is found in freshwater, estuarine, and saltwater wetlands in Camp Lejeune. Base wetlands are maintained and protected for the alligator. Signs have been erected where alligators are known to live. Annual surveys of Wallace, Southwest, French, Duck, Mill, and Stone Creeks have been conducted since 1977 to identify alligators and their habitats on Base.

Two protected sea turtles, the Atlantic loggerhead and Atlantic green turtle, nest on Onslow Beach at Camp Lejeune and are both classified as threatened species. The green turtle was found nesting in 1980; the sighting was the first time the species was observed nesting north of Georgia. The turtle returned to nest in 1985. Turtle nests on the beach are surveyed and protected, turtles are tagged, and annual turtle status reports are issued.

Four bird species (black skimmer, piping plover, Bachman's sparrow, and peregrine falcon) have also been identified during surveys at Camp Lejeune. The piping plover and peregrine falcon are classified as threatened species. The black skimmer and Bachman's sparrow are classified as special concern (state). The black skimmer and piping plover are sea and shore birds respectively. Skimmers nest on low sandy islands and sand bars along the coast and piping plovers prefer beaches with broad open sandy flats above the high tide line. Skimmers feed above open water and piping plovers feed along the edge of incoming waves. Like the black skimmer and piping plover, Bachman's sparrows are very specific in their habitat requirements. They live in open stretches of pines with grasses and scattered shrubs for ground cover. Bachman's sparrows were observed at numerous locations throughout the southern portion of Camp Lejeune.

In addition to the protected species that breed or forage at Camp Lejeune, several protected whales migrate through the coastal waters off the base during the spring and fall. These include the Atlantic right whale, finback whale, sea whale, and sperm whale. Before artillery or bombing practice is conducted in the area, aerial surveys are made to assure that whales are not present in the impact areas.

A natural heritage resources survey was conducted at Camp Lejeune (LeBlond, 1991) to identify threatened or endangered plants and areas of significant natural interest. From this survey, the rough-leaf loosestrife was the only specie identified that is both Federal and state endangered. Also, several state endangered/threatened and Federal and state candidate species were found on the Base.

3.1.11 Population Distribution

Land Use Demographics

MCB Camp Lejeune presently covers approximately 236 square miles. The Base's population of active and retired military, dependants, and civilian employees is in excess of 142,000. This includes a military population of approximately 40,000 and about 8,000 members of the organized Marine Corps Reserve who train at Camp Lejeune each year. Additionally, the Base employs 4,800 civilians in both appropriated and non-appropriated funded activities. Military dependants living on and off Base number about 56,000 and there is an estimated 41,000 retired military and their dependants living in the area.

The existing land use pattern for the various developed geographic areas within the MCB are listed, per geographic area, on Table 3-5. In addition, the number of acres comprising each land use category has been estimated and provided on the table. Site 16 and Buildings M119 and SM172 are located in the northern region of MCB Camp Lejeune in Montford Point (Camp Johnson).

3.2 Hadnot Point Industrial Area

This section describes the physical setting, topography, drainage characteristics, geology, hydrogeology, and ecological features of Site 78. Information provided in this section is based on previous investigations at Site 78, mainly the Site 78 RI (Baker, June 1994) and on the PA field reconnaissance.

3.2.1 Local Environmental Setting

3.2.1.1 Site Topography and Surface Features

OU No. 1 is dominantly a flat area with surface elevations between 5 and 30 ft above msl. As depicted on Figure 3 - 2, the highest surface elevations within OU No. 1 are encountered near the center of Site 78 (HPIA) where the elevation is approximately 30 ft above msl. Elevations drop off sharply to near 5 ft above msl at the banks of Beaver Dam Creek (north of Site 78, and north and west of Site 21), and the New River (southwest of Sites 24 and 78). The terrain in the area indicates that drainage of OU No. 1 is toward Codgels Creek which drains into the New River southwest of Site 24.

Overall, there are not any significant land surface features (e.g., valleys, ridges, etc.) at OU No. 1. Most of the area is devoted to industrial activities and therefore is covered with numerous buildings and other structures. Surface cover within OU No. 1 is predominately asphalt and concrete with some grass and soil covered areas along the southern and northern boundaries. The south-southeastern boundary of OU No. 1 is bordered by Codgels Creek, unnamed tributaries of Codgels Creek, marsh areas, and woodlands (Figure 3-2).

3.2.1.2 Site Geology

Surficial Sediments

The surficial sediments of the Undifferentiated Formation consist of interfingering beds of sand, clay, sandy clay and silt that contain some peat and shells of Quaternary and Miocene age. These sediments commonly extend to depths of 30 to 80 feet below ground surface (bgs) within the HPIA. Thickness of the surficial aquifer, which is within the Undifferentiated Formation, ranges from about 10 to 70 feet and, typically averages 25 feet. The clay, sandy clay, and silt beds that occur in the surficial aquifer are thin and discontinuous throughout. A semi-confining unit has been reported underlying the surficial aquifer within some portions of the HPIA, mainly in the north - northeastern areas (ESE, 1990). Other studies (Geophex, Law-Catlin) have reported an absence of a continuous confining /semi-confining layer within the HPIA. For more detailed information on the geology of the HPIA area (Site 78) refer to Section 3.0 of the OU No. 1 RI Report (Baker, June 1994).

3.2.1.3 Population Distribution

The existing land use pattern for the various developed geographic areas within the MCB are listed, per geographic area, on Table 3-5. In addition, the number of acres comprising each land use category has been estimated and provided on the table.

As shown in Table 3-5, Hadnot Point encompasses a total of 1,080 developed acres. The majority of this land is used for industrial purposes such as maintenance and supply/storage. Other major land uses include administration, troop housing, community development and recreation. Less common uses of the land at Hadnot Point include operations, training/instruction, medical, family housing, commercial development, and utilities.

3.2.2 Groundwater Migration Pathway

3.2.2.1 Site Hydrogeology

Surficial Aquifer

Recharge to the surficial aquifer is by rainfall. The aquifer receives more recharge in the winter than in the summer when much of the water evaporates or is transpired by plants before it can reach the water table. Most of the surficial groundwater is discharged to local streams, but some water passes through the underlying semiconfining unit. Recharge for the surficial aquifer is based on an average rainfall of 52 inches per year and an average recharge of 30 percent, or an annual recharge of approximately 16 inches per year. The remaining 70 percent of the rainfall is lost as surface runoff or evapotranspiration. Sixteen inches of recharge equates to 7,600,000 gpd per square mile or approximately 114,000,000 gpd for all of MCB, Camp Lejeune (based on 150 square miles of recharge area). Water levels in the wells tapping the surficial aquifer vary seasonally. The water table is generally highest in the winter and spring, and lowest in the summer and early fall.

Based on information available from UST and IR studies, transmissivity ranges from 3 to 525 gal/day/ft; storativity at 1.54×10^{-2}; and hydraulic conductivity ranges from approximately 0.3 to 17 ft/day. The average pumping rates for the surficial aquifer based on the pump test data are from 0.5 to three gpm.

Although the aquifer is classified as GA (i.e., existing or a potential source of drinking water supply for humans), it is not used as a potable water source at MCB, Camp Lejeune. The primary reason for it's non-use is because of its low yielding production rates which are typically less than three gpm.

Castle Hayne

The principal water supply aquifer for MCB Camp Lejeune is the Castle Hayne aquifer. This aquifer primarily resides within the River Bend Formation, which consists of sand, cemented shells and limestone. The depth to the top of the aquifer ranges from 30 feet bgs to 80 feet bgs. The depth variations are attributed to the interpreted occurrences of mound features within the Castle Hayne, underlying collapse, and the top of the Castle Hayne Formation being an erosional surface (Geophex, 2002). The thickness of the aquifer in the HPIA is more than 300 feet.

Estimated transmissivity, hydraulic conductivity and storage coefficient values (unitless) for the Castle Hayne aquifer range from 6,100 to 183,300 gpd/ft, 14 to 91 ft/d and 2×10^{-4} to 1.9×10^{-3}, respectively. An aquifer pump test conducted by ESE (1990) in the HPIA, using an existing water supply well (HP642), indicates an average transmissivity and storage coefficient of 9,600 gpd/ft and 8.8×10^{-4}, respectively (ESE, 1990).

The vertical hydraulic conductivity of the Castle Hayne confining unit was estimated to range from 0.0014 to 0.41 ft/d. These values are comparable to those determined for silts and clays; therefore, this unit may only be partly effective at retarding the vertical movement of groundwater between the surficial and Castle Hayne aquifers (Cardinell, et al., 1993).

Recharge of the Castle Hayne aquifer at MCB Camp Lejeune is primarily received from the surficial aquifer. Natural discharge is to the New River and its major tributaries. The Castle Hayne aquifer provides roughly seven million gallons of water to MCB Camp Lejeune. Groundwater pumping has not significantly affected natural head gradients in the aquifer.

For more detailed information on the hydrogeology of the HPIA area (Site 78) refer to Section 3.0 of the OU No. 1 RI Report (Baker, June 1994).

In general, the groundwater flow is from east to west across Site 78 as shown on Figure 3-3. Static water elevations are taken regularly at Site 78 during the LTM program. For detailed groundwater contours at this site refer to recent LTM Reports (Baker, 2001), the Draft NAE Report for OU 1 (Baker, February 2002), or the Technology Evaluation for Site 78 (Baker, April 2002).

3.2.2.2 Potable Water Supply Inventory

Active potable water supply wells within a two-mile radius of the HPIA PA Sites are shown on Figure 3-4. Table 3-6 provides detailed information for each of these wells.

The OU No. 1 ROD (Baker, September 1994) specified restrictions on use of specific water supply wells in or near OU No. 1. The specific wells listed were HP-601, 602, 608, 630, 634, and 637. These wells were all inactive and/or permanently closed at the time the Final ROD was signed. All wells have since been permanently abandoned according to North Carolina Administrative Code Title 15A, Chapter 2C.0113 (Baker, June 2001). The ROD also specified restrictions on the installation of new supply wells within the operable unit.

3.2.2.3 Present Groundwater Conditions and Usage

The LUCIP for OU No. 1 restricts groundwater usage, and any construction activities that may contact groundwater within OU No. 1. The following section presents the aquifer use controls as documented in the LUCIP for OU No. 1 (Baker, June 2001).

Except for monitoring purposes, all use of groundwater within a 1,000 ft buffer surrounding known areas of groundwater contamination is prohibited. In addition, any activities, which may impact the area of known groundwater contamination are prohibited unless specifically approved by both NCDENR and USEPA. This includes installation and operation of water supply wells as well as any dewatering activities that draw water from the contaminated groundwater plume, even if they are located outside the 1,000 ft buffer. These controls are to remain in effect until it can be demonstrated that groundwater contaminants no longer remain at the sites.

3.2.3 Surface Water Migration Pathway

When evaluating the surface water pathway during a CERCLA PA, the likelihood of release to surface water, targets, and waste characteristics must be considered. Evaluating the likelihood of release requires a hypothesis as to whether hazardous substances are likely to have migrated from the sites to the surface water. When a direct release is not suspected, considerations addressing regional and local setting, such as distance to surface water and the flood potential at the site, must be evaluated.

3.2.3.1 Surface Water Hydrology

The majority of MCB Camp Lejeune is situated near sea level (i.e., estuarine conditions which are tidally influenced). The New River is the dominant surface water feature and receives drainage from most of OU No. 1. It flows in a southerly direction and empties into the Atlantic Ocean through the New River Inlet.

Overall, there are three main surface water bodies within OU No. 1. These include: Beaver Dam Creek, Codgels Creek (and unnamed tributaries), and the New River. The New River borders the operable unit to the southwest, Codgels Creek flows along the southern boundary of Site 78 (northern boundary of Site 24), and Beaver Dam Creek lies north of Site 78 across Holcomb Boulevard. All three of these surface water features are depicted on Figure 3-2. Note that Codgels Creek has several unnamed tributaries located west from the main stream. According to the NC DENR, Codgels Creek classifies as SC NSW and Beaver Dam Creek classifies as SB NSW.

The 100-year flood plain elevation for this area of MCB Camp Lejeune is approximately 10 ft above msl. OU No. 1 lies between elevations five and 30 ft above msl (Figure 3-2), therefore, some portions (e.g., Site 24 near Codgels Creek) of the OU No. 1 are within the 100-year flood plain.

3.2.3.2 Present Surface Water Conditions and Usage

Release of hazardous substances to surface water from past operations conducted at Hadnot Point could impact drinking water supplies, human food chain organisms, and sensitive environments. The evaluation of surface water pathway targets must, therefore, be included in the

characterization of setting. Target evaluation focuses on three areas: intakes supplying drinking water; fisheries; and surface water sensitive environments within a 5-mile downstream target distance limit.

Drinking Water Supply Intakes

The New River and its tributaries make up the major surface water body system present at MCB Camp Lejeune. As this system is tidally influenced, it is not considered as a viable source of potable water. The drinking water supply is derived from groundwater production wells located at various locations throughout the base. Additionally, the tributaries entering the New River are gaining waterways that provide little or no recharge to the underlying aquifers. Therefore, potential releases to surface water bodies at the base would not impact the target population.

Fisheries

Fisheries are contamination impact targets under the Human Food Chain Threat. Under CERCLA, a fishery is any area of a surface water body in which food chain organisms are taken or could be taken for human consumption on a subsistence, sporting, or commercial basis. This definition includes any portion of a body of water that could provide at least one fish, shellfish, crustacean, amphibian, or amphibious reptile for human consumption. The definition would not apply if the water body was sterile or closed to fishing for reasons not associated with the site (e.g., sewage contamination, red tide, contamination from other facilities).

The New River and its tributaries provide recreational fishing for residents and tourists of Onslow County throughout the year. Therefore, it is conceivable that releases to this surface water system could impact the existing fisheries and the target population.

Surface Water Sensitive Environments

Sensitive environments in the surface water pathway must lie in or adjacent to the 5-mile downstream target area of the New River. The only sensitive environment that meets this requirement is the presence of wetlands.

Wetlands also are identified as sensitive environments under CERCLA guidelines. The CERCLA definition of a wetland is an area that is sufficiently inundated or saturated by surface or groundwater to support vegetation adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Substantial areas of wetlands exist throughout the surface water system comprised of the New River and its tributaries. Releases to this system could potentially impact these environmentally sensitive areas. During the RI (Baker, June 1994) wetlands were identified for Site 78, as well as a complete ecological screening of the area. Refer to Figure 3-5 for a biohabitation map of Site 78 that includes wetland identification, as well as identification of wildlife areas, waterways, forested areas, and industrial/commercial areas.

3.2.4 Soil Exposure Pathway

Currently, the LUCIP for OU No. 1 implements a Boundary of Land Use Controls that prohibits land use for non-industrial purposes within the operable unit (Baker, June 2001).

The soil exposure pathway assesses the impact to human health and the environment by direct exposure to hazardous substances and areas of suspected contamination. This pathway differs from the other three migration pathways in that it accounts for contact with in-place hazardous substances at the site, rather than migration of substances from the site. The PA evaluation takes into account the likelihood of release, targets and waste characteristics for the soil exposure pathway. The likelihood of release and the waste characteristics are analogous to the other pathways; however, the targets are evaluated with regard to two different categories: resident population and nearby population. The resident population category deals with human, environmental, and resource targets located on or very near to the site. The nearby population threat accounts for the likelihood of residents within the surrounding area coming into contact with contamination which may be affiliated with the site.

Areas of suspected contamination are defined by the presence of hazardous substances. Thus, in general, most sources are considered areas of suspected contamination with potential impacts on population. There are two exceptions where a known source of contamination is considered to have no impact on population:

- Sources with more than 2 feet of cover, and
- Sources with an impenetrable cover, regardless of thickness.

In the above two scenarios, a soil exposure pathway is considered to be absent. The majority of the identified areas of concern at Hadnot Point are covered with an impenetrable surface (asphalt and/or concrete) and therefore are exempt from the soil exposure pathway. Four buildings, HP902, HP1120, HP1409 and the former location of HP1512, consist of small grassy areas and some unpaved roads. Therefore, they do not meet the above conditions for exemptions. These areas present the potential for inhalation, dermal contact and/or ingestion of contaminated site surficial soils and therefore would be evaluated for the surface soil pathway. It should be noted that if construction or any other activity involving the removal of the fill material at the other identified areas of concern was to occur, the scenario would be altered and development of a soil exposure pathway for those areas would also be required.

Another factor to consider is whether the soil in these areas of concern is typically agitated or penetrated in any way (i.e. digging). Most buildings in Hadnot Point are currently used for automotive/boat repair and heavy equipment storage. Agitation of the grass or soil covered areas most likely occurs when transporting various vehicles, boats, and other heavy equipment on, off, and around the site. This would increase the soil exposure pathway to those individuals (resident population) who work or come into contact with these agitated, unpaved soils. There is no significant threat to those individuals from the surrounding area (nearby population), as it is not likely that they would come into contact with potential contamination at the site.

3.2.5 Air Migration Pathways

3.2.5.1 Local Setting

The PA evaluation of the air pathway requires consideration of the same three factor categories identified in the previous pathway: waste characteristics, likelihood of release, and targets. The principal threat under the air pathway is the threat of airborne releases of hazardous substances.

Evaluating the likelihood of release requires professional judgment, based on site and pathway conditions, as to whether it is likely that release of a hazardous substance to the air, if it occurred, could be detected. This differs somewhat from the release evaluation for the groundwater and surface water migration pathways, where judgment is based on whether a release is likely to have occurred.

The targets evaluation is primarily concerned with identifying and evaluating the human population within the 1-mile target distance limit around the site, and sensitive environments within one-half mile. Because a release from the sites within Hadnot Point is not expected, the targets (residential, student, and worker population) are identified as secondary targets: targets that are less likely to be subjected to exposure from release of hazardous substances to the air. In addition, the entire area of Hadnot Point is, and always has been, used strictly for industrial purposes. There are no sensitive environments such as schools or day care centers in the near vicinity. The air pathway is the only pathway that evaluates impacts on population in this PA.

Again, because the majority of identified areas of concern are under a cover of asphalt and/or concrete, the likelihood for contamination to be detected in the air pathway is not probable. However, there is no analytical data confirming or denying the release of contaminants, especially from the locations containing grass or soil covered areas: HP902, HP1120, HP1409 and HP1512. Previous investigations around these buildings show detection of several contaminants, most likely resulting from both past and present uses of the facilities, that present a potential release through the air pathway. These are VOCs (including TCE and 1,2-DCE), and SVOC's (including napthalene, phenanthrene, fluoroanthrene, pyrene and benzene), typically found in high concentrations during previous soil gas sampling.

3.2.5.2 Present Air Conditions and Usage

Air quality in the HPIA is impacted by both stationary and mobile sources. Industrial operations in the vicinity that are potential pollution sources include petroleum and solvent storage facilities, painting and auto repair facilities, and vapor stripping tower emissions from ongoing remedial activities. Some of these potential sources are subject to emission controls but may generate residential particulates or other air quality degradents.

3.3 Air Station

This section describes the physical setting, topography, drainage characteristics, geology, hydrogeology, and ecological features of the Air Station area of the PA Sites. Information provided in this section is based on previous investigations at the Air Station, mainly the Sites 75 and 76 Pre-RI (Baker, November 1988), and on the PA field reconnaissance.

3.3.1 Local Environmental Setting

3.3.1.1 Site Topography and Surface Features

The site terrain is relatively flat and is covered by pavement and concrete. There are several shallow drainage swales (one foot deep or less) that run north to south across the site. Surface runoff from the sites not intercepted by a manmade structure may drain to Edwards Creek. Previous investigations at nearby IR Sites 75 and 76 indicate that groundwater in this area generally flows towards Edwards Creek. Topographic contour elevations are illustrated on Figure 2-7 for the Air Station PA Sites. A recent aerial photo is illustrated on Figure 2-8 and shows the land features of the PA Sites. As shown, the area surrounding the PA buildings is paved and there are drainage ditches that surround the area.

3.3.1.2 Site Geology

Site specific geology in the area of Buildings TC830, SAS113, AS116, AS118 and AS119 is unknown; however, information is available for nearby Sites 75 and 76, that are north of the PA Sites. The following section describes the site geology at Sites 75 and 76 during the Pre-RI (Baker, November 1998).

Site 75 is underlain by soils that are predominately sands and silty sands beneath a foot of surface top soil. From ground surface to a depth of three feet, the soil is a light brown silty sand with a trace of gray clay. The material is loose to medium dense and ranges from moist to damp. At approximately four feet bgs, the silt content decreases transitioning into a "cleaner" sand. The sand's color also changes as depth increases from a light brown to a dark gray.

Site 76 is underlain by layers of sand, silty sand, silty clay and clay, beneath a foot of organically rich surface top soil. The sands are fine grained, light brown to dark gray in color and range from loose to dense. Clay layers from two to five feet in thickness are interbedded throughout the sand layers. This stiff clay is light brown to red in appearance and shown signs of orange mottling. Fine silts are also common at the site and both the sands and clays that are encountered have varying degrees of silt among them.

3.3.1.3 Population Distribution

The existing land use pattern for the various developed geographic areas within the MCB are listed, per geographic area, on Table 3-5. In addition, the number of acres comprising each land use category has been estimated and provided on the table.

The Air Station area of concern is located entirely within the Camp Geiger portion of the Base. As shown in Table 3-5, Camp Geiger encompasses 216 acres, the majority of which is used for supply/storage and maintenance. Other major land uses include administration, troop housing, and community development. Less common land uses include operations, training/instruction, medical, family housing, commercial development, and utilities.

3.3.2 Groundwater Migration Pathway

3.3.2.1 Site Hydrogeology

Site specific hydrogeology in the area of Buildings TC830, SAS113, AS116, AS118 and AS119 is unknown; however, information is available for nearby Sites 75 and 76, that are north of the PA Sites. The following section describes the site hydrogeology at Sites 75 and 76 during the Pre-RI (Baker, November 1998).

Site 75

During the advancement of the borings, groundwater was encountered generally between 3.5 and 4.0 feet bgs at Site 75. This is approximately the same depth at which the silt content in the soil begins to decrease. Because the study area is wide open and grass covered, the entire area is a recharge zone characterized by moderate infiltration of precipitation.

Groundwater elevations were measured on February 26, 1996 from three existing monitoring wells, 75-GW01, 75-GW02, and 75-GW03, and two newly installed monitoring wells, 75-GW04 and 75-GW05 at Site 75. Figure 3-6 depicts a groundwater contour map of the surficial aquifer for the site. The measurements were adjusted to mean sea level and are reported on Table 3-7. Shallow groundwater flow is in the northeast direction with a change in elevation of over three feet, from 12.20 feet msl in the southern most monitoring well to 8.86 feet msl in the northern most monitoring well.

Site 76

During the advancement of the borings, groundwater was encountered between 4.0 and 5.0 feet bgs at Site 76. This is approximately the same depth where the clay layers (if encountered) show the orange mottling. Because the study area is predominantly open and grass covered, the area is a recharge zone characterized by moderate infiltration of precipitation.

Groundwater measurements were collected from the two existing monitoring wells, (76-GW01 and 76-GW02), and the three new monitoring wells (76-GW03, 76-GW04, and 76-GW05) installed during this investigation (Figure 3-6). The groundwater elevations, reported as elevations to mean sea level, ranged from a high of 11.20 feet msl in 76-GW04 to a low of 5.96 feet msl in 76-GW02. Table 3-8 is a summary of groundwater elevations at Site 76.

The groundwater flow direction in the surficial aquifer is to the southwest from northeast across the site. The validity of this northeast flow is confirmed by the fact that Site 76 is immediately adjacent to Site 75 which also has indicated a northeast groundwater flow direction.

The groundwater contours as illustrated on Figure 3-6 show that surficial groundwater flow in this area of the Base is generally northeast toward Edwards Creek. It can be assumed that groundwater flow in the area of the PA Sites is also north towards Edwards Creek.

3.3.2.2 Potable Water Supply Inventory

Active potable water supply wells are shown with a two mile radius on Figure 3-4. As shown there are a number of active water supply wells within a one mile radius of the Air Station PA Sites. Table 3-6 provides detailed information for each of these wells.

3.3.2.3 Present Groundwater Conditions and Usage

There are presently no groundwater usage restrictions near the Air Station PA Sites. Surficial groundwater is not used as a potable water supply source at the Base.

3.3.3 Surface Water Migration Pathway

When evaluating the surface water pathway during a CERCLA PA, the likelihood of release to surface water, targets, and waste characteristics must be considered. Evaluating the likelihood of release requires a hypothesis as to whether hazardous substances are likely to have migrated from the sites to the surface water. When a direct release is not suspected, considerations addressing regional and local setting, such as distance to surface water and the flood potential at the site, must be evaluated.

3.3.3.1 Surface Water Hydrology

The majority of MCB Camp Lejeune is situated near sea level (i.e., estuarine conditions which are tidally influenced). The New River is the dominant surface water feature and receives drainage from most of the Air Station. The surface water generally flows in a southerly direction and empties into the Atlantic Ocean through the New River Inlet (Figure 1-1).

Overall, there are two main surface water bodies (Edwards Creek and the New River into which it flows) that could be impacted by releases from the four sites of concern. It should be noted that there are IR Sites in this area of the Air Station that may potentially drain into Edwards Creek, and include Sites 89, 75, 76, and 44 as shown on Figure 3-7. Edwards Creek flows in an easterly direction across this portion of the Air Station, and eventually flows in the New River, as shown in Figures 3-6 and 3-7. Stick Creek is located northeast of the Air Station PA Sites and also flows into the New River. Drainage from the PA Sites may also flow into Stick Creek and eventually the New River.

The 100-year flood plain elevation for this area of MCB Camp Lejeune is approximately 10 ft above msl. Some portions of the Air Station are within the 100-year flood plain. The PA Sites within the Air Station are also potentially susceptible to flooding.

3.3.3.2 Present Surface Water Conditions and Usage

Release of hazardous substances to surface water from past operations conducted at the Air Station PA Sites could impact drinking water supplies, human food chain organisms, and sensitive environments. The evaluation of surface water pathway targets must, therefore, be included in the characterization of the setting. Target evaluation focuses on three areas: intakes

supplying drinking water; fisheries; and surface water sensitive environments within a 5-mile downstream target distance limit.

Drinking Water Supply Intakes

The New River and its tributaries make up the major surface water body system present at MCB Camp Lejeune. As this system is tidally influenced, it is not considered as a viable source of potable water. The drinking water supply is derived from groundwater production wells located at various locations throughout the base. Additionally, the tributaries entering the New River are gaining waterways that provide little or no recharge to the underlying aquifers. Therefore, potential releases to surface water bodies at the base would not impact the target population.

Fisheries

Fisheries are contamination impact targets under the Human Food Chain Threat. Under CERCLA, a fishery is any area of a surface water body in which food chain organisms are taken or could be taken for human consumption on a subsistence, sporting, or commercial basis. This definition includes any portion of a body of water that could provide at least one fish, shellfish, crustacean, amphibian, or amphibious reptile for human consumption. The definition would not apply if the water body was sterile or closed to fishing for reasons not associated with the site (e.g., sewage contamination, red tide, contamination from other facilities).

The New River and its tributaries provide recreational fishing for residents and tourists of Onslow County throughout the year. Therefore, it is conceivable that releases to this surface water system could impact the existing fisheries and the target population.

Surface Water Sensitive Environments

Sensitive environments in the surface water pathway must lie in or adjacent to the 5-mile downstream target area of the New River. The only sensitive environment that meets this requirement is the presence of wetlands.

Wetlands also are identified as sensitive environments under CERCLA guidelines. The CERCLA definition of a wetland is an area that is sufficiently inundated or saturated by surface or groundwater to support vegetation adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Substantial areas of wetlands exist throughout the surface water system comprised of the New River and its tributaries. Releases to this system could potentially impact these environmentally sensitive areas. Wetlands located in the vicinity of the Air Station PA Sites are identified on Figure 3-7 and include Edwards Creek, Stick Creek and the New River.

3.3.4 Soil Exposure Pathway

The soil exposure pathway assess the impact to human health and the environment by direct exposure to hazardous substances and areas of suspected contamination. The pathway differs from the other three migration pathways in that it accounts for contact with in-place hazardous substances at the site, rather than migration of substances from the site.

The PA evaluation takes into account the likelihood of release, targets and waste characteristics for the soil exposure pathway. The likelihood of release and the waste characteristics are analogous to the other pathways; however, the targets are evaluated with regard to two different categories: resident population and nearby population. The resident population category deals with human, environmental, and resources targets located on or very near to the site. The nearby population threat accounts for the likelihood of residents within the surrounding area coming into contact with contamination which may be affiliated with the site.

Areas of suspected contamination are defined by the presence of hazardous substances. Thus, in general, most sources are considered areas of suspected contamination with potential impacts on population. There are two exceptions where a known source of contamination is considered to have no impact on population:

- Sources with more than 2 feet of cover, and
- Sources with an impenetrable cover, regardless of thickness.

In the above two scenarios, a soil exposure pathway is considered to be absent. The majority of the identified areas of concern at the Air Station are covered with an impenetrable surface (asphalt and/or concrete) and therefore are exempt from the soil exposure pathway. Two buildings, TC830 and AS119, consist of small grassy areas and therefore do not meet the above conditions for exemptions. These area present the potential for inhalation, dermal contact and or/ ingestion of contaminated site surficial soils and therefore would be evaluated for the surface soil pathway. It should be noted that if construction or any other activity involving the removal of the fill material at the other identified areas of concern was to occur, the scenario would be altered and development of a soil exposure pathway for those areas would be required.

Another factor to consider is whether the soil in these areas of concern are typically agitated or penetrated in any way (i.e. digging). The buildings of concern at the Air Station are currently used for storage and automobile maintenance. Agitation of the grassy areas most likely occurs when transporting automobiles or other such heavy equipment on, off, and around the site. This would increase the soil exposure pathway to those individuals (resident population) who work or come into contact with these agitated, unpaved soils. There is no significant threat to those individuals from the surrounding area (nearby population), as it is not likely that they would come into contact with potential contamination at the site.

3.3.5 Air Migration Pathway

3.3.5.1 Local Setting

The PA evaluation of the air pathway requires consideration of the same three factor categories identified in the previous pathway: waste characteristics, likelihood of release, and targets. The principal threat under the air pathway is the threat of airborne releases of hazardous substances.

Evaluating the likelihood of release requires professional judgment, based on site and pathway conditions, as to whether it is likely that release of a hazardous substance to the air, if it occurred, could be detected. This differs somewhat from the release evaluation for the groundwater and surface water migration pathways, where judgment is based on whether a release is likely to have occurred.

The targets evaluation is primarily concerned with identifying and evaluating the human population within the 1-mile target distance limit around the site, and sensitive environments within one-half mile. Because a release from the sites within the Air Station is not expected, the targets (residential, student, and worker population) are identified as secondary targets: targets that are less likely to be subjected to exposure from release of hazardous substances to the air. In addition, nearly the entire area of the Air Station is, and always has been, used strictly for industrial purposes. There are no sensitive environments such as schools or day care centers in the near vicinity. The air pathway is the only pathway that evaluates impacts on population in this PA.

Again, because the majority of identified areas of concern are under a cover of asphalt and/or concrete, the likelihood for contamination to be detected in the air pathway is not probable. However, there is no analytical data confirming or denying the release of contaminants, especially from the locations containing grass or soil covered areas: TC830 and AS119. The only building in the Air Station where a previous investigation was conducted in the near vicinity is Building AS116. The investigation was conducted at nearby Building AS114. VOCs and SVOCs were detected in excess of SWMU criteria and are currently being investigated further.

3.3.5.2 Present Air Conditions and Usage

Air quality at the Air Station PA Sites is impacted by both stationary and mobile sources. Operations in the vicinity that are potential pollution sources include petroleum and solvent storage facilities, and painting and auto repair facilities.

3.4 Montford Point

This section describes the physical setting, topography, drainage characteristics, geology, hydrogeology, and ecological features of the PA Sites in the Montford Point area of Camp Lejeune. Information provided in this section is based on previous investigations at Montford Point and on the PA field reconnaissance.

3.4.1 Local Environmental Setting

3.4.1.1 Site Topography and Surface Features

The area of the PA Sites, is relatively flat with a slight slope to the southeast. Most of the site is currently a cleared area that is paved. Figure 2-8 presents the topography and surface features identified at the PA Sites.

3.4.1.2 Site Geology

Site specific geology in the area of Buildings M119 and SM173 is unknown; however, information is available for nearby Site 16, that is southwest of the PA Sites. The following section describes the site geology at Site 16 during the RI (Baker, January 1996).

The RI was limited to investigating the shallow groundwater zone; therefore, site-specific geology describes the site to depth of approximately 35 feet bgs. The site is primarily underlain by sands and silty sands with lenses and/or discontinuous layers of sand and clay, clay, and sandy clay. These surficial soils represent the Quaternary age "undifferentiated" Formation that characterizes the shallow water table aquifer. Results of the standard penetration tests (ASTM D1586-84) indicates the relative density of the soils range from loose to very dense. Unified Soil Classification System (USCS) classification for the surficial soils identified at the site are SM (silty sand), SP (poorly graded sands with little to no fines), and CL (sandy clay and clay). Fill material was identified at some borehole locations (within the open site area), ranging in thickness from one to nine feet. This fill material consisted of replaced soil, as well as treated timbers, rubber tires, and gravel. Only shallow groundwater monitoring wells were installed during the RI, therefore, no specific information on the depth of the surficial soils or the lithology of the underlying soils is available.

Geologic cross-sections were developed for the surficial soils based on samples collected during the RI. As shown on Figure 3-8, two cross-sections were developed using the groundwater monitoring boreholes. Cross-section A-A' (Figure 3-9) depicts the surficial lithology from north to south and cross-section B-B' (Figure 3-10) depicts the lithology from southwest to northeast of the surficial soils.

3.4.1.3 Population Distribution

The following sections concerning land use demographics were taken from the OU No. 8 (Site 16) RI (Baker, January 1996).

Montford Point is one of the Marine Corps Bases' oldest areas and has seen little planning over the decades. Most of the 233 acres of development are congregated on the eastern side of Montford Landing Road. Of the 233 acres of development, 35 percent (i.e., 82 acres) consist of troop housing. Community facilities are located near troop housing in the northeast section of the area. The troop housing facilities located at the southern tip of Montford Point have very limited community facilities nearby.

Classroom training facilities are scattered throughout the developed areas of Montford Point. This use constitutes nearly 21 percent (i.e., 48 acres) of the developed area and, therefore, is the second largest land use category existing at Montford Point. Site 16 and Buildings M119 and SM173 are located within this area.

The existing land use pattern for the various developed geographic areas within the MCB are listed, per geographic area, on Table 3-5. In addition, the number of acres comprising each land use category has been estimated and provided on the table. Site 16 and Buildings M119 and SM172 are located in the northern region of MCB Camp Lejeune in Montford Point (Camp Johnson).

3.4.2 Groundwater Migration Pathway

3.4.2.1 Site Hydrogeology

Groundwater was encountered during the RI at elevations ranging from 1.37 to 6.93 feet above msl. Measured shallow groundwater levels for Site 16 are presented on Table 3-9. The groundwater elevation contours for the shallow aquifer on March 27, 1995 are presented on Figure 3-11. The contour maps indicate a linear flow towards the southeast, in the direction of Northeast Creek. Recharge for this area is from the northwest. The shallow groundwater gradient measured from well 16-MW01 to well 16-MW04 to the southeast for December 11, 1994 was 0.002 ft/ft and from well 16-MW-1 to 16-MW03 for March 27, 1995 was 0.004 ft/ft. Shallow groundwater discharges to Northeast Creek.

The shallow aquifer was characterized by performing in situ rising and falling head slug tests in all newly installed monitoring wells. The tests were performed on December 6 and 7, 1994. An electronic data logger (In Situ Hermit Model SE2000) and pressure transducer assembly were used to record the recovery of groundwater in the monitoring wells to static level. All data was recorded on logarithmic scale to more closely monitor the initial changes in groundwater elevation. The data resulting from the slug tests were converted into time (in minutes) and the corresponding change in water level displacement (in feet). Results from the rising head tests were analyzed using Geraghty & Miller's AQTESOLV computer program for performing quantitative groundwater assessments. Results from falling head tests were analyzed for wells 16-MW02, 16-MW05, and 16-MW06 due to the fact that these shallow wells exhibited groundwater levels at or above the top of the sand packs, making the falling head tests valid at these locations. The Bouwer and Rice solution for slug tests in unconfined aquifers was used to evaluate all test data. For the input parameters and plots generated from the slug tests refer to Appendix E of the Site 16 RI Report (Baker, January 1996).

Table 3-10 lists the K values obtained from the data analysis, the average hydraulic gradient from the two groundwater elevation contour maps, the assumed effective porosity, and the calculated value for groundwater velocity. The average estimated K value from the six wells (total of 9 tests) was 5.69 feet/day (2.01 x 10^{-3} cm/sec), which is within the typical range for silty sands (Freeze/Cherry, 1979). The average hydraulic gradient from groundwater measurements between wells 16-MW01 and 16-MW04 on December 11, 1994, and wells 16-MW01 and 16-MW03 on March 27, 1995 was 0.003 ft/ft. Published effective porosity values indicate a range of 25 to 50 percent for sands and silts (Freeze/Cherry, 1979). Due to the silty nature of the sands, a value of 35 percent was used for effective porosity. The estimated average linear groundwater velocity was calculated by using the following formula:

$$V=Ki/n$$

Where: V = groundwater velocity
K = hydraulic conductivity
i = hydraulic gradient
n = effective porosity

Using these variables, the groundwater velocity (V) in a northwest to southeast direction is estimated to be 0.05 feet/day (18.25 feet/year). This is a conservative estimate because of the nature of the silty sand and the variability in the estimated K values from the slug tests. An approximate transmissivity value (T) can be obtained from multiplying the hydraulic conductivity (K) by the saturated thickness (b) of the aquifer. Using a saturated thickness of 33.5 feet, which corresponds to the maximum depth of the shallow wells installed at Site 16, an approximate T value for the shallow aquifer in this direction is 190.62 $feet^2$/day (14.3 x 10^2 gallons/day/ft). A recent hydrogeologic investigation conducted by Baker in the Camp Geiger area (1994), which included an aquifer pump test within the shallow water-bearing zone (approximately 25 foot depth), indicated T and K values of 94.92 ft^2/day (7.1 x 10^2 gallons/day/ft) and 6.3 feet/day (2.2 x 10^{-3} cm/sec), respectively. Values for T determined from a pump test performed at Hadnot Point on the opposite side of the New River from Camp Geiger were 75 $feet^2$/day (5.61 x 10^2 gallons/day/ft). The average transmissivity value from these two pump tests is 85 $feet^2$/day (6.36 x 10^2 gallons/day/ft). The calculated transmissivity value of 190.62 $feet^2$/day from the slug tests is twice the average pump test value.

A tidal study was conducted at Site 16 to determine the influence of tidal effects on the shallow groundwater within the site boundaries. A staff gauge was installed in Northeast Creek, approximately 50 feet from shore. It was placed in a southeasterly direction from the former burn dump. A pressure transducer was attached to the staff gauge, positioned approximately 1 foot off the creek bottom. Pressure transducers were also installed in monitoring wells 16-MW03, just on-shore from Northeast Creek (approximately 10 feet), and 16-MW05, within the former burn dump. Measurements were recorded with an In-Situ Hermit Model 2000 data logger and a Hermit Model 1000C data logger over a period of three days (December 1-4, 1994). Figure 3-12 presents a graph of the readings from the staff gauge, and monitoring wells 16-MW03 and 16-MW05. The "0" mark on the Y-axis is referenced to the level of the creek and groundwater levels in the monitoring wells at the start of the study.

The staff gauge in Northeast Creek indicated fluctuations in the water surface from 0.2 to 0.7 feet. Well 16-MW03, near Northeast Creek, exhibited groundwater fluctuations of 0.1 to 0.3 feet. No fluctuations in groundwater were exhibited in well 16-MW05, which is located approximately 470 feet from Northeast Creek. Figure 3-12 illustrates that the cyclic nature of the fluctuations of the creek and groundwater in well 16-MW03 are "offset". A rise in the level of the creek coincides with a decrease in the groundwater level. The data indicates that there is a tidal effect

on the shallow groundwater at Site 16, but there is a delay between the highest elevations of the groundwater and the creek. The tidal influence from Northeast Creek reaches inland, but at a distance probably less than 300 feet.

3.4.2.2 Potable Water Supply Inventory

Active potable water supply wells are shown with a two-mile radius on Figure 3-4. As shown, there are no active water supply wells within a 1-mile and 2-mile radius of the Montford Point PA Sites.

3.4.2.3 Present Groundwater Conditions and Usage

There are presently no groundwater usage restrictions near the Montford Point PA Sites. Surficial groundwater is not used as a potable water supply source at the Base.

3.4.3 Surface Water Migration Pathway

When evaluating the surface water pathway during a CERCLA PA, the likelihood of release to surface water, targets, and waste characteristics must be considered. Evaluating the likelihood of a release requires a hypothesis as to whether hazardous substances are likely to have migrated from the sites to the surface water. When a direct release is not suspected, considerations addressing regional and local setting, such as distance to surface water and the flood potential at the site, must be evaluated.

3.4.3.1 Surface Water Hydrology

The majority of MCB Camp Lejeune is situated near sea level (i.e., estuarine conditions which are tidally influenced). The New River and Northeast Creek are the dominant surface water features in the Montford Point area, and receive drainage from most of Montford Point. In the area of the PA Sites, the Northeast Creek is effectively a bay of the New River and thus will be included in the discussion as part of the New River. The New River flows in a southerly direction and eventually empties into the Atlantic Ocean through the New River Inlet (Figure 1-1).

The New River is the only surface water body that could be impacted by releases from the two Montford Point PA Sites. The New River borders the PA Sites to the east and southeast and is depicted on Figures 3-11 and 3-13.

The 100-year flood plain elevation for this area of MCB Camp Lejeune is approximately 10 ft above msl. Some portions of Montford Point are within the 100-year flood plain. PA Sites M119 and SM173 are susceptible to flooding during heavy precipitation events.

3.4.3.2 Present Surface Water Conditions and Usage

Release of hazardous substances to surface water from past operations conducted at Montford Point could impact drinking water supplies, human food chain organisms, and sensitive environments. The evaluation of surface water pathway targets must, therefore, be included in the characterization of setting. Target evaluation focuses on three areas: intakes supplying drinking water; fisheries; and surface water sensitive environments within a 5-mile downstream target distance limit.

Drinking Water Supply Intakes

The New River and its tributaries make up the major surface water body system present at MCB Camp Lejeune. As this system is tidally influenced, it is not considered as a viable source of potable water. The drinking water supply is derived from groundwater production wells located at various locations throughout the base. Additionally, the tributaries entering the New River are gaining waterways that provide little or no recharge to the underlying aquifers. Therefore, potential releases to surface water bodies at the base would not impact the target population.

Fisheries

Fisheries are contamination impact targets under the Human Food Chain Threat. Under CERCLA, a fishery is any area of a surface water body in which food chain organisms are taken or could be taken for human consumption on a subsistence, sporting, or commercial basis. This definition includes any portion of a body of water that could provide at least one fish, shellfish, crustacean, amphibian, or amphibious reptile for human consumption. The definition would not apply if the water body was sterile or closed to fishing for reasons not associated with the site (e.g., sewage contamination, red tide, contamination from other facilities).

The New River and its tributaries provide recreational fishing for residents and tourists of Onslow County throughout the year. Therefore, it is conceivable that releases to this surface water system could impact the existing fisheries and the target population.

Surface Water Sensitive Environments

Sensitive environments in the surface water pathway must lie in or adjacent to the 5-mile downstream target area of the New River. The only sensitive environment that meets this requirement is the presence of wetlands.

Wetlands also are identified as sensitive environments under CERCLA guidelines. The CERCLA definition of a wetlands is an area that is sufficiently inundated or saturated by surface or groundwater to support vegetation adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Substantial areas of wetlands exist throughout the surface water system comprised of the New River and its tributaries. Releases to this system could potentially impact these environmentally sensitive areas. Wetlands have been identified for the Montford Point PA Sites as illustrated on Figure 3-13.

3.4.4 Soil Exposure Pathway

The soil exposure pathway assess the impact to human health and the environment by direct exposure to hazardous substances and areas of suspected contamination. This pathway differs from the other three migration pathways in that it accounts for contact with in-place hazardous substances at the site, rather than migration of substances from the site.

The PA evaluation takes into account the likelihood of release, targets and waste characteristics for the soil exposure pathway. The likelihood of release and the waste characteristics are analogous to the other pathways; however, the targets are evaluated with regard to two different categories: resident population and nearby population. The resident population category deals with human, environmental, and resource targets located on or very near to the site. The nearby population threat accounts for the likelihood of residents within the surrounding area coming into contact with contamination which may be affiliated with the site.

Areas of suspected contamination are defined by the presence of hazardous substances. Thus, in general, most sources are considered areas of suspected contamination with potential impacts on population. There are two exceptions where a known source of contamination is considered to have no impact on population:

- Sources with more than 2 feet of cover, and
- Sources with an impenetrable cover, regardless of thickness.

In the above two scenarios, a soil exposure pathway is considered to be absent. The majority of the identified areas at Montford Point are covered with an impenetrable surface (asphalt and/or concrete) and therefore are exempt from the soil exposure pathway. Both buildings in the area, M119 and the former location of SM173 consist of small grassy areas and unpaved roads. Therefore, they do not meet the above conditions for exemptions. These areas present the potential for inhalation, dermal contact and/or ingestion of contaminated site surficial soils and therefore would be evaluated for the surface soil pathway. It should be noted that if construction or any other activity involving the removal of the fill material at the other identified areas on concern was to occur, the scenario would be altered and development of a soil exposure pathway for those areas would also be required.

Another factor to consider is whether the soil in these areas of concern is typically agitated or penetrated in any way (i.e. digging). The buildings at Montford Point are currently used for an automobile vehicle maintenance shop and vehicle wash rack. Agitation of the grass or unpaved roads most likely occurs when transporting the vehicles on, off, and around the site. This would increase the soil exposure pathway to those individuals (resident population) who work or come into contact with these agitated, unpaved soils. There is no significant threat to those individuals from the surrounding area (nearby population), as it is not likely that they would come into contact with potential contamination at the site.

3.4.5 Air Migration Pathway

3.4.5.1 Local Setting

The PA evaluation of the air pathway requires consideration of the same three factor categories identified in the previous pathway: waste characteristics, likelihood of release, and targets. The principal threat under the air pathway is the threat of airborne releases of hazardous substances.

Evaluating the likelihood of release requires professional judgment, based on site and pathway conditions, as to whether it is likely that release of a hazardous substance to the air, if it occurred, could be detected. This differs somewhat from the release evaluation for the groundwater and surface water migration pathways, where judgment is based on whether a release is likely to have occurred.

The targets evaluation is primarily concerned with identifying and evaluating the human population within the 1-mile target distance limit around the site, and sensitive environments with one half-mile. Because a release from the sites within Montford Point is not expected, the targets (residential, student, and worker) are identified as secondary targets: targets that are less likely to be subjected to exposure from release of hazardous substances to the air. In addition, nearly the entire area of Montford point is, and always has been, used mainly for industrial purposes. There are no sensitive environments such as schools or day care centers in the near vicinity. The air pathway is the only pathway that evaluates impacts on population in this PA.

Again, because the majority of identified areas of concern are under a cover of asphalt and/or concrete, the likelihood for contamination to be detected in the air pathway is not probable. However, there is no analytical data confirming or denying the release of contaminants, especially from the locations containing grass or soil covered areas. No previous investigations have been conducted at Building M119 and former Building SM173. However, the SWMU program is currently investigating the wash rack and oil/water separator in this location. Findings from the SWMU investigation are presented in Appendix H, SM173.

3.4.5.2 Present Air Conditions and Usage

Air quality at Montford Point is impacted by both stationary and mobile sources. Operations in the vicinity that are potential pollution sources include petroleum and solvent storage facilities and painting and auto repair facilities.

TABLES

TABLE 3-1

CLIMATIC DATA SUMMARY
MARINE CORPS AIR STATION, NEW RIVER
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

	Precipitation (Inches)			Relative Humidity (Percent)	Temperature (Fahrenheit)			Mean Number of Days With				
								Precipitation		Temperature		
	Maximum	Minimum	Average		Maximum	Minimum	Average	>=0.01"	>=0.5"	>=90F	>=75F	<=32F
January	7.5	1.4	4.0	79	54	34	44	11	2	0	1	16
February	9.1	.9	3.9	78	57	36	47	10	3	0	2	11
March	8	.8	3.9	80	64	43	54	10	3	*	5	5
April	8.8	.5	3.1	79	73	51	62	8	2	1	13	*
May	8.4	.6	4.0	83	80	60	70	10	3	2	25	0
June	11.8	2.2	5.2	84	86	67	77	10	4	7	29	0
July	14.3	4.0	7.7	86	89	72	80	14	5	13	31	0
August	12.6	1.7	6.2	89	88	71	80	12	4	11	31	0
September	12.8	.8	4.6	89	83	66	75	9	3	4	27	0
October	8.9	.6	2.9	86	75	54	65	7	2	*	17	*
November	6.7	.6	3.2	83	67	45	56	8	2	0	7	3
December	6.6	.4	3.7	81	58	37	48	9	2	0	2	12
Annual	65.9	38.2	52.4	83	73	53	63	118	35	39	189	48

Notes:

* = Mean no. of days less than 0.5 days
Source: Naval Oceanography Command Detachment, Asheville, North Carolina. Measurements obtained from January 1955 to December 1990.

TABLE 3-2

GEOLOGIC AND HYDROGEOLOGIC UNITS IN THE COASTAL PLAIN OF NORTH CAROLINA PRELIMINARY ASSESSMENT SITES, CTO-0190 MCB CAMP LEJEUNE, NORTH CAROLINA

GEOLOGIC UNITS			HYDROGEOLOGIC UNITS
System	**Series**	**Formation**	**Aquifer and Confining Unit**
Quaternary	Holocene/Pleistocene	Undifferentiated	Surficial Aquifer
Tertiary	Pliocene	Yorktown Formation [1]	Yorktown Confining Unit
			Yorktown Aquifer
	Miocene	Eastover Formation [1]	Pungo River Confining Unit
		Pungo River Formation [1]	Pungo River Aquifer
		Belgrade Formation [2]	Castle Hayne Confining Unit
	Oligocene	River Bend Formation	Castle Hayne Aquifer
	Eocene	Castle Hayne Formation	Beaufort Confining Unit [3]
	Palocene	Beaufort Formation	Beaufort Aquifer
Cretaceous	Upper Cretaceous	Peedee Formation	Peedee Confining Unit
			Peedee Aquifer
		Black Creek and Middendorf Formations	Black Creek Confining Unit
			Black Creek Aquifer
		Cape Fear Formation	Upper Cape Fear Confining Unit
			Upper Cape Fear Aquifer
			Lower Cape Fear Confining Unit
			Lower Cape Fear Aquifer
	Lower Cretaceous [1]	Unnamed Deposits [1]	Lower Cretaceous Confining Unit
			Lower Cretaceous Aquifer [1]
Pre-Cretaceous Basement Rocks		---	---

[1] Geologic and hydrologic units not present beneath Camp Lejeune.
[2] Constitutes part of the surficial aquifer and Castle Hayne confining unit in the study area.
[3] Estimated to be confined to deposits of Paleocene age in the study area.

Source: Cardinell, et al., 1993

TABLE 3-3

HYDRAULIC PROPERTY ESTIMATES OF THE CASTLE HAYNE AQUIFER AND CONFINING UNIT
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Hydraulic Properties	USGS Phase I Study[1]	USGS Aquifer Test[2]	ESE, Inc. [3]	NC DENR Aquifer Test[4]	RASA Estimate[5]
Aquifer transmissivity (cubic foot per day per square foot times foot of aquifer thickness)	4,300 to 24,500 average 9,500	1,140 to 1,325	820 to 1,740 average 1,280	900	10,140 to 26,000
Aquifer hydraulic conductivity (foot per day)	14 to 82 average 35	20 to 60	--	18 to 91 average 54	45 to 80 average 65
Aquifer storage coefficient (dimensionless)	--	2.0×10^{-4} to 2.2×10^{-4}	5.0×10^{-4} to 1.0×10^{-3} average 8.0×10^{-4}	1.9×10^{-3}	--
Confining-unit vertical hydraulic conductivity (foot per day)	--	3.0×10^{-2} to 4.1×10^{-1}	1.4×10^{-3} to 5.1×10^{-2} average 3.5×10^{-3}	--	--

Notes:

(1) Analysis of specific capacity data from Harned and others (1989).
(2) Aquifer test at well HP-708.
(3) Aquifer test at Hadnot Point well HP-462 from Environmental Sciences and Engineering, Inc. (1988).
(4) Unpublished aquifer test data at well X24s2x, from NC DENR well records (1985).
(5) Transmissivities based on range of aquifer thickness and average hydraulic conductivity from Winner and Coble (1989).

Source: Cardinell, et al., 1993.

TABLE 3-4

PROTECTED SPECIES
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Species	Protected Classification
Animals:	
American alligator (Alligator mississippienis)	SC
Bachmans sparrow (Aimophilia aestivalis)	FCan, SC
Green (Atlantic) turtle (Chelonia m. mydas)	T(f), T(s)
Loggerhead turtle (Caretta caretta)	T(f), T(s)
Peregrine falcon (Falco peregrinus)	E(f), E(s)
Piping plover (Charadrius melodus)	T(f), T(s)
Red-cockaded woodpecker (Picoides borealis)	E(f), E(s)
Southern Hognose Snake (Heterodon simus)	FCan, SR
Diamondback Terrapin (Malaclemys terrapin)	FCan, SC
Carolina Gopher Frog (Rana capito capito)	FCan, SC
Cooper's Hawk (Accipiter cooperii)	SC
Eastern Diamondback Rattlesnake (Crotalus adamanteus)	SR
Eastern Coral Snake (Micrurus fulvius)	SR
Pigmy Rattlesnake (Sistrurus miliarius)	SR
Black Bear (Ursus americanus)	SR
Plants:	
Rough-leaf loosestrife (Lysimachia asperulifolia)	E(f), E(s)
Seabeach Amaranth (Amaranthus pumilus)	T(f), T(s)
Chapman's Sedge (Carex chapmanii)	FCan
Hirst's Witchgrass (Dichanthelium sp.)	FCan
Pondspice (Litsea aestivalis)	FCan
Boykin's Lobelia (Lobelia boykinii)	FCan
Loose Watermilfoil (Myriophyllum laxum)	FCan,T(s)
Awned Meadowbeauty (Rhexia aristosa)	FCan,T(s)
Carolina Goldenrod (Solidago pulchra)	FCan, E(s)
Carolina Asphodel (Tofieldia glabra)	FCan
Venus Flytrap (Dionaea muscipula)	FCan
Flaxleaf Gerardia (Agalinis linifolia)	SR
Pinebarrens Goober Grass (Amphicarpum purshii)	SR
Longleaf Three-awn (Aristida palustris)	SR
Pinebarrens Sandreed (Calamovilfa brevipilis)	E(s)
Warty Sedge (Carex verrucosa)	SR
Smooth Sawgrass (Cladium mariscoides)	SR
Leconte's Flatsedge (Cyperus lecontei)	SR
Erectleaf Witchgrass (Dichanthelium erectifolium)	SR
Horsetail Spikerush (Eleocharis equisetoides)	SR
Sand Spikerush (Eleocharis montevidensis)	SR
Flaxleaf Seedbox (Ludwigia linifolia)	SR

TABLE 3-4 (Continued)

PROTECTED SPECIES
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Species	Protected Classification
Plants (cont.):	
Torrey's Muhley (Muhlenbergia torreyana)	E(s)
Southeastern Panic Grass (Panicum tenerum)	SR
Spoonflower (Peltandra sagittifolia)	SR
Shadow-witch (Ponthieva racemosa)	SR
West Indies Meadowbeauty (Rhexia cubensis)	SR
Pale Beakrush (Rhynchospora pallida)	SR
Longbeak Baldsedge (Rhynchospora scirpoides)	SR
Tracy's Beakrush (Rhynchospora tracyi)	SR
Canby's Bulrush (Scirpus etuberculatus)	SR
Slender Nutrush (Scleria minor)	SR
Lejeune Goldenrod (Solidago sp.)	SR
Dwarf Bladderwort (Utricularia olivacea)	T(s)
Elliott's Yellow-eyed Grass (Xyris elliottii)	SR
Carolina Dropseed (Sporobolus sp.)	T(s)

Legend:

E(f) = Federal Endangered
T(f) = Federal Threatened
Fcan = Candidate for Federal Listing
E(s) = State Endangered
T(s) = State Threatened
SC = State Special Concern
SR = State Rare

Source: LeBlond, 1994

TABLE 3-5

LAND UTILIZATION: DEVELOPED AREAS ACRES/LAND USE (PERCENT)
PA SITES
PRELIMINARY ASSESSMENT, CTO-0190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Geographic Area	Oper.	Training (Instruc.)	Maint.	Supply/ Storage	Medical	Admin.	Family Housing	Troop Housing	CM	CO	Recreat.	Utility	Total
Hadnot Point	31 (2.9)	15 (1.4)	154 (14.3)	157 (14.4)	10 (0.9)	122 (11.3)	22 (2.0)	196 (18.1)	115 (10.7)	36 (3.3)	182 (16.9)	40 (3.7)	1,080 (100)
Paradise Point	1 (0)		3 (0.4)	1 (0)			343 (34)	19 (1.9)	31 (3.1)		610 (60.4)	2 (0.2)	1,010 (100)
Berkeley Manor/ Watkins Village							406 (80)		41 (8.1)	1 (0.2)	57 (11.2)	2 (0.5)	507 (100)
Midway Park		1 (0.4)		2 (0.7)		2 (0.7)	248 (92.2)		8 (3.0)	3 (1.1)	4 (1.5)	1 (0.4)	269 (100)
Tarawa Terrace I and II			3 (0.5)			1 (0.3)	428 (77.4)		55 (9.9)	11 (2.0)	47 (8.5)	8 (1.4)	553 (100)
Knox Trailer							57 (100)						57 (100)
French Creek	8 (1.4)	1 (0.2)	74 (12.7)	266 (45.6)	3 (0.5)	7 (1.2)		122 (20.9)	22 (3.8)	6 (1.0)	74 (12.7)		583 (100)
Courthouse Bay		73 (28.6)	28 (10.9)	14 (5.5)		12 (4.7)	12 (4.7)	43 (16.9)	15 (5.9)	4 (1.6)	43 (16.9)	11 (4.3)	255 (100)
Onslow Beach	6 (9.8)	1 (1.6)	3 (4.8)	2 (3.2)	1 (1.6)	2 (3.2)		2 (3.2)	12 (19.3)		25 (40.3)	8 (13.0)	62 (100)
Rifle Range		1 (1.3)	1 (1.3)	7 (8.8)	1 (1.3)	5 (6.3)	7 (8.8)	30 (37.5)	5 (6.3)	1 (1.3)	9 (11.3)	13 (16.3)	80 (100)
Camp Geiger	4 (1.9)	15 (6.9)	19 (8.8)	50 (23.1)		23 (10.6)		54 (25.0)	27 (12.5)	2 (1.0)	16 (7.4)	6 (2.8)	216 (100)
Montford Point	6 (2.6)	48 (20.5)	2 (0.9)	4 (1.7)	2 (0.9)	9 (3.9)		82 (35.2)	20 (8.6)	1 (0.4)	49 (21.0)	10 (4.3)	233 (100)
Base-wide Misc.	1 (0.8)			87 (68.0)		3 (2.3)			19 (14.8)			18 (14.1)	128 (100)
TOTAL	**57 (1.1)**	**155 (3.1)**	**287 (5.7)**	**590 (11.7)**	**17 (0.38)**	**186 (3.7)**	**1,523 (30.2)**	**548 (10.8)**	**370 (7.4)**	**65 (1.3)**	**1.116 (22.2)**	**119 (2.4)**	**5,033 (100)**

CM = Community Development
CO = Commercial Development

TABLE 3-6
LIST OF ACTIVE WATER SUPPLY WELLS
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Well ID #	Well ID #	Well ID #
557	662	**616**
558	698	**623**
584	699	**646**
585	700	**647**
586	701	**654**
595	703	**AS 4150**
596	704	**BB 44**
606	705	**BB 47**
607	707	**LCH 4009**
611	708	**TC 600**
612	709	**TC 1253**
613	710	
614	711	
617	5186	
618	AS 190	
619	AS 191	
620	AS-5001	
621	BA 145	
622	BA 164	
627	BA 190	
628	BB 218	
629	BB 220	
632	BB 221	
633	BB 280	
640	BB 281	
643	LCH 4007	
644	TC 1000	
663	TC 1001	
641	TC 604	
642	VL 101	
648	VL-102	
650	VL-103	
652	VL-104	
661	VL-105	

Notes:
*Shaded wells will soon be replaced
*All Wells are Sampled Once a Year for Volatile Organic Chemicals (VOC's)

***Bold** Wells (3rd Column) are Sampled Twice a Year (January and July) for VOC's. These Water Supply Wells are Located Within 1500 Ft. of Known Contaminated Areas

Source: MCB, Camp Lejeune, March 2002.

TABLE 3-6 (Cont.)
LIST OF ACTIVE WATER SUPPLY WELLS
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

40 CFR 141.61
Maximum Contaminant Levels for Volatile Organic Contaminants

Contaminant	Maximum Contaminant Level (mg/l) (ppb)	2L Standards Groundwater (ppb)
p-Isopropyltoluene	N/A	
chloromethane	N/A	N/A
DCDfluormethane	N/A	1,400
Bromomethane	N/A	N/A
Chloroethane	N/A	N/A
Fluorotrichloromethane	N/A	N/A
Hexachlorobutadine	N/A	.44
Napthalene	N/A	21
1,2,4-TChlorobenzene	70	70
c-1,2-Dchloroethylene	70	70
Dibromomethane	N/A	N/A
1,1-Dichloropropene	N/A	N/A
1,3-Dichloropropane	N/A	N/A
1,3-Dichloropropene	N/A	N/A
1,2,3-TChlororopane	N/A	.005
2,2-Dichloropropane	N/A	N/A
1,2,4-TMethylbenzene	N/A	N/A
1,2,3-Tchlorobenzene	N/A	N/A
n-Butylbenzene	N/A	N/A
1,3,5-TMBenzene	N/A	350
tert-Butylbenzene	N/A	70
sec-Butylbenzene	N/A	70
Bromochloromethane	N/A	N/A
Chloroform	N/A	0.19
Bromoform	N/A	0.19
BDChloromethane	N/A	0.60
CDBromomethane	N/A	N/A
o-Chlorotoluene	N/A	N/A
p-Chlorotoluene	N/A	N/A
m-Dichlorobenzene	600	620
p-Dichlorobenzene	75	75
1,1-DCEthane	N/A	700
1,2-Dichloroethane	5	0.38
Carbon Tetrachloride	5	0.30
1,1,2-TCEthane	5	N/A
1,1,1,2-TCEthane	N/A	N/A
1,1,2,2-TCEthane	N/A	0.17
Chlorobenzene	100	100
Ethylbenzene	700	29
Bromobenzene	N/A	N/A
Isopropylbenzene	N/A	N/A
n-Propylbenzene	N/A	N/A
Vinyl chloride	2	.015

TABLE 3-6 (Cont.)
LIST OF ACTIVE WATER SUPPLY WELLS
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Maximum Contaminant Level (mg/l) (ppb)	2L Standards Groundwater (ppb)
Benzene	5	5
Trichloroethylene	5	2.80
para-Dichlorobenzene	75	75
1,1-Dichloroethylene	7	7
1,1,1-Trichloroethane	200	200
1,2-Dichloropropane	5	0.56
Ethylbenzene	700	29
Monochlorobenzene	100	N/A
o-Dichlorobenzene	600	620
Styrene	100	100
Tetrachloroethylene	5	0.70
Toluene	1,000	1000
trans-1,2-Dichloroethylene	100	70
Xylenes (total)	10,000	530
Dichloromethane	5	N/A

***N/A Unregulated Contaminants**

Maximum Contaminant Levels for Synthetic Organic Contaminants (SOC's)

Contaminant	Maximum Contaminant Level (mg/l) (ppb)
Alachlor	2
Aldicarb	3
Aldicarb sulfoxide	4
Aldicarb sulfone	2
Atazine	3
Carbofuran	40
Chlordane	2
Dibromochloropropane	0.2
2,4-D	70
Ethylene dibromide	0.05
Heptachlor	0.4
Heptachlor epoxide	0.2
Lindane	0.2
Methoxychlor	40
Polychlorinated biphenyls	0.5
Pentachlorophenol	1
Toxaphene	3
2,4,5-TP	50
Benzo[a]pyrene	0.2
Dalapon	200
Di(2-ethylhexyl) adipate	400
Di(2-ethylhexyl) phthalate	6
Dinoseb	7
Diquat	20
Endothall	100
Endrin	2

TABLE 3-6 (Cont.)
LIST OF ACTIVE WATER SUPPLY WELLS
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant	Maximum Contaminant Level (mg/l) (ppb)
Gyphosate	700
Hexachlororbenzene	1
Hexachlorocyclopentadiene	50
Oxamyl (Vydate)	200
Picloram	500
Simazine	4
2,37,8-TCDD (Dioxin)	$3x10^{-5}$
Dicamba	N/A

***Camp Lejeune Samples Every Three Years for SOC's**

***Camp Lejeune Sampled All Online Water Supply Wells and Finished Water (Hadnot, Holcomb Blvd, MCAS, and Courthouse Bay) Twice in 2001 for Highlighted Synthetic Organic Chemicals Using Method 515.1.**

40 CFR 141.62
Maximum Contaminant Levels for Inorganic Contaminants

Contaminant	Maximum Contaminant Level (mg/l) (ppb)
Arsenic	10,000
Fluroide	4,000
Asbestos	7 Million Fibers/Liter
Barium	2,000
Cadmium	5
Chromium	100
Mercury	2
Nitrate	10,000 (as Nitrogen)
Nitrite	1000 (as Nitrogen)
Total Nitrate and Nitrite	10,000 (as Nitrogen)
Selenium	50
Antimony	6
Beryllium	4
Cyanide (as free Cyanide)	200
Thallium	2

40 CFR 141.64
Maximum Contaminant Levels for Disinfection Byproducts

Contaminant	Maximum Contaminant Level (mg/l) (ppb)
Total trihalomethanes (TTHM)	80
Haloacetic acids (five) (HAA5)	60
Bromate	10
Chlorite	1000

Notes:
Source: MCB, Camp Lejeune, March 2002.

TABLE 3-7

SUMMARY OF WATER LEVEL MEASUREMENTS - FEBRUARY 26, 1996
SITE 75, MCAS BASKETBALL COURT
AIR STATION PA SITES
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Monitoring Well Number	Top of Casing Elevation (Ft. above msl)[1]	Depth to Groundwater (ft. Below top of casing)	Groundwater Elevation (Ft. above msl)[1]
75-GW01	17.2	6.05	11.15
75-GW02	19.56	7.36	12.2
75-GW03	19.83	7.74	12.09
75-GW04	12.77	3.91	8.86
75-GW05	14.25	4.54	9.71

Notes:

[1] Mean sea level

TABLE 3-8

SUMMARY OF WATER LEVEL MEASUREMENTS - FEBRUARY 26, 1996
SITE 76, MCAS CURTIS ROAD
AIR STATION PA SITES
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Monitoring Well Number	Top of Casing Elevation (ft. above msl)[1]	Depth to Groundwater (ft. below top of casing)	Groundwater Elevation (ft. above msl)[1]
76-GW01	18.92	8.31	10.61
76-GW02	10.27	4.31	5.96
76-GW03	12.43	5.28	7.15
76-GW04	16.56	5.36	11.20
76-GW05	16.60	7.67	8.93

Notes:

[1] Mean sea level

TABLE 3-9

SUMMARY OF WATER LEVEL MEASUREMENTS FOR MONITORING WELLS ON
DECEMBER 11, 1994, FEBRUARY 3-4 , 1995, AND MARCH 27, 1995
OPERABLE UNIT NO. 8 (SITE 16)
MONTFORD POINT PA SITES
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Well No.	Top of PVC Casing Elevation[1] (feet, above msl)	Depth to Groundwater (feet, below top of casing) (12/11/94)	Groundwater Elevation (feet, above msl) (12/11/94)	Depth to Groundwater (feet, below top of casing) (02/3-4/95)	Groundwater Elevation (feet, above msl) (02/3-4/95)	Depth to Groundwater (feet, below top of casing) (03/27/95)	Groundwater Elevation (feet, above msl) (03/27/95)
16-MW01	19.88	15.61	4.27	13.72	6.16	12.95	6.93
16-MW02	6.76	4.51	2.25	3.9	2.86	3.68	3.08
16-MW03	11.63	10.26	1.37	9.8	1.83	9.87	1.76
16-MW04	12.55	10.89	1.66	10.35	2.2	10.36	2.19
16-MW05	21.28	18.43	2.85	17.22	4.06	16.84	4.44
16-MW06	18.43	15.7	2.73	14.46	3.97	14.16	4.27

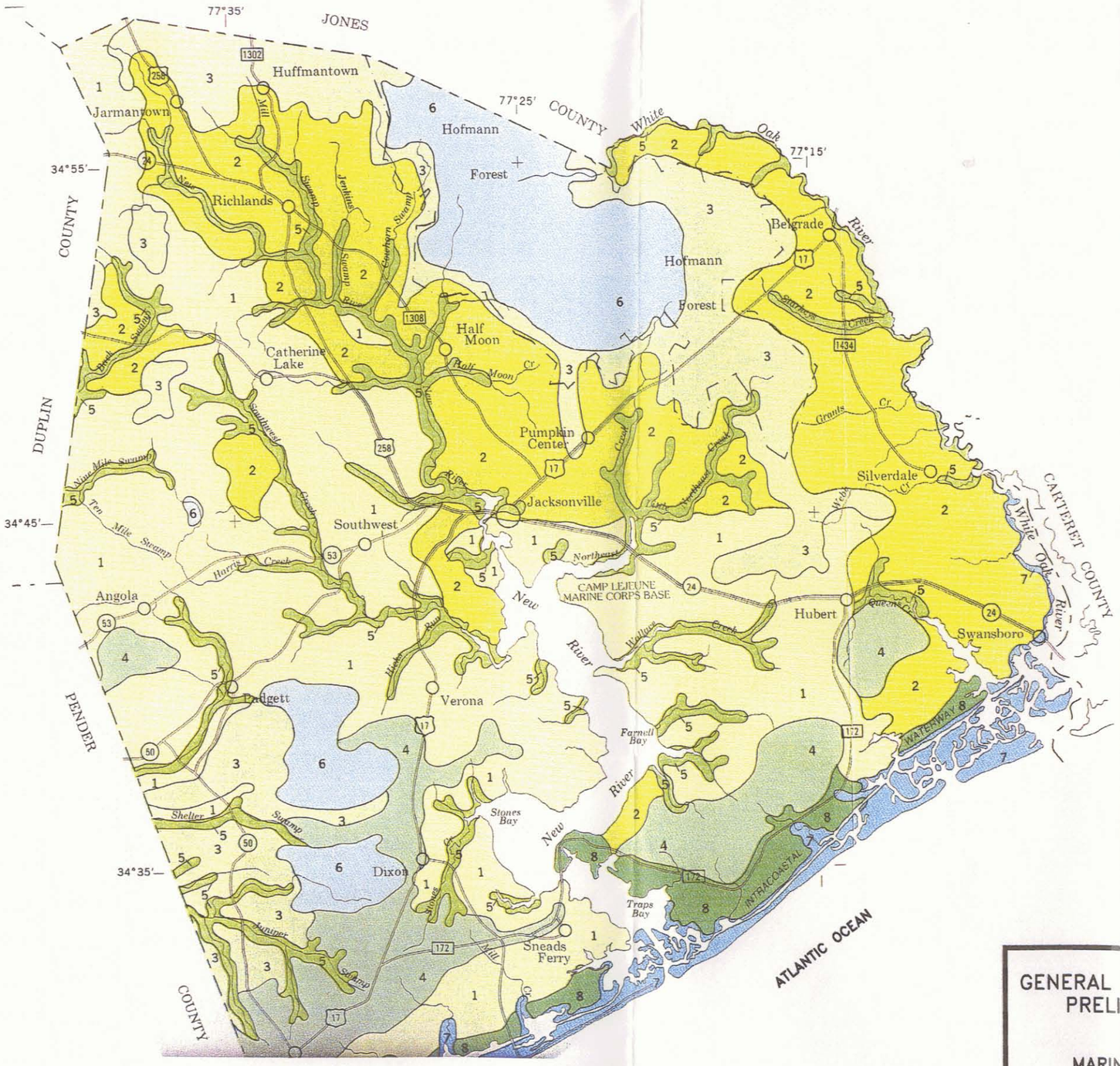
TABLE 3-10

AQUIFER CHARACTERISTICS - MONITORING WELLS
OPERABLE UNIT NO. 8 (SITE 16)
MONTFORD POINT PA SITES
PRELIMINARY ASSESSMENT SITES, CTO-0190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Well No.	Hydraulic Conductivity (K) (feet/day)	Hydraulic Gradient (i) (feet/feet)	Effective Porosity (n)	Groundwater Velocity (V) (feet/day)
16-MW01 (Rising Head)	10.19	0.003	0.35	0.09
16-MW02 (Rising Head)	6.09	0.003	0.35	0.05
16-MW02 (Falling Head)	3.46	0.003	0.35	0.03
16-MW03 (Rising Head)	1.07	0.003	0.35	0.01
16-MW04 (Rising Head)	13.02	0.003	0.35	0.11
16-MW05 (Rising Head)	3.34	0.003	0.35	0.03
16-MW05 (Falling Head)	2.74	0.003	0.35	0.02
16-MW06 (Rising Head)	7.68	0.003	0.35	0.07
16-MW06 (Falling Head)	6.34	0.003	0.35	0.05

FIGURES

2219539R



SOIL LEGEND

1. BAYMEADE-FORESTON-STALLINGS
2. NORFOLK-GOLDSBORO-ONSLOW
3. RAINS-WOODINGTON-TORHUNTA
4. LEON-MURVILLE-KUREB
5. MUCKALEE-DOROVAN
6. CROATAN
7. BOHICKET-NEWHAN
8. WANDO-PACTOLUS

Compiled 1990

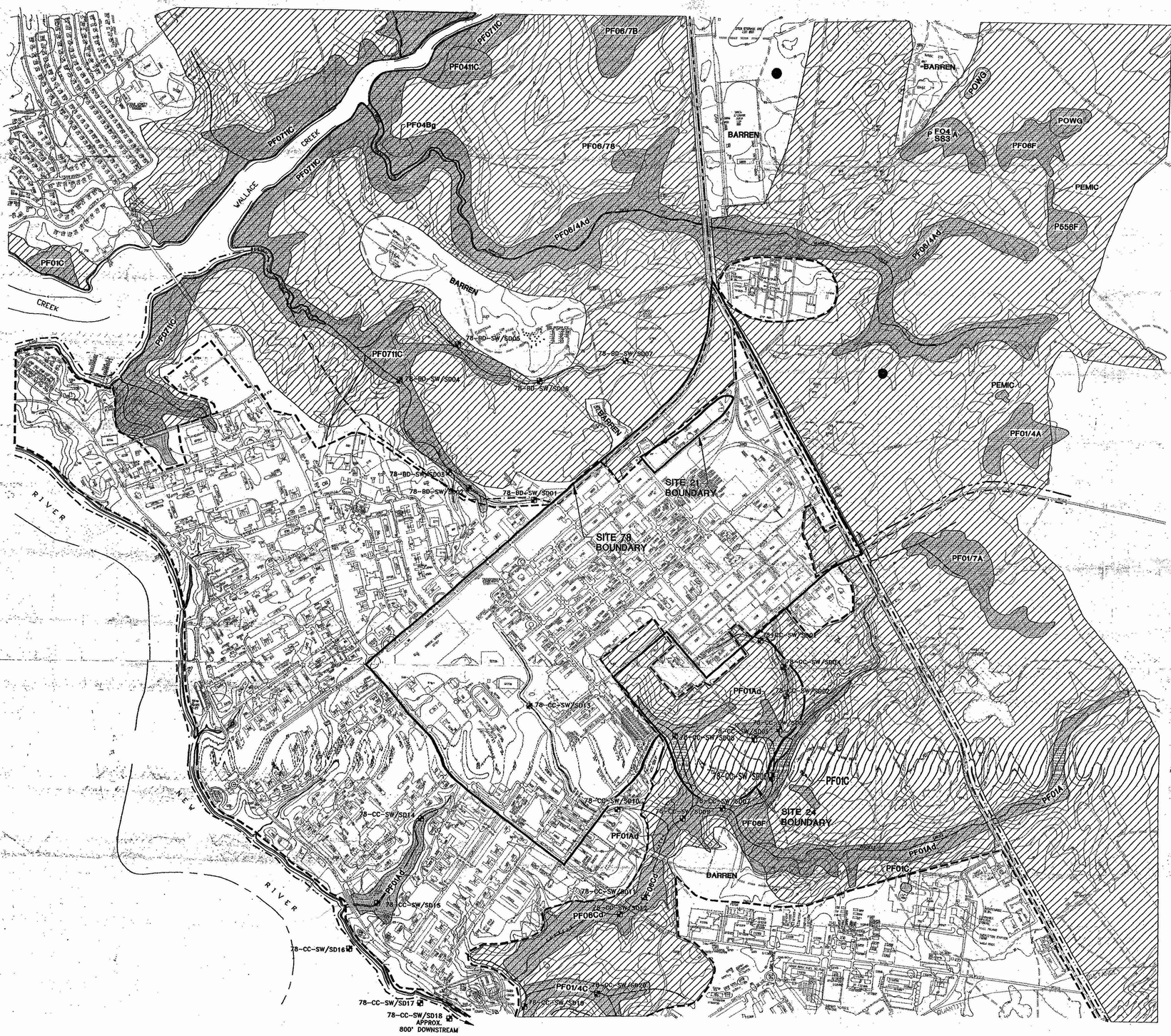
SOURCE: SOIL SURVEY OF ONSLOW CO., SCS, 1992.

Baker

Baker Environmental Inc.

FIGURE 3-1
GENERAL SOIL MAP OF ONSLOW COUNTY
PRELIMINARY ASSESSMENT SITES
CTO - 0190

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



WETLANDS KEY

SYSTEM	P – PALUSTRINE				
CLASS	RB–ROCK BOTTOM	UB–UNCONSOLIDATED BOTTOM	AB–AQUATIC BED	US–UNCONSOLIDATED SHORE	ML–MOSS LICHEN
SUBCLASS	1.BEDROCK 2.RUBBLE	1.COBBLE–GRAVEL 2.SAND 3.MUD 4.ORGANIC	1.ALGAL 2.AQUATIC MOSS 3.ROOTED VASCULAR 4.FLOATING VASCULAR 5.UNKNOWN SUBMERGENT 6.UNKNOWN SURFACE	1.COBBLE–GRAVEL 2.SAND 3.MUD 4.ORGANIC 5.VEGETATED	1.MOSS 2.LICHEN

SYSTEM	P – PALUSTRINE			
CLASS	EM–EMERGENT	SS–SCRUB SHRUB	FO–FORESTED	OW–OPEN WATER (UNKNOWN BOTTOM)
SUBCLASS	1.PERSISTENT 2.NONPERSISTENT	1.BROAD–LEAVED DECIDUOUS 2.NEEDLE LEAVED DECIDUOUS 3.BROAD–LEAVED EVERGREEN 4.NEEDLE–LEAVED EVERGREEN 5.DEAD 6.DECIDUOUS 7.EVERGREEN	1.BROAD–LEAVED DECIDUOUS 2.NEEDLE LEAVED DECIDUOUS 3.BROAD–LEAVED EVERGREEN 4.NEEDLE–LEAVED EVERGREEN 5.DEAD 6.DECIDUOUS 7.EVERGREEN	

LEGEND

- WILDLIFE FOOD PLOTS
- DEER MANAGEMENT ADAPTATION AREA
- QUAIL MANAGEMENT ADAPTATION AREA
- TURKEY MANAGEMENT ADAPTATION AREA
- WATERWAYS
- INDUSTRIAL/COMMERCIAL AREA
- WETLANDS
- FORESTED AREA
- 78–BD–SW/SD01 SURFACE WATER(SW)/SEDIMENT(SD) SAMPLE STATION

NOTE:
–THE FORESTED AREA IS COMPRISED PRIMARILY OF LOBLOLLY PINE AND LONGLEAF PINE. SLASH PINES AND SHORTLEAF PINES MAY ALSO BE PRESENT. HARDWOODS, SUCH AS WATER OAK, GREEN ASH, SWEETGUM, AND EASTERN COTTONWOOD ARE INTERMIXED WITH THE CONIFERS ALONG THE SURFACE WATER BODIES.
–THE RED–COCKADED WOODPECKER AND AMERICAN ALLIGATOR ARE ENDANGERED SPECIES FOUND AT CAMP LEJEUNE. HOWEVER THERE ARE NO KNOWN SIGHTINGS OF THESE SPECIES ON SITE O.U. #1.

DRAWN	RRR
REVIEWED	NCM
S.O.#	26007-190
CADD#	2190723P

NORTH

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

BAKER ENVIRONMENTAL, Inc.
Coraopolis, Pennsylvania

Baker

SITE 78
NWI / BIOHABITATION MAP
HPIA PA SITES
PRELIMINARY ASSESSMENT SITES, CTO - 0190

SCALE 800 0 400 800 — 1 Inch = 800 ft.

DATE APRIL 2002

SHEET NO. 3-2

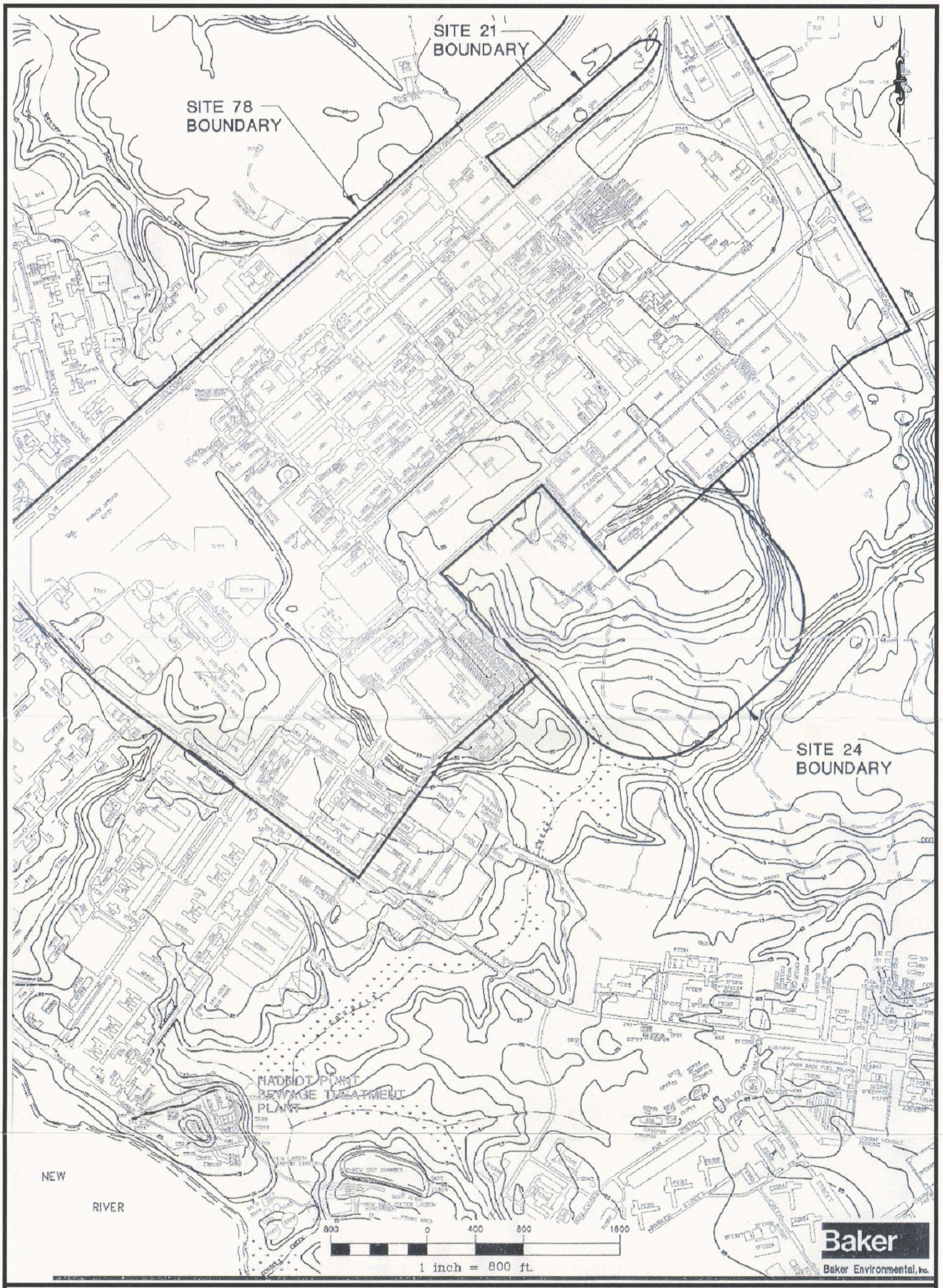


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FIGURE 3-2
SITE TOPOGRAPHY AND LAND FEATURES
OPERABLE UNIT No. 1
HPIA PA SITES
PRELIMINARY ASSESSMENT SITES, CTO-0190
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

2120345L

78-GW13 NA
78-GW20 NA
78-GW06 13.97
78-GW19 NA
78-GW14 19.01
78-GW05 17.73
78-GW07 NA
78-GW18 NA
78-GW08 15.67
78-GW15 18.98
78-GW09-1 16.91
78-GW10 15.66
78-GW17-1 19.24
78-GW40 21.19
78-GW23 21.72
78-GW24-1 25.04
78-GW04-1 19.16
78-GW22-1 (ABANDONED)
78-GW41 22.84
78-GW12 18.38
78-GW11 14.67
78-GW16 20.51
78-GW25 24.19
78-GW22A 24.51
78-GW01 NA
78-GW02 34.6
78-GW03 25.0
78-GW36 17.2
78-GW21 23.69
78-GW33 23.0
78-GW29 NA
78-GW37 NA
78-GW35 NA
78-GW38 NA
78-GW34 NA
78-GW39 4.11*

APPROXIMATE SITE BOUNDARY

SITE 78

SITE 24

UNNAMED TRIBUTARY TO CODGELS CREEK

HOLCOMB BOULEVARD
WEST ROAD
CHEMICAL STD. TANKS
COAL LANDING
CENTER ROAD
GIBB STREET
EAST ROAD
MICHAEL STREET
BIRCH ROAD
ASH STREET
HICKORY ROAD
LOUIS ROAD
OIL/WATER SEPARATOR
MT/CRD. BLDG.
OVERHD. SHELTER
WASH RACKS
'B' STREET
BRIDGE
DOUGLAS STREET
FRANKLIN STREET
'D' STREET
MT/ENG. BLDG.
FUEL ISLAND
DUNCAN STREET
R-BALL COURTS
METAL STORAGE SHED
TRANSFORMER CONDENSATE TANK

500 0 250 500
1 inch = 500 ft.

Baker

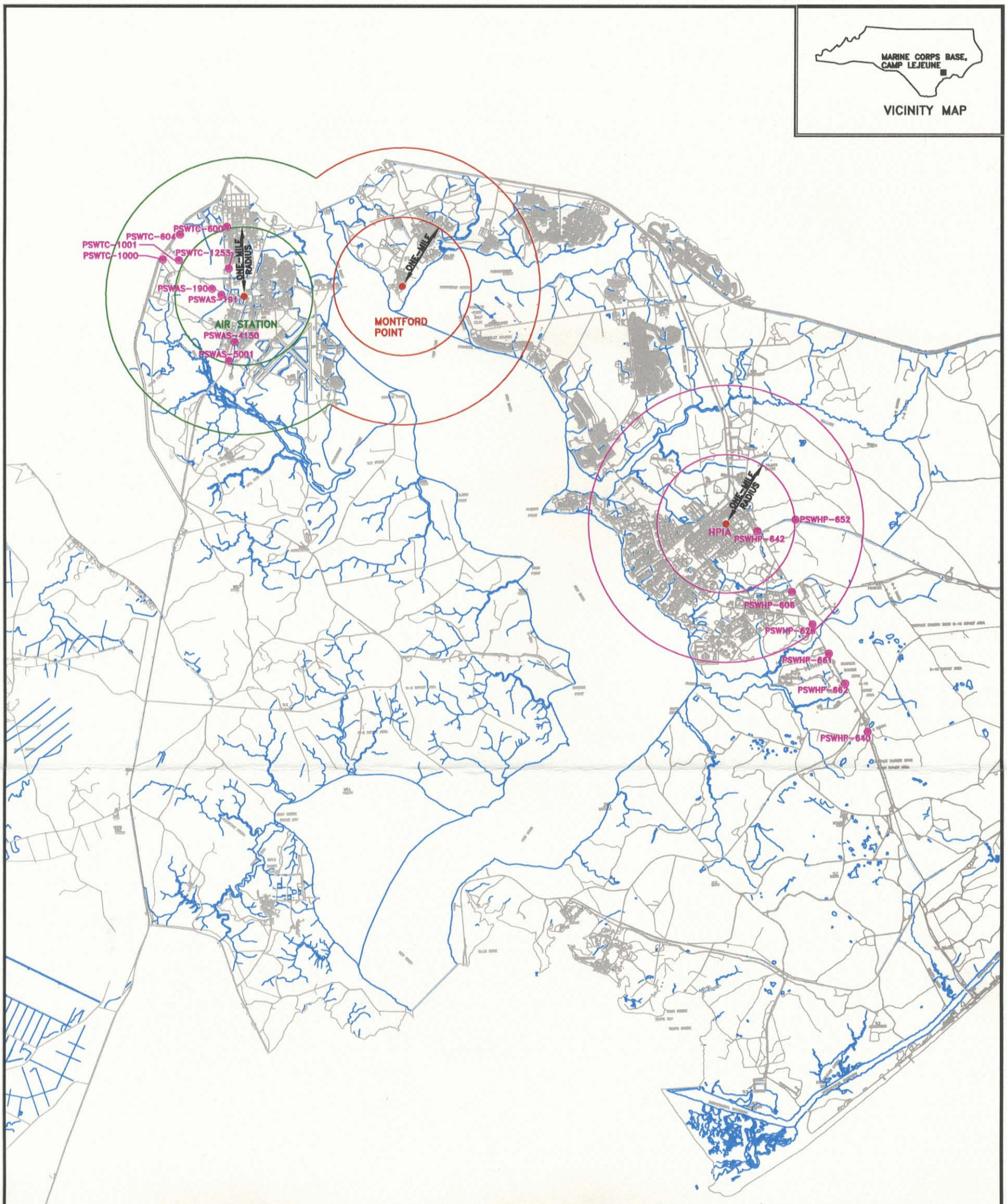
NOTES:

–WELLS SHOWN IN BLACK REGULAR FONT ARE NOT INCLUDED IN THE MONITORING PROGRAM.

LEGEND

- 78-GW04-1 — SHALLOW MONITORING WELL
- 19.18 — GROUNDWATER ELEVATION (MSL) MEASURED ON 01/15/00
- GROUNDWATER CONTOUR
- SHALLOW GROUNDWATER FLOW DIRECTION
- NA — DATA NOT AVAILABLE
- * — MEASUREMENTS NOT USED TO DETERMINE CONTOURS

FIGURE 3-3
GROUNDWATER CONTOUR MAP
SURFICIAL AQUIFER
OPERABLE UNIT NO. 1 – SITE 78
HPIA PA SITES
PRELIMINARY ASSESSMENT SITES, CTO – 0190
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



LEGEND

HP-704 DENOTES PA SITE AREA

POTABLE WATER SUPPLY WELLS THAT ARE CURRENTLY IN SERVICE

FIGURE 3-4
ACTIVE POTABLE WATER SUPPLY WELLS WITHIN A TWO-MILE RADIUS OF PA SITES PRELIMINARY ASSESSMENT SITES, CTO - 0190

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

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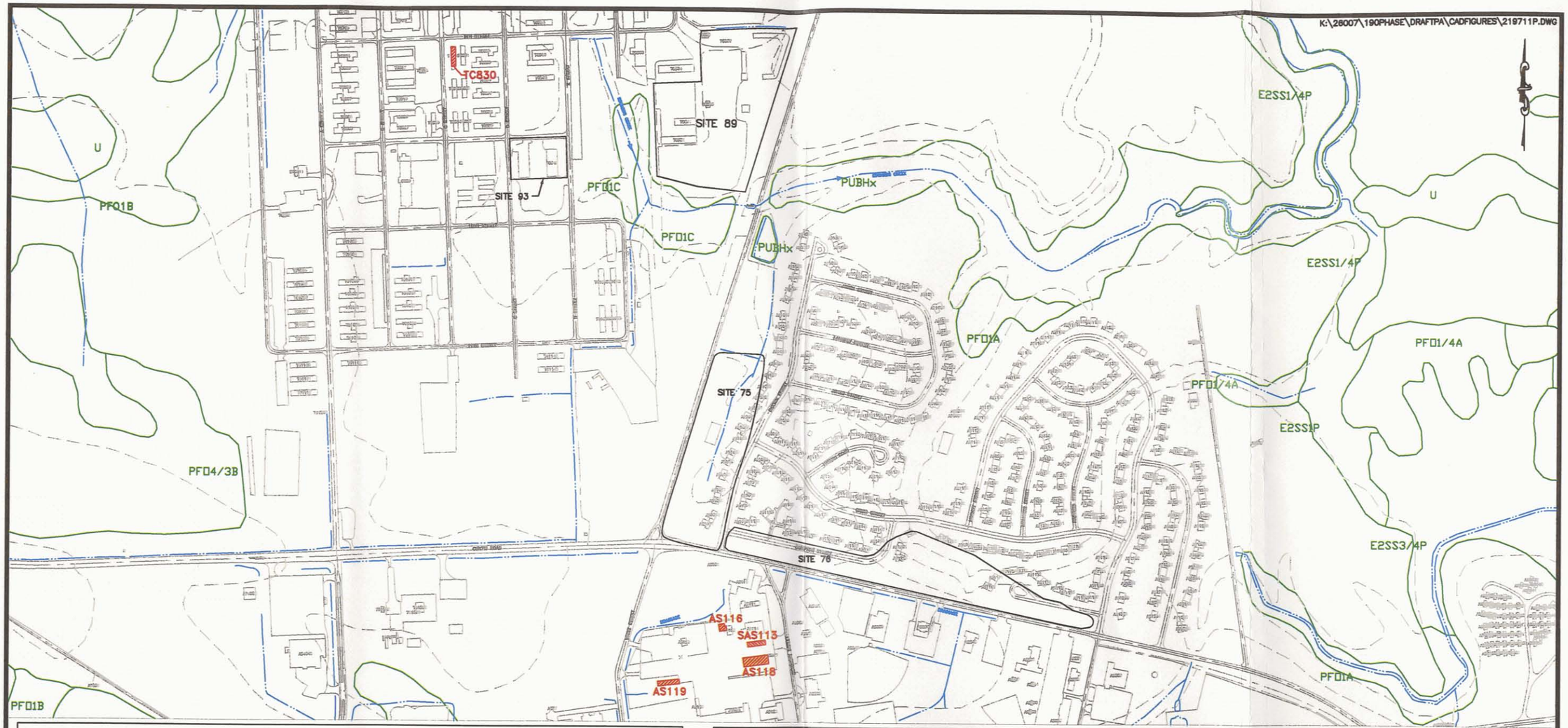


ECOLOGICAL SYSTEM	E – ESTUARINE			
ECOLOGICAL SUBSYSTEM	1 – SUBTIDAL	2 – INTERTIDAL		
CLASS	UB – UNCONSOLIDATED BOTTOM	EM – EMERGENT	SS – SCRUB / SHRUB	
SUBCLASS	1 Cobble / Gravel 2 Sand 3 Mud 4 Organic	1 Persistent 2 Nonpersistent 3 Narrow – leaved Nonpersistent 4 Broad – leaved Nonpersistent 5 Narrow – leaved Persistent 6 Broad – leaved Persistent	1 Broad – Leaved Deciduous 3 Broad – Leaved Evergreen 4 Needle – Leaved Evergreen 5 Dead 6 Deciduous 7 Evergreen	

ECOLOGICAL SYSTEM	P – PALUSTRINE			
CLASS	UB – UNCONSOLIDATED BOTTOM	EM – EMERGENT	SS – SCRUB / SHRUB	FO – FORESTED
SUBCLASS	1 Cobble / Gravel 2 Sand 3 Mud 4 Organic	1 Persistent 2 Nonpersistent 3 Narrow – leaved Nonpersistent 4 Broad – leaved Nonpersistent 5 Narrow – leaved Persistent 6 Broad – leaved Persistent	1 Broad – Leaved Deciduous 2 Needle – Leaved Deciduous 3 Broad – Leaved Evergreen 4 Needle – Leaved Evergreen 5 Dead 6 Deciduous 7 Evergreen	1 Broad – Leaved Deciduous 2 Needle – Leaved Deciduous 3 Broad – Leaved Evergreen 4 Needle – Leaved Evergreen 5 Dead 6 Deciduous 7 Evergreen

600 0 300 600

1 inch = 600 ft.

MODIFYING TERMS

In order to more adequately describe wetland and aquatic habitats one or more of the water regime, water chemistry, soil, or special modifiers may be applied at the class or lower level in the hierarchy. The farmed modifier may also be applied to the ecological system.

WATER REGIME (1)		WATER CHEMISTRY	SPECIAL MODIFIERS
Non Tidal	Tidal	Coastal Salinity	Coastal Salinity
A Temporary	K Artificial	1 Hyperhaline	b Beaver
B Saturated	L Subtidal	2 Euhaline	d Partially Drained/Ditched
C Seasonal	M Irregularly Exposed	3 Mixohaline (Brackish)	f Farmed
D Seasonal well drained	N Regular	4 Polyhaline	h Diked/Impounded
E Seasonal Saturated	P Irregular	5 Mesohaline	i Artifical
F Semipermanent	R Seasonal Tidal	6 Oligohaline	l Spoil
G Intermittantly Exposed	S temporary Tidal	0 Fresh	x Excavated
H permanent			

LEGEND

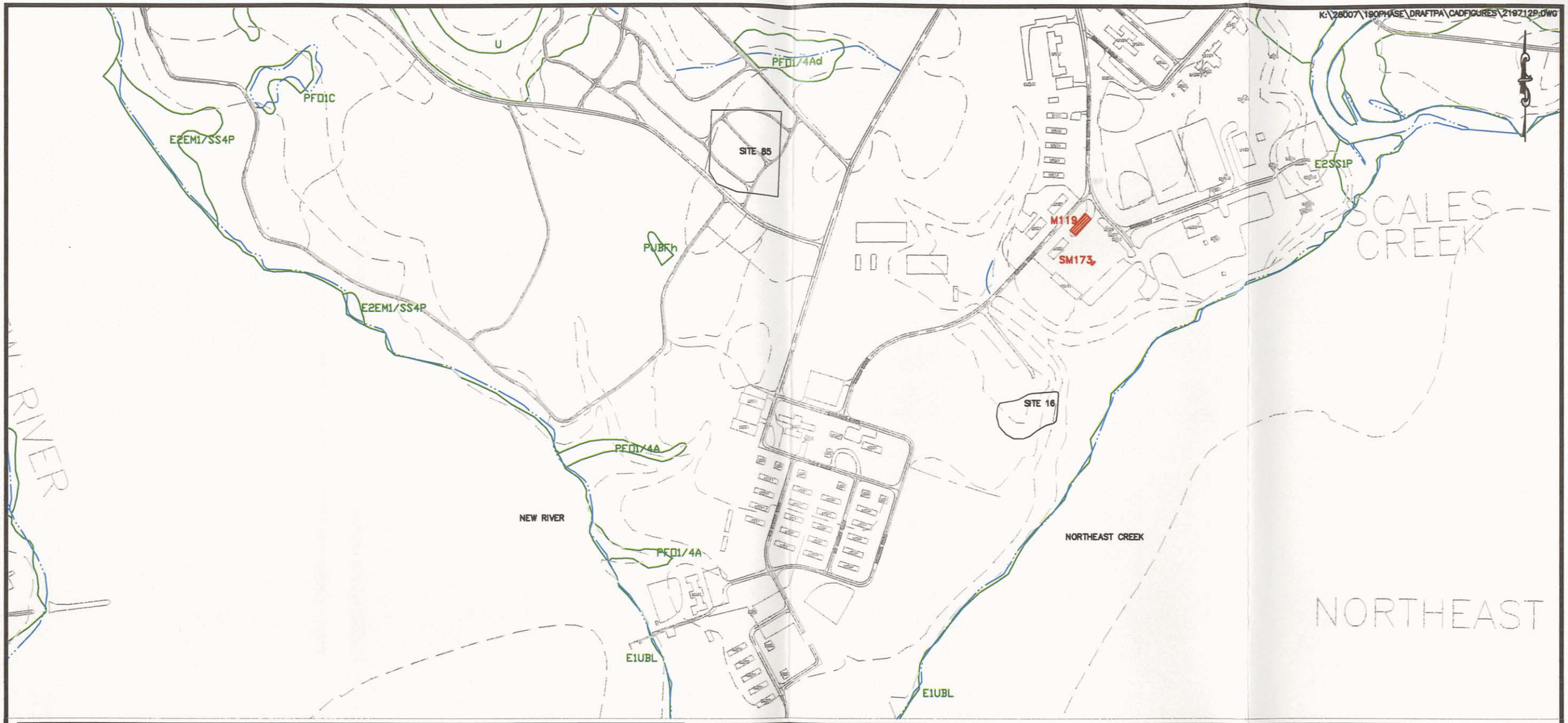
- PA SITE
- APPROXIMATE SITE BOUNDARY
- GROUND ELEVATION CONTOUR
- DIRECTION OF SURFACE WATER FLOW
- WETLAND BOUNDARY

SOURCE: MCB, CAMP LEJEUNE, MARCH 2000

Baker

FIGURE 3–3
WETLAND LOCATION MAP
AIR STATION PA SITES
PRELIMINARY ASSESSMENT SITES,
CTO – 0190
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

K:\26007\190PHASE\DRAFTPA\CADFIGURES\219712P.DWG



ECOLOGICAL SYSTEM	E – ESTUARINE		
ECOLOGICAL SUBSYSTEM	1 – SUBTIDAL	2 – INTERTIDAL	
CLASS	UB – UNCONSOLIDATED BOTTOM	EM – EMERGENT	SS – SCRUB / SHRUB
SUBCLASS	1 Cobble / Gravel 2 Sand 3 Mud 4 Organic	1 Persistent 2 Nonpersistent 3 Narrow – leaved Nonpersistent 4 Broad – leaved Nonpersistent 5 Narrow – leaved Persistent 6 Broad – leaved Persistent	1 Broad – Leaved Deciduous 3 Broad – Leaved Evergreen 4 Needle – Leaved Evergreen 5 Dead 6 Deciduous 7 Evergreen

MODIFYING TERMS

In order to more adequately describe wetland and aquatic habitats one or more of the water regime, water chemistry, soil, or special modifiers may be applied at the class or lower level in the hierarchy. The farmed modifier may also be applied to the ecological system.

WATER REGIME (1)		WATER CHEMISTRY	SPECIAL MODIFIERS
Non Tidal	Tidal	Coastal Salinity	Coastal Salinity
A Temporary	K Artificial	1 Hyperhaline	b Beaver
B Saturated	L Subtidal	2 Euhaline	d Partially Drained/Ditched
C Seasonal	M Irregularly Exposed	3 Mixohaline (Brackish)	f Farmed
D Seasonal well drained	N Regular	4 Polyhaline	h Diked/Impounded
E Seasonal Saturated	P Irregular	5 Mesohaline	i Artifical
F Semipermanent	R Seasonal Tidal	6 Oligohaline	s Spoil
G Intermittantly Exposed	S temporary Tidal	0 Fresh	x Excavated
H permanent			

ECOLOGICAL SYSTEM	P – PALUSTRINE			
CLASS	UB – UNCONSOLIDATED BOTTOM	EM – EMERGENT	SS – SCRUB / SHRUB	FO – FORESTED
SUBCLASS	1 Cobble / Gravel 2 Sand 3 Mud 4 Organic	1 Persistent 2 Nonpersistent 3 Narrow – leaved Nonpersistent 4 Broad – leaved Nonpersistent 5 Narrow – leaved Persistent 6 Broad – leaved Persistent	1 Broad – Leaved Deciduous 2 Needle – Leaved Deciduous 3 Broad – Leaved Evergreen 4 Needle – Leaved Evergreen 5 Dead 6 Deciduous 7 Evergreen	1 Broad – Leaved Deciduous 2 Needle – Leaved Deciduous 3 Broad – Leaved Evergreen 4 Needle – Leaved Evergreen 5 Dead 6 Deciduous 7 Evergreen

450 0 225 450

1 inch = 450 ft.

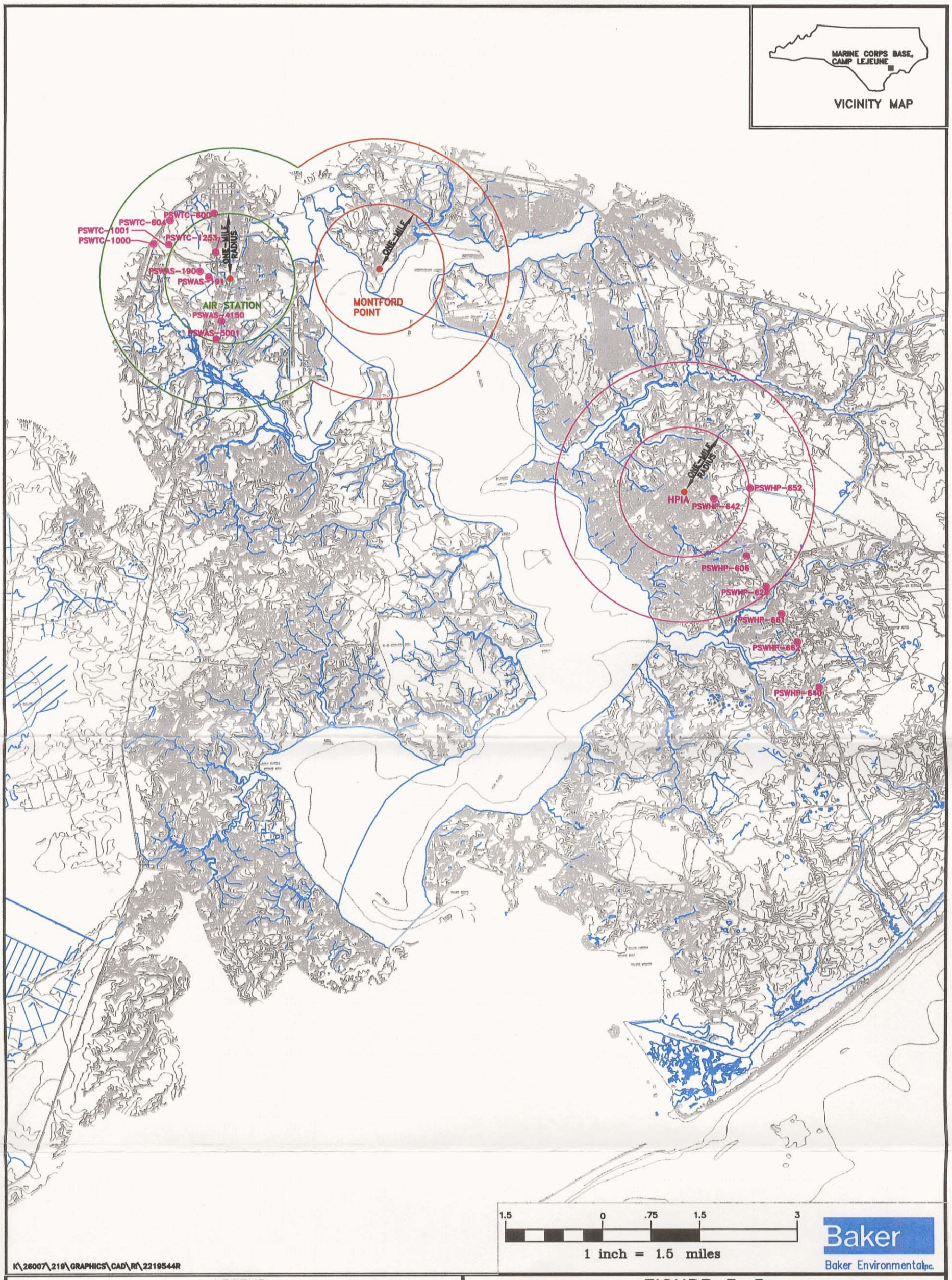
Baker

LEGEND

- PA SITE
- APPROXIMATE SITE BOUNDARY
- GROUND ELEVATION CONTOUR
- DIRECTION OF SURFACE WATER FLOW
- WETLAND BOUNDARY

SOURCE: MCB, CAMP LEJEUNE, MARCH 2000

FIGURE 3-4
WETLAND LOCATION MAP
MONTFORD POINT PA SITES
PRELIMINARY ASSESSMENT SITES, CTO – 0190
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



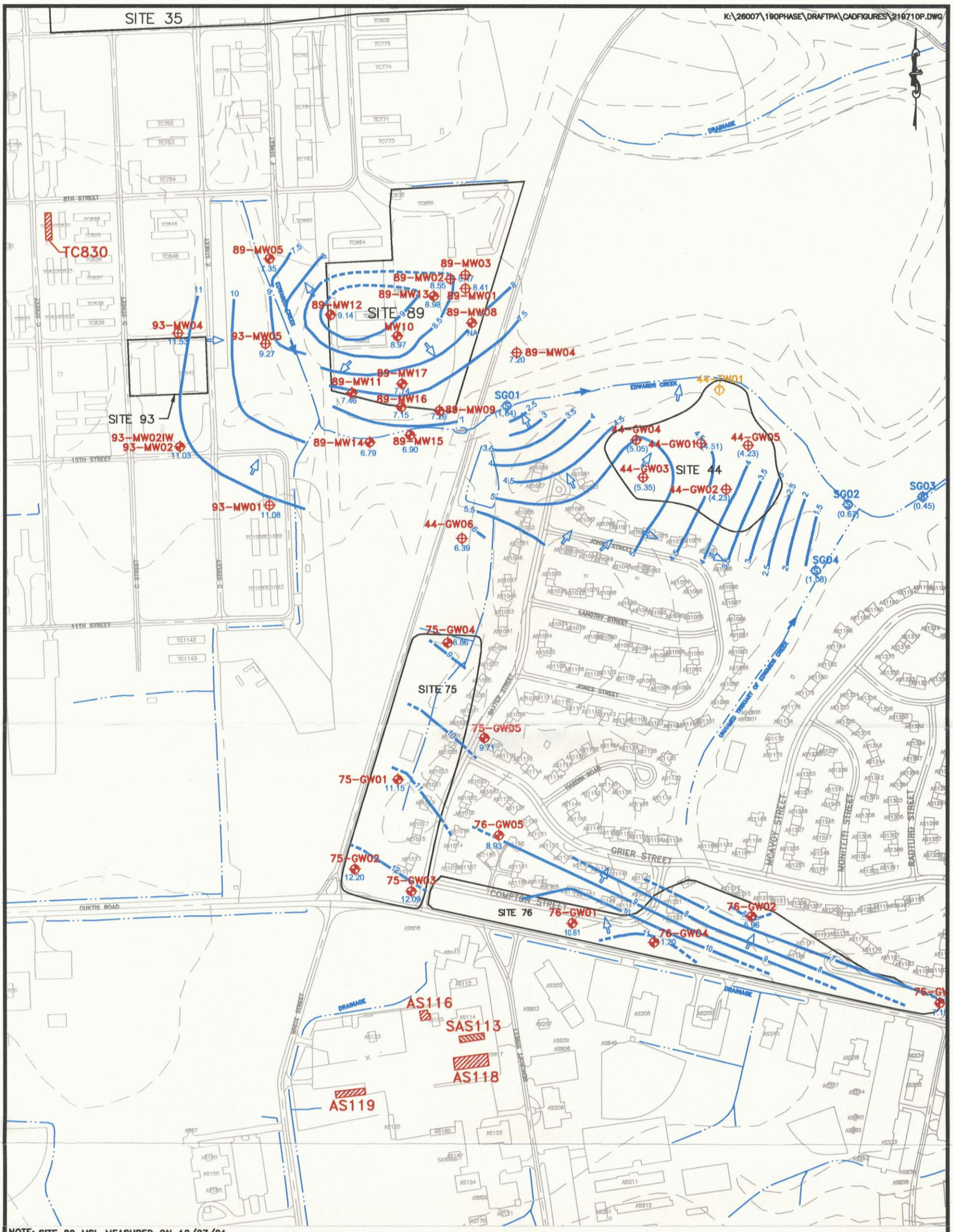
LEGEND

HP-704 DENOTES PA SITE AREA

POTABLE WATER SUPPLY WELLS THAT ARE CURRENTLY IN SERVICE

FIGURE 3-5
ACTIVE POTABLE WATER SUPPLY WELLS WITHIN A TWO-MILE RADIUS OF PA SITES PRELIMINARY ASSESSMENT SITES, CTO - 0190

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



NOTE: SITE 89 MSL MEASURED ON 10/27/01
SITE 93 MSL MEASURED ON 11/10/01
SITE 76 MSL MEASURED ON 2/26/96
SITE 75 MSL MEASURED ON 2/26/96
SITE 44 MSL MEASURED ON 8/95

SOURCE: MCB, CAMP LEJEUNE, MARCH 2000

400 0 200 400
1 inch = 400 ft.

Baker Environmental, Inc.

LEGEND

- PA SITE
- APPROXIMATE SITE BOUNDARY
- GROUND ELEVATION CONTOUR
- MONITORING WELL LOCATION
- DIRECTION OF SURFACE WATER FLOW
- DIRECTION OF GROUNDWATER FLOW
- 11.20 – GROUNDWATER ELEVATION, MSL
- -11- – GROUNDWATER CONTOUR, MSL
- PROJECTED GROUNDWATER CONTOUR

FIGURE 3-6
GROUNDWATER CONTOUR MAP
SURFICIAL AQUIFER
AIR STATION PA SITES
PRELIMINARY ASSESSMENT SITES, CTO - 0190

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

ECOLOGICAL SYSTEM	E – ESTUARINE		
ECOLOGICAL SUBSYSTEM	1 – SUBTIDAL	2 – INTERTIDAL	
CLASS	UB – UNCONSOLIDATED BOTTOM	EM – EMERGENT	SS – SCRUB / SHRUB
SUBCLASS	1 Cobble / Gravel 2 Sand 3 Mud 4 Organic	1 Persistent 2 Nonpersistent 3 Narrow – leaved Nonpersistent 4 Broad – leaved Nonpersistent 5 Narrow – leaved Persistent 6 Broad – leaved Persistent	1 Broad – Leaved Deciduous 3 Broad – Leaved Evergreen 4 Needle – Leaved Evergreen 5 Dead 6 Deciduous 7 Evergreen

ECOLOGICAL SYSTEM	P – PALUSTRINE			
CLASS	UB – UNCONSOLIDATED BOTTOM	EM – EMERGENT	SS – SCRUB / SHRUB	FO – FORESTED
SUBCLASS	1 Cobble / Gravel 2 Sand 3 Mud 4 Organic	1 Persistent 2 Nonpersistent 3 Narrow – leaved Nonpersistent 4 Broad – leaved Nonpersistent 5 Narrow – leaved Persistent 6 Broad – leaved Persistent	1 Broad – Leaved Deciduous 2 Needle – Leaved Deciduous 3 Broad – Leaved Evergreen 4 Needle – Leaved Evergreen 5 Dead 6 Deciduous 7 Evergreen	1 Broad – Leaved Deciduous 2 Needle – Leaved Deciduous 3 Broad – Leaved Evergreen 4 Needle – Leaved Evergreen 5 Dead 6 Deciduous 7 Evergreen

MODIFYING TERMS

In order to more adequately describe wetland and aquatic habitats one or more of the water regime, water chemistry, soil, or special modifiers may be applied at the class or lower level in the hierarchy. The farmed modifier may also be applied to the ecological system.

WATER REGIME (1)		WATER CHEMISTRY	SPECIAL MODIFIERS
Non Tidal	Tidal	Coastal Salinity	Coastal Salinity
A Temporary	K Artificial	1 Hyperhaline	b Beaver
B Saturated	L Subtidal	2 Euhaline	d Partially Drained/Ditched
C Seasonal	M Irregularly Exposed	3 Mixohaline (Brackish)	f Farmed
D Seasonal well drained	N Regular	4 Polyhaline	h Diked/Impounded
E Seasonal Saturated	P Irregular	5 Mesohaline	i Artifical
F Semipermanent	R Seasonal Tidal	6 Oligohaline	l Spoil
G Intermittantly Exposed	S temporary Tidal	0 Fresh	x Excavated
H permanent			

LEGEND

- PA SITE
- APPROXIMATE SITE BOUNDARY
- GROUND ELEVATION CONTOUR
- DIRECTION OF SURFACE WATER FLOW
- WETLAND BOUNDARY

SOURCE: MCB, CAMP LEJEUNE, MARCH 2000

DRAWN	/RRR
REVIEWED	NCM
S.O.#	26007-190
CADD#	2190724P

K:\26007\190PHASE\DRAFTPA\CADFIGURES\

NORTH

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

BAKER ENVIRONMENTAL, Inc.
Coraopolis, Pennsylvania

Baker

WETLAND LOCATION MAP
AIR STATION PA SITES
PRELIMINARY ASSESSMENT SITES, CTO - 0190

SCALE 1"=400'

DATE 4/26/02

FIGURE NO.

3-7

2120345L

78-GW13 NA
78-GW20 NA
78-GW06 13.97
78-GW19 NA
78-GW05 17.73
78-GW07 NA
78-GW14 19.01
78-GW18 NA
78-GW08 15.67
78-GW15 18.98
78-GW09-1 16.91
78-GW17-1 19.24
78-GW42 11.00
78-GW10 15.66
78-GW40 21.19
78-GW23 21.72
78-GW22-1 (ABANDONED)
78-GW24-1 25.04
78-GW04-1 19.18
78-GW41 22.84
78-GW12 18.38
78-GW11 14.67
78-GW16 20.51
78-GW25 24.19
78-GW01 NA
78-GW02 34.6
78-GW22A 24.51
78-GW03 25.0
78-GW36 17.2
78-GW21 23.69
78-GW33 23.0
APPROXIMATE SITE BOUNDARY
78-GW29 NA
78-GW37 NA
SITE 78
78-GW35 NA
78-GW38 NA
78-GW34 NA
SITE 24
78-GW39 4.11*
UNNAMED TRIBUARY TO CODGELS CREEK

500 0 250 500
1 inch = 500 ft.

Baker

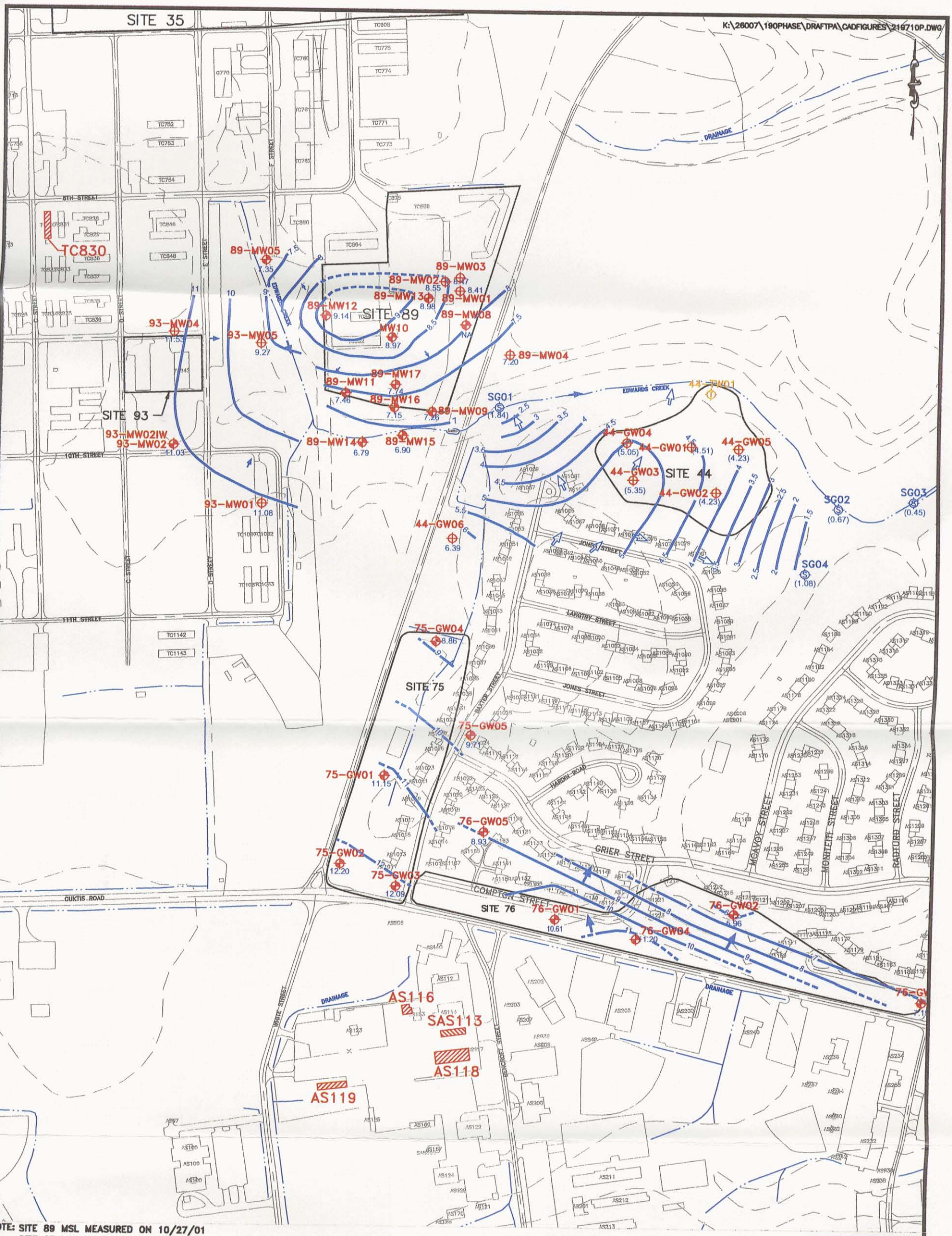
NOTES:

–WELLS SHOWN IN BLACK REGULAR FONT ARE NOT INCLUDED IN THE MONITORING PROGRAM.

LEGEND

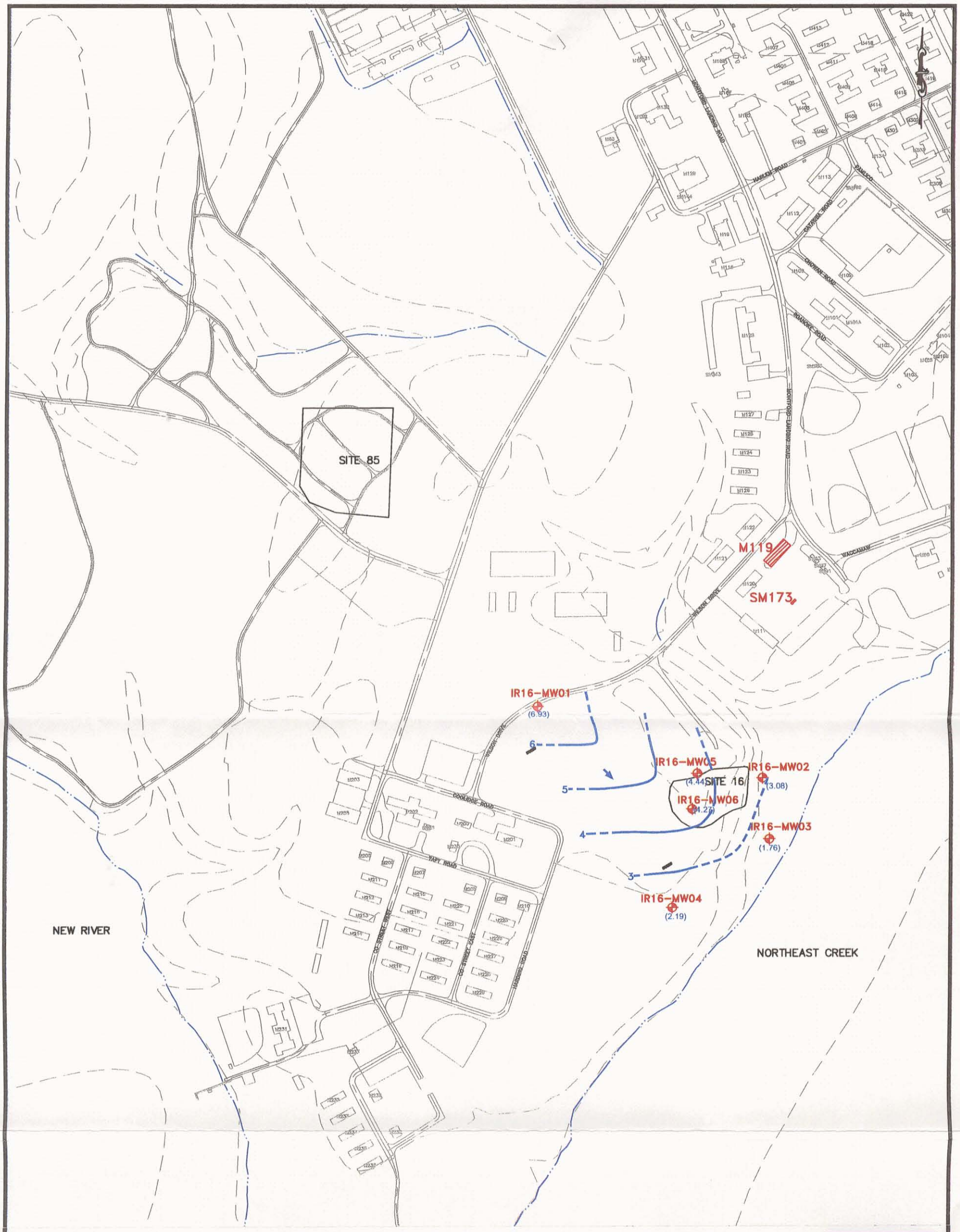
78-GW04-1	SHALLOW MONITORING WELL
19.18	GROUNDWATER ELEVATION (MSL) MEASURED ON 01/15/00
	GROUNDWATER CONTOUR
	SHALLOW GROUNDWATER FLOW DIRECTION
NA	DATA NOT AVAILABLE
*	MEASUREMENTS NOT USED TO DETERMINE CONTOURS

FIGURE 3-7
GROUNDWATER CONTOUR MAP
SURFICIAL AQUIFER
OPERABLE UNIT NO. 1 – SITE 78
HPIA PA SITES
PRELIMINARY ASSESSMENT SITES, CTO – 0190
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



Baker
Baker Environmental, Inc.

FIGURE 3-8
GROUNDWATER CONTOUR MAP
SURFICIAL AQUIFER
AIR STATION PA SITES
PRELIMINARY ASSESSMENT SITES, CTO - 0190
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



LEGEND

- PA SITE
- APPROXIMATE SITE BOUNDARY
- GROUND ELEVATION CONTOUR
- MONITORING WELL LOCATION
- DIRECTION OF SURFACE WATER FLOW
- –2– GROUNDWATER ELEVATION, MSL
- PROJECTED GROUNDWATER CONTOUR

SOURCE: MCB, CAMP LEJEUNE, MARCH 2000

FIGURE 3–9
CONTOUR LOCATION MAP
MONTFORD POINT PA SITES
PERLIMINARY ASSESSMENT SITES, CTO – 0190

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SECTION 4.0

4.0 SUMMARY OF FINDINGS

A preliminary assessment of 12 sites at Camp Lejeune has been completed. Six of the sites are located within OU No. 1 (Site 78) near areas that have been previously investigated through the IR, UST, or SWMU Programs. Four of the sites are located on the Air Station portion of the Base and two of the sites are located in the Montford Point portion of the Base, in areas that have not been previously investigated. The areas of most concern are those that have not been studied previously and/or are not included in an existing OU. The buildings at the Air Station and Montford Point portions of the Base have mainly been used as vehicle repair related facilities. Based on the information as presented in this report and suspected past material and waste handling practices at the Base, these areas have a potential to release hazardous materials to the environment. Detailed information was not found for most of the sites reviewed including wastes generated and waste disposal practices. Much of the basis for identifying the wastes in these facilities is the knowledge of the typical materials and wastes associated with the processes housed in these areas and that they generally contain potential contaminants.

Most of the sites were suspected to have stored solvents and waste oils resulting from operations such as vehicle related repair and storage. Other areas of concern focused on potential contamination from hazardous and flammable materials storage, and paint strippers (mineral spirits, toluene, acetone or MEK).

During the Environmental Literature Review, USTs and ASTs were identified that may have contained waste oils, gasoline or diesel fuel in the area of the PA Sites. A detailed discussion of the ASTs and USTs are included in Appendix C.

To qualitatively evaluate the potential impact of the 12 sites on human health and the environment, information on the regional and local geology, hydrogeology, population, and nearby sensitive environments was gathered and, along with the present site conditions, was evaluated with respect to four potential pathways (migration and exposure): groundwater, surface water, soil and air.

- Groundwater Migration Pathway - Of the four pathways, the groundwater migration exposure pathway has the greatest potential for being affected by contamination originating from the Camp Lejeune PA sites. Since the groundwater table is shallow (typically less then 10 feet below grade), contamination has a relatively limited distance

to migrate vertically before reaching the shallow groundwater system. The groundwater in this shallow aquifer is not used for drinking water purposes; therefore, there would not be any primary or secondary targets with this pathway.

The Upper Castle Hayne aquifer is found immediately below the surficial aquifer. However, the separation of the water table and the Castle Hayne is not always obvious. Often, this separation is effected only by the lower permeability material of the surficial water table aquifer transitioning to the significantly more permeable material of the Upper Castle Hayne; there is rarely a distinguishable low permeability unit acting as a aquitard to vertical migration of groundwater. This may increase the risk of contaminants penetrating into the Castle Hayne aquifer, which is the source that supplies the entire Base with potable water.

- Surface Water Migration Pathway - Due to the proximity of the PA Sites to the New River and its major tributaries and assumed surface water drainage pathways, the likelihood of release of contaminants to the surface water would have been high at the time of potential hazardous operation at the sites. The outfalls would have contributed various contaminants generated throughout the PA Sites to the surface water. Because the extent and type of contamination has not been determined, it is difficult to speculate whether contaminants could have impacted potential receptors in the past. Presently, the most likely potential surface water contamination is contributed to the surface water through groundwater recharge; however, further information would be needed to determine the potential impacts under this scenario. Since there are no surface water intakes downstream of the PA Sites to create a threat to drinking water, the likely potential targets would be limited to the human food chain through fishing activities, and sensitive environments.

- Soil Exposure Pathway - The soil exposure pathway has been exempted for the majority of the areas of concern identified at the PA Sites because asphalt and/or concrete cover the areas. Under CERCLA guidelines, sources with an impenetrable cover, regardless of thickness, are not considered under the soil exposure pathway. This pathway has been considered exempt for all the areas of concern, with the exception of grass or soil covered sections.

- Air Migration Pathway - The significance of the air migration pathway is contingent on whether hazardous substances are likely to be migrating from the sites to the air. Again, due to the extensive surface cover at the majority of the areas of concern and the nature of contaminants at the areas identified as potential migration sites, it is considered unlikely that any hazardous substances could migrate through asphalt and/or concrete to the air.

In conclusion, the pathway of greatest concern is groundwater. Surface water also poses a significant threat as a potential hazardous substance pathway at the Base. Soil and air are less likely to serve as pathways for contaminants at the Camp Lejeune PA Sites.

Analytical data to document evidence of releases and exposure of targets were not available for review. Therefore, historical and accessible information as well as professional judgment were relied upon to develop the hypotheses within this report.

SECTION 5.0

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the data collected and evaluated for the 12 sites of concern identified throughout the Base, the present condition of the sites indicates that there should be little, if any, impact on the people living on and working in the areas evaluated. However, CERCLA guidelines emphasize the need to exercise conservative judgement with respect to additional investigations in the absence of definitive proof concerning the nature and extent of potential contamination associated with any of the sites. Because information is not known for the majority of the sites about the possible types and or extent of contamination, initial field investigation activities should be completed at the following seven sites:

HPIA

- Building HP1120
- Building HP1409
- Former Building HP1512

Air Station

- Building SAS113
- Building AS116
- Building AS119

Montford Point

- Building M119

Field investigation activities might include as appropriate:

- Collection and analysis of surface and subsurface soil samples - to assess whether soils contain contamination.

- Collection and analysis of groundwater samples - to determine if local groundwater quality has been affected by past site operations.

The field investigation activities would be limited to the identified areas of concern. The information obtained during a field investigation would aid in confirming the presence or absence of contamination and to confirm the identified migration and exposure pathways.

Investigations into these sites should also direct any non-CERCLA issues to the appropriate RCRA regulatory programs as identified in Appendix C.

The following discussion provides the conclusions and recommendations for the 12 sites studied. Conclusions and recommendations are based on the information presented throughout this PA Report, including the operational history and waste assessment, and pathway and environmental hazard assessment.

5.1 HPIA Sites

5.1.1 Building HP902

Based on the findings of previous investigations, building HP902 has been thoroughly assessed through numerous investigations as mentioned previously and does not warrant additional investigation. As presented in Appendix F, a former UST containing TCE was determined near Building HP903. Currently, a pump and treat system and a LTM program are in place in this area of contamination as stipulated in the ROD for OU No. 1 (Baker, September 1994). Investigations performed in this area include a soil gas investigation, soil borings analyzed during both the CS and the RI, a geophysical investigation, and installation and sampling of monitoring wells and recovery wells.

5.1.2 Building HP908

Further investigations are not warranted for Building HP908. Based on the analytical results from the RI (Baker, June 1994) as presented in Appendix F, the area of Building HP908 was determined not to contain VOCs, SVOCs, PCBs, or pesticides. Studies performed during the RI at Building HP908 include a soil gas investigation, soil boring analyses, and monitoring well installation and sampling.

5.1.3 Building HP1120

Building HP1120 may be a source of potential contamination based on past use and previous disposal practices at the Base. Building HP1120 has been used as an Auto Hobby Shop since the 1950s. Known wastes used or stored in this building include automotive grease, oil, waste oils, and paint. There is also an AST in this building that may contain waste oil. No known investigations have been performed at Building HP1120. During the site visit a hazardous waste storage structure was identified near this building and Building HP1124 in the parking lot. From the picture there is evidence of staining. It is recommended that Building HP1120 and the associated AST and hazardous waste structure be studied further to determine possible contamination surrounding this area.

5.1.4 Building HP1124

Investigations through the SWMU program determined that the AST in Building HP1124 would not require further investigations; however, temporary wells are currently being installed (March/April 2002) near the oil/water separator at Building 1107. Based on the current findings of the SWMU program, as provided in Appendix H.1, Building HP1124 does not require further investigation. If, however, contaminants are identified from the on-going SWMU investigation, future actions may be warranted through the RCRA Program.

5.1.5 Building HP1409

It is recommended that the area surrounding Building HP1409 and the area of the 550 gallon vat of paint stripper and the random AST storage area, be further investigated to determine potential contamination. Building HP1409 was constructed in the 1940s and has been used as a upholstery and carpentry shop, a decontamination building, a storage building, and a furniture repair shop. Painting was also conducted at this building and a number of wastes including paint stripper, hydraulic fluid, penetrating fluid, and gear case oil have been used or stored here. There is a 550 gallon vat of paint stripper that was used or may still be used in this building. Paint stripping chemicals can include any of the following products: mineral spirits, toluene, MEK, or acetone. There are no known investigations that have been performed at Building HP1409, although a number of investigations have been performed at neighboring buildings southwest of Building HP1409. During the site visit a number of ASTs and containers were identified adjacent to

Building HP1409 as shown in Appendix B, Photo 26. The contents and capacity of these ASTs and containers are unknown.

5.1.6 Building HP1512

It is recommended that former Building HP1512 require further investigations to determine if contamination exists. Information for the former structure HP1512 is unknown. No records have been found to document the operational history of the building. It is assumed that this former structure was used as a vehicle support structure. There are also no known waste characteristics for this structure. No known previous samples have been collected in the area of the former Building HP1512, except for groundwater from monitoring well IR78-GW11 that is located across Hammond Street. Lack of information of this former structure leaves unanswered questions concerning types of wastes that may have been generated, used, or disposed of in this area.

5.2 Air Station Sites

5.2.1 Building TC830

TC830 is not recommended for further investigation. No information was found during the Environmental Literature Review or field reconnaissance to indicate that any hazardous wastes were used or disposed of at Building TC830. The Environmental Literature Review verified that this facility did not perform dry cleaning operations, and therefore, dry cleaning chemicals are not suspected at this building.

5.2.2 Building SAS113

Based on the lack of information and the known operations (vehicle repair) performed in this building it is recommended that Building SAS113 requires further investigation to determine if contamination exists. Records of chemicals/compounds used or stored in Building SAS113 were not found during the Environmental Literature Review. Since this is a vehicle support area, it is suspected that any number of automobile repair wastes are used or stored here and may include the following: paints, paint thinners, waste oil, antifreeze, parts cleaning wastes (solvents and parts washers), automotive batteries, and shop cleaning wastes (floor cleaning wastes, absorbents used for spills or leaks and shop rags). The waste disposal practices are also unknown at this

structure. No known investigations have been performed at Building SAS113. Lack of information for Building SAS113 leaves unanswered questions concerning types of wastes that may have been generated, used, or disposed of in this area.

5.2.3 Building AS116

Based on the lack of information and the known operations (vehicle repair, painting, hazardous and flammable storage) that were performed in this building it is recommended that Building AS116 require further investigations to determine if contamination exits. Records of chemical/compounds used or stored in Building AS116 were not found during the Environmental Literature Review. Since this is a vehicle support area, it is suspected that any number of automobile repair wastes are used or stored here and may include the following: waste oil, antifreeze, parts cleaning wastes (solvents and parts washers), automotive batteries, and shop cleaning wastes (floor cleaning wastes, absorbents used for spills or leaks and shop rags). This building is also listed as a paint shop and may include the following wastes associated with painting: paint thinners (mineral spirits, toluene, MEK or acetone) and waste paint.

In addition to supplying vehicle support, this area was also used to store hazardous and flammable materials. There are no records of the types of hazardous and flammable materials stored in Building AS116. The waste disposal practices are also unknown at Building AS116. No known investigations have been performed at Building AS116. Lack of information for Building AS116 leaves unanswered questions concerning types of wastes that may have been generated, used, or disposed of in this area.

5.2.4 Building AS119

Based on the lack of information and the known operations (vehicle repair) that were performed in this building it is recommended that Building AS119 require further investigations to determine if contamination exists. Records of chemicals/compounds used or stored in Building AS119 were not found during the Environmental Literature Review. Since this is a vehicle support area it is suspected that any number of automobile repair wastes are used or stored in this building and may include the following: paint, paint thinners, waste oil, antifreeze, parts cleaning wastes (solvents and parts washers), automotive batteries, and shop cleaning wastes (floor cleaning wastes, absorbents used for spills or leaks and shop rags). Lack of information for

Building AS119 leaves unanswered questions concerning types of wastes that may have been generated, used, or disposed of in this area.

5.3 Montford Point Sites

5.3.1 Building M119

Based on the amount of potential contaminants that were used at Building M119, it is recommended that this building be investigated further to determine if contamination exists from past operations. Known chemicals/compounds that were used or stored in Building M119 include solvents, waste oils, gasoline, and vehicle repair related materials.

Potential vehicle repair related materials used or stored at this building may include paint and paint thinners, parts cleaning wastes (solvents and parts washers), automotive batteries, automotive oils, and shop cleaning wastes (floor cleaning wastes, absorbents used for spills or leaks and shop rags). Potential gun preservation materials may have also been used at this building during the time the building served as a gun storage area.

Known disposal practices with estimated waste quantities are listed on Table 2-18. As shown, the records indicated that in 1945 trash was collected Base wide (general refuse) daily and hauled to incinerators or open burn dumps. Waste oils (including solvents) were sprayed on unimproved roads on the Base, and solvents used in Building M119 were disposed of via the Safety Kleen Company. In addition, waste oils from both Buildings M119 and M120 were deposited into a UST at an estimated rate of 2,045 gallons annually. A gasoline spill was reported in 1975 when a UST at this building overflowed, and was subsequently cleaned by Base Maintenance personnel (refer to Appendix F.13 for a copy of the spill report). Recommendations regarding the waste oil UST and the fuel oil ASTs that are used to heat the building are included in Appendix C.

5.3.2 Building SM173

It is recommended that since the area of former structure SM173 is currently under investigation through the SWMU program, further investigation through the IR program are not warranted. Former Building SM173 was a small shed that was constructed in 1962 and was used to house a Steam Jenny. Currently, there is a vehicle wash rack and an oil/water separator in this area that is being investigated through the SWMU program as presented in Appendix H, SM173.

6.0 PA SITES FIELD INVESTIGATION

Based on the conclusions and recommendations of this Report, it was decided by the MCB, Camp Lejeune Partnering Team at the April 2002 Partnering meeting to further investigate the HPIA PA Sites (Buildings 1120, 1409 and 1512) during a field investigation at Site 78 that was performed in June 2002. Likewise, the Partnering Team decided at the April 2004 meeting to further investigate the Air Station and Montford Point PA Sites (SAS113, AS116, AS119, M119, and M315). Building M315 was added as a site to be investigated since it was thought that the facility operated as a dry cleaner. No records were found to indicate dry cleaner operations; however, the building was used as a laundry pick up facility until around the 1980s. It was also decided to document the findings of the PA Sites investigation within this PA/SI Report. The objectives of the Partnering Team were met and used to guide the investigation, including identification of locations for sampling and laboratory analytical parameters.

The PA Sites field investigation activities consisted of a soil and groundwater investigation. The focus of the investigation was in the soil and groundwater immediately adjacent to Buildings 1120, 1409 and 1512 within the HPIA; Buildings SAS113, AS116, and AS119 within the Air Station; and M119 and M315 within Montford Point. Field activities were conducted over two field events. The HPIA field event took place from July 1 to 2, 2002, while the Air Station and Montford Point field activities took place June 7 to 11, 2004. The following sections detail the field investigation activities and the findings of the analytical data.

6.1 Surface and Subsurface Soil Investigation

HPIA

The HPIA PA Sites soil investigation within Site 78 consisted of direct push sampling using the Geoprobe® sampling system. Soil samples were collected using a "Macro-Core sampler", a 48-inch long, stainless-steel tube with a 2-inch outside diameter. A 1-1/2-inch inside diameter cutting shoe is threaded to the base of the tube. The macro-core soil samples were collected in a 45-inch long by 1-1/2-inch diameter acetate liner that is inserted into the tube. Soil samples were collected near the water table using the "Macro-Core sampler" and acetate sleeves.

Soil samples were collected from 9 soil borings (3 borings around each building). From each soil boring, samples were collected from two intervals from approximately 0-3 ft and 7-10 ft bgs as

shown on Table 6-1. Soil samples were sent to a fixed base laboratory and analyzed for TCL VOCs, SVOCs, and TAL metals in accordance with Contract Laboratory Protocol (CLP).

Air Station and Montford Point

The soil investigation at the Air Station and Montford Point PA Sites consisted of direct push technology (DPT) using the Geoprobe® sampling system as described above. Soil samples were collected using the "Macro-Core sampler" and acetate sleeves. Soil samples were collected from four soil borings at each PA Site (one boring on each side of the subject building). Samples were collected from each soil boring in the vadose zone from approximately 0-4 ft bgs as listed in Table 6-1 and sent to a fixed base laboratory for TCL VOC, TCL SVOC, TAL metals, and TCL pesticides/PCBs analyses.

6.2 Groundwater Investigation

HPIA

A groundwater investigation was also performed at the three HPIA PA Sites (Buildings 1120, 1409 and 1512) to assess the presence or absence of contamination in the aquifer, which may have resulted from past site activities. The activities associated with the groundwater investigation included temporary monitoring well installation and groundwater sampling.

Nine temporary monitoring wells were installed at the same locations as the Geoprobe® soil borings. The temporary wells were constructed utilizing a 10 foot screen length which was installed to an approximate depth of 30 feet bgs. The wells were constructed using a 2-inch diameter, schedule 40 polyvinyl chloride (PVC) riser and screen (0.01-inch slots).

Groundwater samples were obtained using USEPA Region IV's low flow purging and sampling technique. This technique requires that the groundwater be purged at less than 0.33 gpm by means of either a submersible or peristaltic pump. In this case, Baker personnel utilized a peristaltic pump system. A dedicated length of polyethylene tubing was used for each well sampled. This tubing was disposed following completion of well sampling activities. While the well was being purged, pH, conductivity, temperature and turbidity measurements were obtained. Water quality data are provided on Table 6-2. Once water quality readings (excluding turbidity) stabilized (i.e., two consecutive readings within 10% of each other), a groundwater sample was collected at the same flow rate used for the well purge. Groundwater samples were sent to a fixed base laboratory and analyzed for TCL VOCs, SVOCs, and TAL metals in accordance with CLP as shown on Table 6-3.

Air Station and Montford Point

During the June 2004 field event, a groundwater investigation was also conducted at the Air Station and Montford Point PA Sites. The sample locations were the same as the locations sampled for the soil investigation. Discrete groundwater samples were collected by directly advancing the DPT rod into the water table to a depth of approximately 10 ft bgs at each sample location and extracting samples through a "retractable" screen. Samples were collected with new, clean polyethylene tubing at each sample location utilizing a peristaltic pump. Groundwater samples were sent to a fixed base laboratory and analyzed for TCL VOCs, SVOCs, pesticides/PCBs, and TAL metals in accordance with CLP as shown on Table 6-3.

6.3 Nature and Extent of Contamination

This section presents the results of the PA Sites field investigation at the HPIA, Air Station, and Montford Point. The objectives of this section are to confirm the presence or absence of contamination at Buildings 1120, 1409 and 1512 within Site 78; Buildings SAS113, AS116, and AS119 within the Air Station; and M119 and M315 within Montford Point. The positive detection summary tables and detection figures referenced in the text are presented at the end of Section 6.0. A complete summary of the analytical data is included in Appendix K.

6.3.1 Data Quality and QA/QC

Analytical data generated during the PA Sites Field Investigation were submitted for third-party validation to Environmental Data Services, Inc. of Concord, New Hampshire.

Three trip blanks were prepared during the HPIA soil and groundwater investigation. Concentrations of methylene chloride and styrene were detected in the trip blank samples, however no environmental samples had any detections of either methylene chloride or styrene. Six trip blanks were prepared during the June 2004 investigation at the Air Station and Montford Point sites; there were no detections of VOCs, SVOCs, pesticides, PCBs, or total metals. Laboratory analytical results for the trip blanks are included in Appendix K.

6.3.2 Non-Site Related Analytical Results

Many inorganic constituents detected in the soil and groundwater at the PA Sites can be attributed to non-site related conditions or activities. The primary source of non-site related results include naturally occurring inorganic elements. In addition, non-site related operational activities and conditions might contribute to "on-site" contamination. A discussion of naturally occurring inorganic elements is included below.

6.3.2.1 Naturally-Occurring Inorganic Elements

To differentiate inorganic contamination due to site operations from naturally occurring inorganic elements in site media, the results of the sample analyses were compared to information regarding background conditions at MCB, Camp Lejeune. The Final Base Background Study Report for Soil prepared for MCB Camp Lejeune, North Carolina was used for comparison of soil environmental samples collected at the PA Sites to the background metals in soil in this report (Baker, 2001). The Draft Base Background Study Report for Groundwater for MCB, Camp Lejeune, North Carolina was used for comparison of groundwater samples collected at the PA Sites to the background metals in groundwater in this report (Baker, August 2002).

A brief discussion of background sample set and comparison criteria are discussed in the paragraphs that follow. The Final Base Background Study Report for Soil (Baker 2001) and the Draft Base Background Study for Groundwater (Baker, August 2002) present the complete details on the rationale of choosing background sample locations, method of collection and detailed discussions of analytical results.

The base background soil analytical data was divided into five categories based on soil type and depth of sample interval. These categories include surface soil fine sands, surface soil loams, subsurface soil sand, subsurface soil silt, and subsurface soil clay. Different soil types can exhibit different concentrations of inorganic compounds. The purpose of these divisions was to compare data sets of similar soil types. Surface and subsurface soils of different soil types have properties that effect ion attraction and retention. Typically clays exhibit higher inorganic concentrations. The soil samples taken at the PA Sites were compared to the base background numbers by sample depth with an average of the soil types for each surface and subsurface samples, since soil lithography is not documented for the soil samples collected at the PA Sites, and the known soils

at Site 78 tend to vary from fine sands to loamy fine sands in the surface soil and silty sands and clays in the subsurface soil.

The base background groundwater analytical data was divided into two categories based on the depth of the groundwater sample interval. The two categories are shallow groundwater (10-25 ft bgs) and deep groundwater (20 to 42 ft bgs). Different aquifer characteristics can exhibit different concentrations of inorganic compounds. The purpose of these two divisions was to compare data sets of similar aquifer types. Shallow groundwater and deep groundwater have properties that effect ion attraction and retention (similar to the above paragraph for soils). The groundwater samples taken at the HPIA PA Sites were compared to the base background numbers for the deep groundwater, since the temporary monitoring wells were screened at depths of 30 ft bgs. The groundwater data from the Air Stations and Montford Point sites were compared to the base background numbers for the shallow groundwater since samples were collected at depths ranging from approximately 6 to 20 ft bgs.

Tables 6-4 (surface soil), 6-5 (subsurface soil), 6-6 (shallow groundwater), and 6-7 (deep groundwater) show ranges of detections, and statistical summaries including the arithmetic mean (including half non-detections), and the base background mean plus two standard deviations.
For the HPIA PA Sites, only the inorganics with concentrations exceeding the base background maximum detection will be considered for further evaluation.

6.3.2.2 Background Comparison Tests

For the Air Station and Montford Point PA Sites, a statistical analysis was conducted in addition to a straight comparison to the base background data. Two background comparison tests were run for the inorganic surface soil data. These were aimed at addressing two different questions. One, are the elevated site values unlikely to have come from a population equivalent to background? Two, is the center of the site population significantly higher than the background populations? While there is obviously some correlation between these two comparisons, there can also be differing conclusions from them.

For instance, one or more elevated site values might appear unusual relative to background, but the bulk of the site concentrations appear equivalent to background. Or, there might be a significant shift in the center of the site population, relative to background, but none of the individual site concentrations appear unusual relative to background. Both of these situations occur in the Camp Lejeune comparisons.

Individual Comparison to Background

The comparisons of individual site concentrations have been made to background threshold values (BTVs) established by Baker (2001). The results of these comparisons are shown in Appendix L. Each table represents comparisons for an individual Air Station or Montford Point PA Site. The results of two comparisons are shown, one includes detects versus the BTVs while the other includes detection limits for non-detected cases versus the BTVs. Only six total exceedances are noted (calcium and manganese from SAS113, cadmium from AS119, barium from M119, and arsenic and lead from M315).

To put any of these exceedances in perspective it is useful to refer to plots of the data and results of the statistical comparisons of the centers of the site and background populations. Scatter plots of the data are shown in Appendix L. In these plots, detected concentrations are shown as shaded circles while non-detect proxies (½ the detection limit) are shown as open circles. Frequencies of detections for the background and site data are also provided (at the top of the plots).

Central Tendency Comparison to Background

The comparisons of central tendency were applied using the Wilcoxon Rank Sum (WRS) test. This test is a nonparametric test used for estimating whether a difference exists between two populations. The WRS tests whether measurements from one population consistently tend to be larger (or smaller) than those from the other population. Such a nonparametric test is suggested when the sample size is less than 20, which is the case in this comparison where the number of site samples is four (EPA, 2002). As a nonparametric test based on ranks of the data, it is less influenced by spurious results in either data set than parametric tests, such as the t-test, which make a distributional assumption about the data.

When one is interested only if one of the two populations exceeds the other (such as whether site concentrations exceed background) then the WRS test is performed as a one-tailed test. This test calculates the probability that the observed differences between the site and background populations are due merely to random variability in the data, as opposed to the site data actually being shifted higher than the background. If this probability is less than a chosen significance level, say 0.05, then the decision is made that a significant difference does exist between the two populations. A significance level of 0.05, for instance, implies that one has 95% confidence ([1 – 0.05]*100%) that the two groups will be accepted to be statistically equivalent when they actually are.

The WRS test was applied to comparisons between site data and background data for soil data collected at the Air Station and Montford Point PA Sites (shown in Appendix L). The number of available site samples (four) puts limitations on the interpretation of these results, but they are nevertheless offered as an accompaniment to the comparison to BTVs and the scatter plots. In general, these comparisons indicate few background exceedances with surface soil (eight in total). These were for calcium (in the five Air Station and Montford Point PA Sites), cadmium and magnesium (in Building AS119), and lead (in M315). Interestingly, three of these cases (calcium in SAS113, cadmium in AS119, and lead in M315) were also noted with BTV exceedances.

Comparisons of the background values to the environmental samples for the surface and subsurface soil, and shallow groundwater are discussed in Section 6.4.

6.3.3 State and Federal Criteria and Standards

Contaminant concentrations were also compared to contaminant-specific established State and Federal criteria and standards such as Maximum Contaminant Levels (MCLs) or Ambient Water Quality Criteria (AWQC).

The only enforceable federal regulatory standards for groundwater are the Federal MCLs. In addition to the federal standards, the State of North Carolina has developed the North Carolina Water Quality Standards (NCWQS) for groundwater. The State also has soil quality criteria designed to prevent groundwater contamination. These criteria are referred to as soil-to-groundwater maximum contaminant concentrations. Regulatory guidelines were used for comparative purposes to infer the potential risks and environmental impacts when necessary.

A brief explanation of the criteria and standards used for the comparison of site analytical results is presented below.

Federal Maximum Contaminant Levels - February 1996 and 1999 - Federal MCLs are enforceable standards for public water supplies promulgated under the Safe Drinking Water Act (SDWA) and are designed for the protection of human health. MCLs are based on laboratory or epidemiological studies and apply to drinking water supplies consumed by a minimum of 25 persons. They are designed for prevention of human health effects associated with lifetime exposure (70-year lifetime) of an average adult (70-kg) consuming 2 liters of water per day.

MCLs also consider the technical feasibility of removing the contaminant from the public water supply.

North Carolina Water Quality Standards (Groundwater) NCWQS, 1994 - NCWQS are the maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the state, which may be tolerated without creating a threat to human health or which otherwise render the groundwater unsuitable for its intended purpose.

North Carolina Soil-to-Groundwater Concentrations - 1996. Soil-to-Groundwater concentrations numbers are determined by North Carolina and based on the current Groundwater Protection Standard (2L) or Interim Maximum Allowable Concentration (IMAC). If there are no 2L or IMAC, the Soil-to-Groundwater number is based on the recommended 2L, or if not available, the Maximum Contaminant Level Goal (MCLG), which is based on a 10^{-6} carcinogenic risk.

6.3.4 Laboratory Analytical Results

This section discusses analytical results from the PA Sites field investigation activities that consisted of surface and subsurface soil, and groundwater samples.

Surface and subsurface soil analytical data was screened using the North Carolina soil-to-groundwater concentrations to assess which contaminants require further consideration. Inorganic compounds were further screened using base background data. Inorganic compound concentrations exceeding both North Carolina soil-to-groundwater concentrations and base background require further consideration. The results of the two comparison tests will also be assessed in evaluating which inorganics at the Air Station and Montford Point sites require further consideration.

Groundwater organic analytical data was screened using the NCWQS and USEPA MCLs for positive detections of VOCs in groundwater. Groundwater inorganic analytical data was screened using the NCWQS and base background groundwater data. Groundwater inorganic compound concentrations exceeding both NCWQS and base background require further consideration.

6.3.4.1 HPIA Building 1120

A total of three surface soil, three subsurface soil, and three groundwater samples (from temporary monitoring wells) were collected at Building 1120 and analyzed for VOCs, SVOCs, and TAL metals (Tables 6-1 and 6-3). Included on Tables 6-8 and 6-9 is a summary of analytical results for Building 1120, with comparison criteria for soil and groundwater, respectively. Figures 6-1, 6-2, 6-5 and 6-6 depict all positive detections at Building 1120 including comparison criteria for volatiles in soil, metals in soil, volatiles in groundwater, and metals in groundwater, respectively.

6.3.4.1.1 Soil

Volatile Organic Compounds

Six different VOCs were detected in the soil at Building 1120, as shown on Figure 6-1 and Table 6-9. However, only tetrachloroethene, detected at 54 J micrograms per kilogram (µg/kg), exceeds the North Carolina soil-to-groundwater screening concentration of 20 µg/kg.

No SVOCs were detected in any of the soil samples.

Metals

Eighteen metals were detected in the surface soil, and fourteen metals were detected in the subsurface soil at Building 1120, as shown on Figure 6-2 and Table 6-8. The only metals that exceed the North Carolina soil-to-groundwater concentrations are iron and mercury. No metals exceed the base background data for soils. Iron and mercury exceed the North Carolina soil-to-groundwater concentrations of 151.2 milligrams per kilogram (mg/kg) and 0.014 mg/kg, respectively. Iron results range from 270 mg/kg to 1,300 mg/kg, and mercury results are 0.018 mg/kg and 0.032 mg/kg.

6.3.4.1.2 Groundwater

Volatile Organic Compounds

Four different VOCs were detected in the groundwater at Building 1120, as shown on Figure 6-5 and Table 6-9. Three VOCs exceed the NCWQS. No VOCs exceeded the USEPA MCLs. The VOCs bromodichloromethane, chloroform, and dibromochloromethane exceed the NCWQS of 0.6 (interim) micrograms per liter (µg/L), 0.19 µg/L, and 0.41 (interim) µg/L, respectively. Bromodichloromethane results range from 0.78 J µg/L to 2.4 J µg/L, chloroform results range from 3.4 J µg/L to 8.7 µg/L, and dibromochloromethane was detected at 0.84 J µg/L.

No SVOCs were detected in any of the groundwater samples.

Metals

Sixteen different metals were detected in the groundwater at Building 1120, as shown on Figure 6-6 and Table 6-9. One metal exceeds the NCWQS. No metals exceed the base background data. One detection of iron at 2,100 µg/L, exceeds the NCWQS of 300 µg/L.

6.3.4.2 HPIA Building 1409

A total of three surface soil, three subsurface soil, and three groundwater samples (from temporary monitoring wells) were collected at Building 1409 and analyzed for VOCs, SVOCs, and TAL metals (Tables 6-1 and 6-3). Included on Tables 6-10 and 6-11 is a summary of analytical results for Building 1409, with comparison criteria for soil and groundwater, respectively. Figures 6-1, 6-3, 6-5 and 6-6 depict all positive detections at Building 1409 including comparison criteria for volatiles in soil, metals in soil, volatiles in groundwater, and metals in groundwater, respectively.

6.3.4.2.1 Soil

Volatile and Semi-Volatile Organic Compounds

One VOC (bis(2-ethylhexyl)phthalate 810 µg/kg) and one SVOC (acetone 3.4 J µg/kg) were detected in the soil at Building 1409, as shown on Figure 6-1 and Table 6-10. These detections do not exceed the North Carolina soil-to-groundwater screening concentrations of bis(2-ethylhexyl)phthalate 28,650 µg/kg, and acetone 2,800 µg/kg.

Metals

Eighteen metals were detected in the surface soil, and sixteen metals were detected in the subsurface soil at Building 1409, as shown on Figure 6-3 and Table 6-10. The only metals that exceed the North Carolina soil-to-groundwater concentrations are iron and mercury. No metals exceed the base background data for soils. Iron and mercury exceed the North Carolina soil-to-groundwater concentrations of 151.2 mg/kg and 0.014 mg/kg, respectively. Iron results range from 390 mg/kg to 2,600 mg/kg, and mercury results are 0.014 J mg/kg and 0.047 mg/kg.

6.3.4.2.2 Groundwater

Volatile Organic Compounds

Three different VOCs were detected in the groundwater at Building 1409, as shown on Figure 6-5 and Table 6-11. All three VOCs exceed the NCWQS. No VOCs exceeded the USEPA MCLs. The VOCs bromodichloromethane, chloroform, and dibromochloromethane exceed the NCWQS of 0.6 (interim) µg/L, 0.19 µg/L, and 0.41 (interim) µg/L, respectively. Bromodichloromethane was detected at 5.6 J µg/L, chloroform results are 1.5 J µg/L and 31 µg/L, and dibromochloromethane was detected at 1.3 J µg/L.

No SVOCs were detected in any of the groundwater samples.

Metals

Fourteen different metals were detected in the groundwater at Building 1409, as shown on Figure 6-6 and Table 6-11. Two metals exceed the NCWQS. No metals exceed the base background

data. Two detections of iron, at 790 µg/L and 9,700 µg/L, exceed the NCWQS of 300 µg/L. One detection of manganese, at 120 µg/L, exceeds the NCWQS of 50 µg/L.

6.3.4.3 HPIA Building 1512

A total of six subsurface soil and three groundwater samples (from temporary monitoring wells) were collected at Building 1512 and analyzed for VOCs, SVOCs, and TAL metals (Tables 6-1 and 6-3). Included on Tables 6-12 and 6-13 is a summary of analytical results for Building 1512, with comparison criteria for soil and groundwater, respectively. Figures 6-1, 6-4, 6-5 and 6-6 depict all positive detections at Building 1512 including comparison criteria for volatiles in soil, metals in soil, volatiles in groundwater, and metals in groundwater, respectively.

6.3.4.3.1 Soil

Volatile and Semi-Volatile Organic Compounds

One VOC and ten SVOCs were detected in the soil at Building 1512, as shown on Figure 6-1 and Table 6-12. No detections exceed the North Carolina soil-to-groundwater screening concentrations.

Metals

Nineteen metals were detected in the subsurface soil at Building 1512, as shown on Figure 6-4 and Table 6-12. Three metals exceed the base background soil data and two metals exceed the North Carolina soil-to-groundwater concentrations. Barium, calcium and lead exceed the base background soil data of 27.1 mg/kg, 4,950 mg/kg, and 12.2 J mg/kg, respectively. Barium was detected at 64 mg/kg, calcium at 17,000 mg/kg and lead at 29 mg/kg at one sample location (1512-IS01-05). Iron and mercury exceed the North Carolina soil-to-groundwater concentrations of 151.2 mg/kg and 0.014 mg/kg, respectively. Iron results range from 580 J mg/kg to 2,700 J mg/kg, and mercury results are 0.018 J mg/kg and 0.02 mg/kg.

6.3.4.3.2 Groundwater

Volatile Organic Compounds

Six different VOCs were detected in the groundwater at Building 1512, as shown on Figure 6-5 and Table 6-13. Four VOCs exceed the NCWQS. No VOCs exceeded the USEPA MCLs. The VOCs bromodichloromethane, chloroform, and dibromochloromethane exceed the NCWQS of 0.6 (interim) µg/L, 0.19 µg/L, and 0.41 (interim) µg/L, respectively. Bromodichloromethane was detected at 0.61 J µg/L and 3.3 J, chloroform results range from 1.2 J µg/L to 15 µg/L, and dibromochloromethane was detected at 0.83 J µg/L.

No SVOCs were detected in any of the groundwater samples.

Metals

Eighteen different metals were detected in the groundwater at Building 1512, as shown on Figure 6-6 and Table 6-13. Two metals exceed the NCWQS, and only one metal exceeds the base background data. Arsenic and iron exceed the NCWQS of 5 µg/L and 300 µg/L, respectively. Arsenic was detected at 11 µg/L, and iron results range from 400 µg/L to 16,000 µg/L. Selenium exceeds the base background data of 3.8 J µg/L. Selenium was detected at 6.2 J µg/L and 11 µg/L.

6.3.4.4 Building SAS113

A total of four surface soil and four groundwater samples were collected at Building SAS113 and analyzed for TCL VOCs, SVOCs, pesticides/PCBs, and TAL metals (Tables 6-1 and 6-3). Included on Tables 6-14 and 6-15 is a summary of analytical results for Building SAS113, with comparison criteria for soil and groundwater, respectively. Figures 6-7, 6-8, 6-11 and 6-12 depict all positive detections at Building SAS113 including comparison criteria for soil and in groundwater.

6.3.4.4.1 Soil

Volatile and Semi-Volatile Organic Compounds

Two VOCs and one SVOC were detected in the soil at Building SAS113, as shown on Figure 6-7 and Table 6-14. No detections exceed the North Carolina soil-to-groundwater screening concentrations.

Pesticides/PCBs

Four pesticides were detected in the surface soil at Building SAS113, as shown on Figure 6-7 and Table 6-14. No detections exceed the North Carolina soil-to-groundwater screening concentrations.

Metals

Fourteen metals were detected in the surface soil at Building SAS113, as shown on Figure 6-8 and Table 6-14. The only metal that exceeds the North Carolina soil-to-groundwater concentration is iron. No metals exceed the base background data for soils. Iron exceeds the North Carolina soil-to-groundwater concentration of 151.2 mg/kg; iron results range from 981 mg/kg to 2,360 mg/kg.

6.3.4.4.2 Groundwater

Volatile and Semi-Volatile Organic Compounds

One VOC and one SVOC were detected in the groundwater at Building SAS113, as shown on Figure 6-11 and Table 6-15. The VOC, carbon disulfide, and the SVOC, caprolactam, did not exceed the NCWQS of 700 µg/L and 3500 µg/L, respectively.

Pesticides/PCBs

One pesticide, beta-BHC, was detected in the groundwater at one location at Building SAS113. Beta-BHC was detected at 0.028 µg/L which exceeds the NCWQS of 0.019 µg/L for total BHC. A MCL has not been established for the pesticide.

Metals

Seventeen different metals were detected in the groundwater at Building SAS113, as shown on Figure 6-12 and Table 6-15. Four metals exceed the NCWQS: arsenic, chromium, iron, and manganese exceed the NCWQS of 5 µg/L, 50 µg/L, 300 µg/L, and 50 µg/L, respectively. Eleven metals exceeded the base background data.

6.3.4.5 Building AS116

A total of four surface soil and four groundwater samples were collected at Building AS116 and analyzed for TCL VOCs, SVOCs, pesticides/PCBs, and TAL metals (Tables 6-1 and 6-3). Included on Tables 6-16 and 6-17 is a summary of analytical results for Building AS116, with comparison criteria for soil and groundwater, respectively. Figures 6-7, 6-9, 6-11 and 6-12 depict all positive detections at Building AS116 including comparison criteria for soil and groundwater.

6.3.4.5.1 Soil

Volatile and Semi-Volatile Organic Compounds

Two VOCs and two SVOCs were detected in the soil at Building AS116, as shown on Figure 6-7 and Table 6-16. No detections exceed the North Carolina soil-to-groundwater screening concentrations.

Pesticides/PCBs

Eight pesticides were detected in the soil at Building AS116. No detections exceed the North Carolina soil-to-groundwater screening concentrations.

Metals

Thirteen metals were detected in the surface soil at Building AS 116, as shown on Figure 6-9 and Table 6-16. The only metal that exceeds the North Carolina soil-to-groundwater concentration is iron. No metals exceed the base background data for soils. Iron exceeds the North Carolina soil-to-groundwater concentration of 151.2 mg/kg; iron results range from 834 mg/kg to 1,310 mg/kg.

6.3.4.5.2 Groundwater

Volatile and Semi-Volatile Organic Compounds

Four VOCs and three SVOCs were detected in the groundwater at Building AS116, as shown on Figure 6-11 and Table 6-17. No VOCs exceeded the NCWQS or MCLs. Two SVOCs, bis(2-ethylhexyl)phthalate (BEHP) and pentachlorophenol exceeded the NCWQS of 2.5 µg/L and 0.29 µg/L, respectively. BEHP and pentachlorophenol were detected at 11 µg/L and 7 J µg/L, respectively. No VOCs or SVOCs exceeded MCLs.

Pesticides/PCBs

One pesticide, alpha-chlordane, was detected in the groundwater at one location at Building AS116. The compound was detected at 0.01 J µg/L, which does not exceed the NCWQS for total chlordane (0.1 µg/L). This detection also does not exceed the MCL of 2 µg/L for chlordane.

Metals

Nineteen different metals were detected in the groundwater at Building AS116, as shown on Figure 6-12 and Table 6-17. Six metals exceed the NCWQS: arsenic, cadmium, chromium, iron, lead, and manganese exceed the NCWQS of 5 µg/L, 1.75 µg/L, 50 µg/L, 300 µg/L, 15 µg/L, and 50 µg/L, respectively. Five of the metals were detected at concentrations that exceed the Base background data.

6.3.4.6 Building AS119

A total of four surface soil and four groundwater samples were collected at Building AS119 and analyzed for TCL VOCs, SVOCs, pesticides/PCBs, and TAL metals (Tables 6-1 and 6-3). Included on Tables 6-18 and 6-19 is a summary of analytical results for Building AS119, with comparison criteria for soil and groundwater, respectively. Figures 6-7, 6-10, 6-11 and 6-12 depict all positive detections at Building AS119 including comparison criteria for soil and in groundwater.

6.3.4.6.1 Soil

Volatile and Semi-Volatile Organic Compounds

Three VOCs and fourteen SVOCs were detected in the soil at Building AS119, as shown on Figure 6-7 and Table 6-18. Benzo(a)pyrene and dibenz(a,h)anthracene were detected at 780 µg/kg and 220J µg/kg, which exceeds the North Carolina soil-to-groundwater screening concentrations of 92.8 µg/kg and 172 µg/kg, respectively.

Pesticides/PCBs

Nine pesticides were detected in the soil at Building AS119. One detection of 4,4'-DDD (140 µg/kg) exceeded the North Carolina soil-to-groundwater screening concentration of 129 µg/kg.

Metals

Sixteen metals were detected in the surface soil at Building AS119, as shown on Figure 6-10 and Table 6-18. The only metal that exceeds the North Carolina soil-to-groundwater concentration is

iron. No metals exceed the base background data for soils. Iron exceeds the North Carolina soil-to-groundwater concentration of 151.2 mg/kg; iron results range from 992 mg/kg to 3,260 mg/kg.

6.3.4.6.2 Groundwater

Volatile and Semi-Volatile Organic Compounds

Three VOCs and two SVOCs were detected in the groundwater at Building AS119, as shown on Figure 6-11 and Table 6-19. One SVOC, BEHP, exceeded the NCWQS of 2.5 µg/L and MCL of 6 µg/L. BEHP was detected at 11 µg/L.

Pesticides/PCBs

Two pesticides were detected in the groundwater at Building AS119. Beta-BHC and delta-BHC were detected at 0.019 J µg/L and 0.014 J µg/L, respectively, which exceeds the NCWQS for total BHC (0.019 µg/L). An MCL has not been established for the pesticide.

Metals

Nineteen different metals were detected in the groundwater at Building AS119, as shown on Figure 6-12 and Table 6-19. Five metals exceed the NCWQS: arsenic, chromium, iron, lead, and manganese exceed the NCWQS of 5 µg/L, 50 µg/L, 300 µg/L, 15 µg/L, and 50 µg/L, respectively. Fourteen metals exceed the base background.

6.3.4.7 Building M119

A total of four surface soil and four groundwater samples were collected at Building M119 and analyzed for TCL VOCs, SVOCs, pesticides/PCBs, and TAL metals (Tables 6-1 and 6-3). Included on Tables 6-20 and 6-21 is a summary of analytical results for Building M119, with comparison criteria for soil and groundwater, respectively. Figures 6-13, 6-14, 6-16 and 6-17 depict all positive detections at Building M119 including comparison criteria for soil and groundwater.

6.3.4.7.1 Soil

Volatile and Semi-Volatile Organic Compounds

One VOC and two SVOCs were detected in the soil at Building M119, as shown on Figure 6-13 and Table 6-20. No detections exceed the North Carolina soil-to-groundwater screening concentrations.

Pesticides/PCBs

Seven pesticides were detected in the surface soil at Building M119. No detections exceed the North Carolina soil-to-groundwater screening concentrations.

Metals

Fifteen metals were detected in the surface soil at Building M119, as shown on Figure 6-14 and Table 6-20. The only metal that exceeds the North Carolina soil-to-groundwater concentration is iron. No metals exceed the base background data for soils. Iron exceeds the North Carolina soil-to-groundwater concentration of 151.2 mg/kg; iron results range from 977 mg/kg to 2,260 mg/kg.

6.3.4.7.2 Groundwater

Volatile and Semi-Volatile Organic Compounds

Three VOCs were detected in the groundwater at Building M119, as shown on Figure 6-16 and Table 6-21. No VOCs exceeded the NCWQS or MCLs.

No SVOCs were detected in the groundwater samples.

Pesticides/PCBs

Two pesticides were detected in the groundwater at Building M119. Beta-BHC and delta-BHC were detected at 0.013 J µg/L and 0.01 J µg/L, respectively, which exceeds the NCWQS for total BHC (0.019 µg/L). An MCL has not been established for the pesticide.

Metals

Sixteen different metals were detected in the groundwater at Building M119, as shown on Figure 6-17 and Table 6-21. Two metals, iron and manganese, exceed the NCWQS of 300 µg/L and 50 µg/L, respectively. Iron detections range from 1,610 µg/L to 8,720 µg/L. Manganese was detected at 74.8 µg/L. Neither of these two metals were among the nine metals that exceeded the base background data.

6.3.4.8 Building M315

A total of four surface soil and four groundwater samples were collected at Building M315 and analyzed for TCL VOCs, SVOCs, pesticides/PCBs, and TAL metals (Tables 6-1 and 6-3). Included on Tables 6-22 and 6-23 is a summary of analytical results for Building M315, with comparison criteria for soil and groundwater, respectively. Figures 6-13, 6-15, 6-16 and 6-17

depict all positive detections at Building M315 including comparison criteria for soil and groundwater.

6.3.4.8.1 Soil

Volatile and Semi-Volatile Organic Compounds

One VOC and one SVOC were detected in the soil at Building M315, as shown on Figure 6-13 and Table 6-22. No detections exceed the North Carolina soil-to-groundwater screening concentrations.

Pesticides/PCBs

Seven pesticides were detected in the surface soil at Building M315. No detections exceed the North Carolina soil-to-groundwater screening concentrations.

Metals

Fourteen metals were detected in the surface soil at Building M315, as shown on Figure 6-15 and Table 6-22. The only metal that exceeds the North Carolina soil-to-groundwater concentration is iron. No metals exceed the base background data for soils. Iron exceeds the North Carolina soil-to-groundwater concentration of 151.2 mg/kg; iron results range from 667 mg/kg to 1,830 mg/kg.

6.3.4.8.2 Groundwater

Volatile and Semi-Volatile Organic Compounds

No VOCs were detected in the groundwater samples.

One SVOC, BEHP, exceeded the NCWQS of 2.5 µg/L. BEHP was detected at 4 J µg/L, below the MCL of 6 µg/L.

Pesticides/PCBs

One pesticide was detected in the groundwater at Building M315. Beta-BHC was detected at 0.014 J µg/L, which does not exceed the NCWQS for total BHC (0.019 µg/L). An MCL has not been established for the pesticide.

Metals

Eighteen different metals were detected in the groundwater at Building M315, as shown on Figure 6-17 and Table 6-23. Three metals, arsenic, iron and lead, exceed the NCWQS of 5 µg/L, 300 µg/L and 15 µg/L, respectively. Nine metals exceed the base background data.

6.4 Summary of Findings of the PA Sites Field Investigation

6.4.1 HPIA Building 1120

As shown on Figure 6-1 there is one VOC (tetrachloroethene 54 J µg/kg) in surface soil that exceeds the North Carolina soil-to-groundwater concentration (20 µg/kg) at sample location 78-IS02-1120-01. This sample was collected at a depth of 1 to 2 ft bgs. There were no detections in the subsurface soil sample (78-IS02-1120-05) collected at a depth of 10 ft bgs. There were also no detections of tetrachloroethene from the groundwater sample collected at this location. Since there were no detections of this compound below the surface soil, it is suspected that a localized spill may account for the detection in surface soil. Therefore, it is recommended that Building 1120 require no further investigation for VOCs or SVOCs in the soil.

As shown on Figure 6-2 there are two metals (iron and mercury) in surface and subsurface soil that exceed the North Carolina soil-to-groundwater concentrations. There are no detections that exceed the base background soil data. Since these detections do not exceed the base background soil data, it is recommended that metals in soils require no further investigation.

As shown on Figure 6-5 there are three VOCs (bromodichloromethane, chloroform, and dibromochloromethane) that exceed the NCWQS in groundwater. There are no detections that exceed the MCLs. It is recommended that the groundwater require no further investigation for VOCs or SVOCs since the detections of these VOCs may be attributed to sample contamination from equipment due to the low concentrations of these VOCs detected throughout the analytical results from all groundwater samples collected at the PA Sites, as illustrated on Figure 6-5.

As shown on Figure 6-6 there is one metal (iron) that exceeds the NCWQS. No metals exceed the base background data for groundwater. Since no metals exceed the base background data, it is recommended that the groundwater at Building 1120 require no further investigation.

In summary, the analytical data shows that Building 1120 requires no further investigation, and there is no evidence from this data to suggests that this area has been impacted from past site operations.

6.4.2 HPIA Building 1409

As shown on Figure 6-1 there are no VOCs or SVOCs at Building 1409 that exceed the North Carolina soil-to-groundwater concentrations. Based on this data, it is recommended that the soils at Building 1409 require no additional investigation for VOCs or SVOCs.

As shown on Figure 6-3 there are two metals (iron and mercury) in surface and/or subsurface soil that exceed the North Carolina soil-to-groundwater concentrations. There are no detections that exceed the base background soil data. Since these detections do not exceed the base background soil data, it is recommended that metals in soils require no further investigation.

As shown on Figure 6-5 there are three VOCs (bromodichloromethane, chloroform, and dibromochloromethane) that exceed the NCWQS in groundwater. There are no detections that exceed the MCLs. It is recommended that the groundwater require no further investigation for VOCs or SVOCs since the detections of these VOCs may be attributed to sample contamination from equipment due to the low concentrations of these VOCs detected throughout the analytical results from all groundwater samples collected at the PA Sites, as illustrated on Figure 6-5.

As shown on Figure 6-6 there are two metals (iron and manganese) that exceed the NCWQS in groundwater. There are no detections that exceed the base background concentrations. Since no metals exceed the base background concentrations, it is recommended that the metals in groundwater require no further investigation at Building 1409.

In summary, the analytical data shows that Building 1409 requires no further investigation, and there is no evidence from this data to suggests that this area has been impacted from past site operations.

6.4.3 HPIA Building 1512

As shown on Figure 6-1 there are no VOCs or SVOCs that exceed the North Carolina soil-to-groundwater concentrations. Based on this data, it is recommended that the soils at Building 1512 require no additional investigation for VOCs or SVOCs.

As shown on Figure 6-4 there are three metals (barium, calcium and lead) in subsurface soil that exceed the base background concentrations and two metals (iron and mercury) in surface and/or

subsurface soil that exceed the North Carolina soil-to-groundwater concentrations. Since the above inorganics did not exceed both the background and soil-to-groundwater concentrations, and calcium is an essential nutrient, it is recommended that metals in soils require no further investigation.

As shown on Figure 6-5 there are three VOCs (bromodichloromethane, chloroform, and dibromochloromethane) that exceed the NCWQS in groundwater. There are no detections that exceed the MCLs. It is recommended that the groundwater require no further investigation for VOCs or SVOCs since the detections of these VOCs may be attributed to sample contamination from equipment due to the low concentrations of these VOCs detected throughout the analytical results from all groundwater samples collected at the PA Sites, as illustrated on Figure 6-5.

As shown on Figure 6-6 there are four metals (arsenic, chromium, iron, and lead) that exceed the NCWQS, and one metal (selenium) that exceeds the base background data for groundwater. Since no metals exceed both criteria, it is recommended that the metals in groundwater require no further investigation at Building 1512.

In summary, the analytical data shows that Building 1512 requires no further investigation, and there is no evidence from this data to suggests that this area has been impacted from past site operations.

6.4.4 Building SAS113

As shown on Figure 6-7 there are no VOCs, SVOCs, pesticides, or PCBs that exceed the North Carolina soil-to-groundwater concentrations. Based on this data, it is recommended that the soils at Building SAS113 require no additional investigation for VOCs, SVOCs, pesticides, or PCBs.

As shown on Figure 6-8, there is one metal (iron) in surface soil that exceeds the North Carolina soil-to-groundwater concentrations; however, the detections of the inorganic do not exceed the base background data. A different metal, calcium, was identified as an exceedance in the two background comparison tests; however, calcium is considered an essential nutrient. It is recommended that metals in soils require no further investigation.

As shown on Figure 6-11 there are no VOCs, SVOCs, or PCBs that exceed the NCWQS in groundwater. One pesticide, beta-BHC, exceeds the NCWQS for BHC. There are no detections

that exceed the MCLs. It is recommended that the groundwater require no further investigation for VOCs, SVOCs, pesticides, or PCBs.

As shown on Figure 6-12 there are five metals (arsenic, chromium, iron, lead, and manganese) that exceed the NCWQS. Chromium, iron, and lead are also among the 11 metals that exceed the base background data for groundwater. It is recommended that additional groundwater investigation be conducted at Building SAS113 by installing one monitoring well in the location with the hottest screening results and sampled using low-flow methods.

In summary, the analytical data shows that Building SAS113 requires additional investigation of metals in groundwater.

6.4.5 Building AS116

As shown on Figure 6-7 there are no VOCs, SVOCs, pesticides, or PCBs that exceed the North Carolina soil-to-groundwater concentrations. Based on this data, it is recommended that the soils at Building AS116 require no additional investigation for VOCs, SVOCs, pesticides, or PCBs.

As shown on Figure 6-9 there is one metal (iron) in surface soil that exceeds the North Carolina soil-to-groundwater concentrations. Since the detections of the inorganic do not exceed the base background data, it is recommended that metals in soils require no further investigation.

As shown on Figure 6-11, BEHP and pentachlorophenol exceed both the NCWQS and the MCLs. It is recommended that the groundwater require no further investigation for VOCs, SVOCs, pesticides, or PCBs since BEHP and pentachlorophenol were detected in one sample, indicating that it is not widespread. Also, BEHP is a common laboratory contaminant.

As shown on Figure 6-12 there are four metals (arsenic, chromium, iron, and lead) that exceed the NCWQS. Arsenic, chromium, iron, and lead are also among the 15 inorganics that exceed the base background data for groundwater. It is recommended that metals in groundwater be further investigated by installing one monitoring well in the location with the hottest screening results and sampled using low-flow methods.

In summary, the analytical data shows that Building AS116 requires further investigation of groundwater.

6.4.6 Building AS119

As shown on Figure 6-7 there are two SVOCs (benzo(a)anthracene and dibenz(a,h)anthracene) and one pesticide (4,4'-DDD) that exceed the North Carolina soil-to-groundwater concentrations. Based on this data, it is recommended that the soils at Building AS119 require further investigation for SVOCs and pesticides.

As shown on Figure 6-10 there is one metal (iron) in surface soil that exceeds the North Carolina soil-to-groundwater concentrations; however, the detections of the inorganic do not exceed the base background data. A different metal, cadmium, was identified as an exceedance in the two background comparison tests. It is recommended that metals in soils require further investigation.

As shown on Figure 6-11, chloroform and BEHP exceed the NCWQS. BEHP also exceeds the MCLs. Beta-BHC and delta-BHC together exceed the NCWQS for BHC. There are no detections that exceed the MCLs. It is recommended that the groundwater require no further investigation for VOCs, SVOCs, pesticides, or PCBs since there was only one detection of BEHP and the detection was at low levels, possibly due to laboratory contamination.

As shown on Figure 6-12 there are five metals (arsenic, chromium, iron, lead, and manganese) that exceed the NCWQS. Chromium, iron, and lead are also among the 14 inorganics that exceed the base background data for groundwater. It is recommended that metals in groundwater be further investigated by installing one monitoring well in the location with the hottest screening results and sampled using low-flow methods.

In summary, the analytical data shows that Building AS119 requires further investigation of soil and groundwater.

6.4.7 Building M119

As shown on Figure 6-13, there are no VOCs, SVOCs, pesticides, or PCBs that exceed the North Carolina soil-to-groundwater concentrations. Based on this data, it is recommended that the soils at Building M119 require no additional investigation for VOCs, SVOCs, pesticides, or PCBs.

As shown on Figure 6-14 there is one metal (iron) in surface soil that exceeds the North Carolina soil-to-groundwater concentrations. Since the detections of the inorganic do not exceed the base background data, it is recommended that metals in soils require no further investigation.

As shown on Figure 6-16, there are no VOCs, SVOCs, or PCBs that exceed the NCWQS in groundwater. Beta-BHC and delta-BHC together exceed the NCWQS for BHC. There are no detections that exceed the MCLs. It is recommended that the groundwater require no further investigation for VOCs, SVOCs, pesticides, or PCBs.

As shown on Figure 6-17 there are two metals (iron and manganese) that exceed the NCWQS; however, these two inorganics do not exceed the base background data for groundwater. High metal concentrations could be due to the collection of samples using DPT and not filtering. It is recommended that metals in groundwater be further investigated by installing one monitoring well in the location with the hottest screening results and sampled using low-flow methods.

In summary, the analytical data shows that Building M119 requires further investigation of metals in groundwater.

6.4.8 Building M315

As shown on Figure 6-13, there are no VOCs, SVOCs, pesticides, or PCBs that exceed the North Carolina soil-to-groundwater concentrations. Based on this data, it is recommended that the soils at Building M119 require no additional investigation for VOCs, SVOCs, pesticides, or PCBs.

As shown on Figure 6-15 there is one metal (iron) in surface soil that exceeds the North Carolina soil-to-groundwater concentrations; however, the detections of the inorganic do not exceed the base background data. Additionally, lead was identified as an exceedance in the two comparison tests performed; therefore, it is recommended that metals in soils be further investigated.

As shown on Figure 6-16, BEHP exceeds the NCWQS. There are no detections that exceed the MCLs. It is recommended that the groundwater require no further investigation for VOCs, SVOCs, pesticides, or PCBs.

As shown on Figure 6-17 there are three metals (arsenic, iron, and lead) that exceed the NCWQS. Lead is also among the nine inorganics that exceed the base background data for groundwater. It is recommended that metals in groundwater be further investigated by installing one monitoring well in the location with the hottest screening results and sampled using low-flow methods.

In summary, the analytical data shows that Building M315 requires further investigation of inorganics in soil and groundwater.

6.5 Conclusions and Recommendations

Based on the data collected and evaluated for the eight sites recommended for field investigation activities, additional field investigation activities should be completed at the following five sites:

Air Station

- Building SAS113 (groundwater)
- Building AS116 (groundwater)
- Building AS119 (soil and groundwater)

Montford Point

- Building M119 (groundwater)
- Building M315 (soil and groundwater)

Field investigation activities might include as appropriate:

- Collection and analysis of additional surface and subsurface soil samples - to assess whether soils contain contamination.

- Collection and analysis of groundwater samples - to determine if inorganic concentrations exceed background concentrations, thereby indicating whether local groundwater quality has been affected by past site operations. It is recommended to install one monitoring well in the location of the highest screening results and to sample using low-flow methods at each of the five sites identified above.

The field investigation activities would be limited to the identified areas of concern. The information obtained during a field investigation would aid in confirming the presence or absence of contamination and to confirm the identified migration and exposure pathways.

Investigations into these sites should also direct any non-CERCLA issues to the appropriate RCRA regulatory programs as identified in Appendix C.

The HPIA PA sites (Buildings 1120, 1409, and 1512) will not require further action as determined during the October 2002 Partnering Meeting.

TABLES

TABLE 6-1
SOIL SAMPLE SUMMARY
PA SITES FIELD INVESTIGATION
PRELIMINARY ASSESSMENT SITES, CTO - 0190
MCB CAMP LEJEUNE, NORTH CAROLINA

Sample ID	Date Sampled	Time Sampled	Depth Interval (ft)	TCL VOA	TCL SVOC	TAL Metals	Pesticides/ PCBs
IR78-1120-IS01-01	06/28/2002	1210	1-2	Yes	Yes	Yes	No
IR78-1120-IS01-01D	06/28/2002	1210	1-2	Yes	Yes	Yes	No
IR78-1120-IS01-05	06/28/2002	1220	10.5	Yes	Yes	Yes	No
IR78-1120-IS02-01	06/28/2002	1355	1-3	Yes	Yes	Yes	No
IR78-1120-IS02-01D	06/28/2002	1355	1-3	Yes	Yes	Yes	No
IR78-1120-IS02-04	06/28/2002	1400	7.5	Yes	Yes	Yes	No
IR78-1120-IS03-01	06/28/2002	1410	1-2	Yes	Yes	Yes	No
IR78-1120-IS03-01D	06/28/2002	1410	1-2	Yes	Yes	Yes	No
IR78-1120-IS03-05	06/28/2002	1420	10	Yes	Yes	Yes	No
IR78-1409-IS01-01	06/28/2002	0725	1.5	Yes	Yes	Yes	No
IR78-1409-IS01-05	06/28/2002	0740	10	Yes	Yes	Yes	No
IR78-1409-IS02-01	06/28/2002	0805	2	Yes	Yes	Yes	No
IR78-1409-IS02-04	06/28/2002	0810	8.5	Yes	Yes	Yes	No
IR78-1409-IS03-01	06/28/2002	0840	1-3	Yes	Yes	Yes	No
IR78-1409-IS03-01MS/MSD	06/28/2002	0840	1-3	Yes	Yes	Yes	No
IR78-1409-IS03-04	06/28/2002	0850	8.5	Yes	Yes	Yes	No
IR78-1512-IS01-03	06/27/2002	1440	7	Yes	Yes	Yes	No
IR78-1512-IS01-05	06/27/2002	1445	10	Yes	Yes	Yes	No
IR78-1512-IS02-04	06/27/2002	1500	8	Yes	Yes	Yes	No
IR78-1512-IS02-05	06/27/2002	1504	9.5	Yes	Yes	Yes	No
IR78-1512-IS03-02	06/27/2002	1520	4	Yes	Yes	Yes	No
IR78-1512-IS03-05	06/27/2002	1525	10	Yes	Yes	Yes	No
IRP1-SS-IS01-1-2	06/07/2004	1350	1-2	Yes	Yes	Yes	Yes
IRP1-SS-IS02-1-2	06/07/2004	1500	1-2	Yes	Yes	Yes	Yes
IRP1-SS-IS03-1-3	06/11/2004	1210	1-3	Yes	Yes	Yes	Yes
IRP1-SS-IS04-1-3	06/11/2004	1330	1-3	Yes	Yes	Yes	Yes
IRP2-SS-IS01-2-3	06/07/2004	1240	2-3	Yes	Yes	Yes	Yes
IRP2-SS-IS02-1-2	06/07/2004	1100	1-2	Yes	Yes	Yes	Yes
IRP2-SS-IS03-1-3	06/11/2004	1005	1-3	Yes	Yes	Yes	Yes
IRP2-SS-IS04-1-3	06/11/2004	1100	1-3	Yes	Yes	Yes	Yes
IRP3-SS-IS01-1-2	06/09/2004	0730	1-2	Yes	Yes	Yes	Yes
IRP3-SS-IS02-2-3	06/09/2004	0845	2-3	Yes	Yes	Yes	Yes
IRP3-SS-IS03-0-3	06/10/2004	1630	0-3	Yes	Yes	Yes	Yes
IRP3-SS-IS04-1-3	06/11/2004	0750	1-3	Yes	Yes	Yes	Yes
IRP4-SS-IS01-0-3	06/09/2004	1230	0-3	Yes	Yes	Yes	Yes
IRP4-SS-IS02-0-3	06/09/2004	1410	0-3	Yes	Yes	Yes	Yes
IRP4-SS-IS03-1-3	06/10/2004	1245	1-3	Yes	Yes	Yes	Yes
IRP4-SS-IS04-0-3	06/10/2004	1430	0-3	Yes	Yes	Yes	Yes
IRP5-SS-IS01-0-3	06/09/2004	1550	0-3	Yes	Yes	Yes	Yes
IRP5-SS-IS02-0-4	06/09/2004	1800	0-4	Yes	Yes	Yes	Yes
IRP5-SS-IS03-0-3	06/10/2004	0810	0-3	Yes	Yes	Yes	Yes
IRP5-SS-IS03-DUP-0-3	06/10/2004	0810	0-4	Yes	Yes	Yes	Yes
IRP5-SS-IS04-0-3	06/10/2004	1000	0-3	Yes	Yes	Yes	Yes

TABLE 6-2

TEMPORARY MONITORING WELL
GROUNDWATER FIELD PARAMETERS
HPIA PA SITES FIELD INVESTIGATION
PRELIMINARY ASSESSMENT SITES, CTO - 0190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Well Number Sample Date	Measuring Time	Well Volumes	Field Parameters			
			Temperature (°C)	pH (S.U.)	Specific Conductance (µmhos/cm)	Turbidity (N.T.U.)
78-1120-TW01 7/01/02	1333	1.0	24.7	4.52	404	160
	1346	3.0	25.7	4.62	391	20
	1356	4.5	25.1	4.07	371	291
	1412	6.0	24.4	4.08	359	>1,000
	1419	7.0	24.1	4.01	344	33
78-1120-TW02 7/01/02	1353	2.0	24.6	4.49	154	1000
	1400	3.0	24.6	4.38	151	273
	1415	5.0	25.2	4.40	148	89
	1425	6.0	24.3	4.39	142	38
	1432	7.0	24.4	4.40	136	23
78-1120-TW03 7/01/02	1520	1.0	23.1	4.58	140	>1,000
	1525	2.0	22.2	3.88	134	792
	1533	3.0	22.1	3.81	133	447
	1540	4.0	22.0	3.85	134	50
	1547	5.0	21.9	3.74	134	48
	1554	6.0	21.7	3.81	136	112
78-1409-TW01 07/01/02	1753	1.0	24.5	5.69	165	>1,000
	1800	2.0	24.1	5.78	158	99
	1810	3.0	24.0	5.50	150	32
	1815	4.0	24.0	5.17	143	20
	1824	5.0	23.8	5.24	147	6
78-1409-TW02 7/01/02	1755	1.0	24.0	5.15	477	>1,000
	1706	3.0	23.8	5.21	367	825
	1716	4.0	23.7	5.02	311	342
	1824	6.0	23.6	5.06	289	237
	1844	8.0	24.0	5.26	276	79
	1853	9.0	23.8	5.10	267	58
	1900	10.0	23.4	5.09	262	34
78-1409-TW03 7/01/02	1655	1.0	26.4	5.05	398	353
	1703	2.0	25.1	5.17	390	152
	1709	3.0	25.2	5.24	356	278
	1715	4.0	25.3	5.32	342	20

TABLE 6-2

TEMPORARY MONITORING WELL
GROUNDWATER FIELD PARAMETERS
HPIA PA SITES FIELD INVESTIGATION
PRELIMINARY ASSESSMENT SITES, CTO - 0190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Well Number Sample Date	Measuring Time	Well Volumes	Field Parameters			
			Temperature (°C)	pH (S.U.)	Specific Conductance (µmhos/cm)	Turbidity (N.T.U.)
78-1512-TW01 07/01/02	0840	1.0	21.4	5.50	8	>1,000
	0850	2.0	21.6	5.75	82	500
	0901	3.0	21.5	5.80	82	800
	0913	4.0	21.7	5.74	84	750
	0922	5.0	22.1	5.52	83	550
	0933	6.0	21.9	5.34	81	400
	0944	7.0	21.8	4.66	80	270
	0955	8.0	21.8	4.58	79	180
	1008	9.0	21.7	4.60	79	120
	1023	10.0	21.9	4.59	79	100
78-1512-TW02 07/01/02	0820	2.0	21.9	5.15	348	230
	0830	3.0	21.6	5.79	277	100
	0844	4.0	21.2	5.31	245	50
	0858	5.5	21.4	5.57	234	36
	0905	6.5	21.3	5.62	222	27
78-1512-TW03 07/01/02	1110	1.0	25.0	4.62	123	>1,000
	1117	2.0	23.5	4.45	116	>1,000
	1125	3.0	23.6	4.58	113	>1,000
	1134	4.0	23.9	4.61	111	>1,000
	1143	5.0	23.4	4.43	110	>1,000
	1152	6.0	23.5	4.60	109	>1,000
	1159	7.0	23.4	4.39	108	>1,000
	1206	8.0	23.2	4.51	109	>1,000
	1211	9.0	23.4	4.43	108	>1,000

Notes:

°C = Degrees Centigrade
S.U. = Standard Units
µmhos/cm = micro ohms per centimeter
mg/L = milligrams per liter
mv = millivolts
N.T.U. = Nephlometric Turbidity Units
NA = Not Applicable

TABLE 6-3
GROUNDWATER SAMPLE SUMMARY
PA SITES FIELD INVESTIGATION
PRELIMINARY ASSESSMENT SITES, CTO - 0190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Location	Date Sampled	TCL VOCs	TCL SVOCs	TAL Metals	TCL Pesticides/ PCBs
78-1120-TW01	07/01/2002	X	X	X	NA
78-1120-TW02	07/01/2002	X	X	X	NA
78-1120-TW03	07/01/2002	X	X	X	NA
78-1409-TW01	07/01/2002	X	X	X	NA
78-1409-TW02	07/01/2002	X	X	X	NA
78-1409-TW03	07/01/2002	X	X	X	NA
78-1512-TW01	07/01/2002	X	X	X	NA
78-1512-TW02	07/01/2002	X	X	X	NA
78-1512-TW03	07/01/2002	X	X	X	NA
IRP1-GW-IS01-6-10	06/07/2004	X	X	X	X
IRP1-GW-IS02-6-10	06/07/2004	X	X	X	X
IRP1-GW-IS03-6-10	06/11/2004	X	X	X	X
IRP1-GW-IS04-6-10	06/11/2004	X	X	X	X
IRP2-GW-IS01-7-11	06/07/2004	X	X	X	X
IRP2-GW-IS02-6-10	06/07/2004	X	X	X	X
IRP2-GW-IS03-6-10	06/11/2004	X	X	X	X
IRP2-GW-IS04-6-10	06/11/2004	X	X	X	X
IRP3-GW-IS01-6-10	06/09/2004	X	X	X	X
IRP3-GW-IS02-6-10	06/09/2004	X	X	X	X
IRP3-GW-IS03-6-10	06/10/2004	X	X	X	X
IRP3-GW-IS04-6-10	06/11/2004	X	X	X	X
IRP4-GW-IS01-12-16	06/09/2004	X	X	X	X
IRP4-GW-IS02-12-16	06/09/2004	X	X	X	X
IRP4-GW-IS03-12-16	06/10/2004	X	X	X	X
IRP4-GW-IS04-14-18	06/10/2004	X	X	X	X
IRP5-GW-IS01-16-20	06/09/2004	X	X	X	X
IRP5-GW-IS02-16-20	06/09/2004	X	X	X	X
IRP5-GW-IS03-16-20	06/10/2004	X	X	X	X
IRP5-GW-IS03-DUP-16-20	06/10/2004	X	X	X	X
IRP5-GW-IS04-15-19	06/10/2004	X	X	X	X

Notes:

TCL	=	Target Compound List
VOC	=	Volatile Organic Compounds
TAL	=	Target Analyte List
NA	=	Not Analyzed
X	=	Requested Analysis

TABLE 6-4
STATISTICS SUMMARY FOR INORGANICS IN SURFACE SOILS
BASE BACKGROUND STUDY
MCB, CAMP LEJEUNE, NORTH CAROLINA

	Distribution	Frequency of Detection	Range	Arithmetic Mean Half Non-Detects	Arithmetic Mean + 2 Standard Deviations	Log Arithmetic Mean Half Non-Detects	Log Arithmetic Mean + 2 Standard Deviations
METALS (mg/kg)							
Aluminum	Neither	50/50	29.4 - 17600J	2,744	8,965	1,188	34,892
Antimony	Neither	19/50	ND - 0.9J	0.223	0.564	0.179	0.644
Arsenic	Neither	18/50	ND - 1.3J	0.313	0.879	0.232	1.00
Barium	Neither	46/50	ND - 24	7.23	19.4	4.35	51.9
Beryllium	Lognormal	31/50	ND - 0.53J	0.0517	0.205	0.0302	0.252
Cadmium	Neither	5/50	ND - 0.11J	0.0163	0.053	0.0129	0.038
Calcium	Neither	42/50	ND - 105000	3,180	33,240	153	9,605
Chromium	Neither	44/50	ND - 12.6	3.03	8.93	1.67	21.5
Cobalt	Neither	27/50	ND - 0.51J	0.147	0.412	0.100	0.583
Copper	Lognormal	39/50	ND - 38.5	2.42	14.2	0.98	11.2
Iron	Neither	50/50	26.3 - 12200J	1,623	6,097	679	14,765
Lead	Lognormal	50/50	0.45 - 38.5J	6.14	21.0	3.94	14,765
Magnesium	Lognormal	43/50	ND - 1610	119	585	49.90	804
Manganese	Lognormal	45/50	ND - 49	6.87	24.3	3.60	43.8
Mercury	Lognormal	25/50	ND - 0.12J	0.0403	0.0961	0.0327	0.120
Nickel	Neither	37/50	ND - 1.8	0.61	1.65	0.350	4.18
Potassium	Lognormal	41/50	ND - 263J	58.09	178	32.1	384
Selenium	Neither	16/50	ND - 3.4	0.28	1.25	0.183	0.819
Silver	Neither	4/50	ND - 1.1	0.0702	0.372	0.049	0.145
Sodium	Neither	1/50	ND - 307	40.46	123	33.4	98.5
Thallium	Neither	0/50	ND	0.180	0.226	0.179	0.223
Vanadium	Lognormal	48/50	ND - 26.2	4.45	14.4	2.44	28.5
Zinc	Lognormal	34/50	ND - 73.9	5.41	28.0	2.18	31.2

TABLE 6-5
STATISTICS SUMMARY FOR INORGANICS IN SUB-SURFACE SOIL
BASE BACKGROUND STUDY
MCB, CAMP LEJEUNE, NORTH CAROLINA

	Distribution	Frequency of Detection	Range	Arithmetic Mean Half Non-Detects	Arithmetic Mean + 2 Standard Deviations	Log Arithmetic Mean Half Non-Detects	Log Arithmetic Mean + 2 Standard Deviations
METALS (mg/kg)							
Aluminum	Neither	50/50	260J - 16800	5,185	13,061	3,715	24,343
Antimony	Neither	14/50	ND - 0.5J	0.180	0.392	0.157	0.419
Arsenic	Neither	19/50	ND - 9.3	1.06	5.29	0.35	4.71
Barium	Lognormal	50/50	0.67J - 27.1	8.28	21.66	5.70	37.34
Beryllium	Lognormal	31/50	ND - 0.91	0.0826	0.358	0.0416	0.432
Cadmium	Neither	0/50	ND	0.012	0.0129	0.0116	0.0130
Calcium	Lognormal	36/50	ND - 4950	221	1,689	51.9	944
Chromium	Lognormal	50/50	0.83 - 23.3	7.25	19.7	5.00	30.9
Cobalt	Neither	36/50	ND - 6.8	0.411	2.33	0.188	1.88
Copper	Lognormal	32/50	ND - 6.7	1.28	4.14	0.691	7.03
Iron	Lognormal	50/50	81.5 - 15600	2,719	10,168	1,287	16,984
Lead	Lognormal	50/50	1 - 12.2J	4.24	9.84	3.49	16,984
Magnesium	Lognormal	49/50	ND - 1250	181	616	103	1,022
Manganese	Neither	50/50	0.57J - 67.6	4.62	23.6	2.80	14.7
Mercury	Lognormal	30/50	ND - 0.16J	0.0355	0.086	0.030	0.096
Nickel	Neither	43/50	ND - 12.3	1.13	4.73	0.58	6.96
Potassium	Lognormal	49/50	ND - 869J	181	621	89.12	1,043
Selenium	Neither	21/50	ND - 1.3	0.252	0.682	0.202	0.70
Silver	Neither	7/50	ND - 0.36J	0.064	0.180	0.054	0.142
Sodium	Neither	0/50	ND	34.2	58.8	31.8	68.0
Thallium	Neither	0/50	ND	0.190	0.215	0.190	0.219
Vanadium	Lognormal	50/50	0.35J - 39	8.60	26.7	5.26	44.7
Zinc	Lognormal	25/50	ND - 39.7	3.29	15.1	1.39	21.5

Table 6-6
Statistics Summary for Inorganics in Shallow Groundwater Samples
Base Background Groundwater Study
MCB Camp Lejeune, North Carolina

	Minimum Detected	Maximum Detected	Frequency of Detection	Arithmatic Mean Half Non-Detects	Standard Deviation	Arithmatic Mean Plus 2 Standard Deviations	Log Arithmatic Mean Half Non-Detects	Log Standard Deviation	Log Arithmatic Mean Plus 2 Standard Deviations
METALS (ug/L)									
Aluminum	294	3650	16/24	942.9	1079.8	3102.6	333.6	6.17	346.0
Antimony	0	0	0/24	1.64	0.39	2.42	1.58	1.30	4.18
Arsenic	6.6 J	19	4/24	2.88	4.62	12.1	1.57	2.48	6.54
Barium	9.2 J	143 J	21/24	43.1	33.2	109.4	33.1	2.10	37.31
Beryllium	0	0	0/24	0.15	0.13	0.42	0.13	1.72	3.56
Cadmium	0	0	0/24	0.18	0.03	0.23	0.18	1.15	2.48
Calcium	501 J	176000 J	24/24	34539.2	48613.0	131765.2	11849.0	4.95	11858.9
Chromium	0.66 J	8.4	11/24	1.56	2.10	5.76	0.77	3.25	7.28
Cobalt	0.73 J	5.6 J	10/24	1.70	1.86	5.42	0.95	2.97	6.90
Copper	5.1 J	5.1 J	1/24	1.38	1.86	3.66	1.01	2.23	5.46
Iron	140 J	32700 J	22/24	2999.6	6623.0	16245.5	943.9	5.31	954.5
Lead	1.5 J	4	10/24	1.40	1.10	3.61	1.08	2.03	5.15
Magnesium	728 J	11500	24/24	3181.5	2574.6	8330.7	2416.32	2.12	2420.6
Manganese	4.7 J	359	24/24	106.8	92.2	291.2	66.7	3.10	72.9
Mercury	0	0	0/24	0.05	0	0.05	0.05	1	2.05
Nickel	2 J	16.5 J	15/24	3.99	3.99	12.0	2.25	3.25	8.76
Potassium	677 J	4410	22/24	1638.7	892.0	3422.7	1380.2	1.95	1384.1
Selenium	0	0	0/24	1.57	0.63	2.83	1.46	1.48	4.42
Silver	0.79 J	0.95 J	2/24	0.39	0.18	0.74	0.35	1.49	3.34
Sodium	3370	23000	24/24	11254.2	6674.4	24602.9	9509.1	1.82	9512.7
Thallium	0	0	0/24	1.89	0.96	3.81	1.67	1.67	5.00
Vanadium	0.82 J	11.5 J	11/24	2.36	3.09	8.55	1	4.06	9.11
Zinc	4.6 J	129 J	14/24	21.0	31.04	83.11	8.76	4.06	16.9

U - Not detected.
UJ - Not detected-Quantitation limit is estimated.
J - Analyte present-Report value is estimated.

TABLE 6-7
STATISTICS SUMMARY FOR INORGANICS IN DEEP GROUNDWATER SAMPLES
BASE BACKGROUND GROUNDWATER STUDY
MCB, CAMP LEJEUNE, NORTH CAROLINA

	Minimum Detected	Maximum Detected	Frequency of Detection	Arithmatic Mean Half Non-Detects	Standard Deviation	Arithmatic Mean Plus 2 Standard Deviations	Log Arithmatic Mean Half Non-Detects Converted	Log Standard Deviation Converted	Log Arithmatic Mean Plus 2 Standard Deviations
METALS (ug/L)									
Aluminum	283	41800 J	14/24	4015.9	9154.3	22324.5	415.7	11.4	438.4
Antimony	0	0	0/24	1.6	0.4	2.37	1.54	1.28	4.1
Arsenic	2.9 J	28.7 J	5/24	2.6	5.6	13.8	1.46	2.16	5.8
Barium	4.2 J	213 J	20/24	44.6	47.4	139.5	30.6	2.36	35.3
Beryllium	2.2 J	3.2 J	2/24	0.39	0.75	1.89	0.18	2.86	5.9
Cadmium	0.48 J	0.97 J	2/24	0.23	0.17	0.57	0.20	1.51	3.2
Calcium	717 J	384000 J	24/24	51995.7	78980.4	209956.6	17676.7	5.93	17688.5
Chromium	0.85 J	80.8 J	12/24	6.9	16.7	40.2	1.32	6.17	13.7
Cobalt	1.1 J	42.7 J	7/24	3.0	8.6	20.2	0.83	3.56	7.9
Copper	1.3 J	47.4 J	7/24	4.7	8.6	24.4	1.54	3.94	9.4
Iron	193 J	55200 J	22/24	8010.8	14326.4	36663.6	2100.6	7.39	2115.4
Lead	1.1 J	61.7 J	9/24	5.1	12.9	30.9	1.45	3.67	8.8
Magnesium	825 J	18500 J	24/24	3637.5	3745.0	11127.6	2643.9	2.16	2648.2
Manganese	4.7 J	1060 J	24/24	137.1	234.4	605.8	56.3	3.82	63.9
Mercury	0	0	0/24	0.05	0.00	0.05	0.05	1	2.0
Nickel	1.7 J	76.5 J	12/24	6.1	15.6	37.4	1.68	4.26	10.2
Potassium	475 J	8980 J	21/24	2174.3	1935.2	6044.8	1571.8	2.32	1576.5
Selenium	3.8 J	3.8 J	1/24	1.58	0.76	3.10	1.43	1.54	4.5
Silver	0.55 J	0.72 J	2/24	0.35	0.13	0.61	0.33	1.40	3.1
Sodium	4410 J	95300	24/24	16226.3	21139.3	58504.8	11047.9	2.16	11052.3
Thallium	0	0	0/24	1.73	0.91	3.56	1.54	1.62	4.8
Vanadium	0.44 J	107 J	14/24	8.66	21.9	52.4	1.65	6.36	14.4
Zinc	2.1 J	333 J	10/24	32.6	73.6	179.8	6.2	6.05	18.3

U - Not detected
UJ - Not detected - Quantitation limit is estimated
J - Analyte present - Report value is estimated

TABLE 6-8

SUMMARY OF SOIL ANALYTICAL RESULTS
HPIA BUILDING 1120
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria		Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria	
		Base Background	NC Soil to Groundwater Concentrations	Min.	Max.			Base Background	NC Soil to Groundwater Concentrations
Volatile Organic Compounds (ug/kg)	Cis/trans-1,2-dichloroethene	--	298.12	2J	2J	1120-IS03-05	1/6	--	0
	Tetrachloroethene	--	19.67	5.8	54J	1120-IS02-04	2/6	--	1
	Toluene	--	16,514.72	30	30	1120-IS03-05	1/6	--	0
	Trichloroethene	--	35.72	5.3J	5.3J	1120-IS03-05	1/6	--	0
	Xylenes, Total	--	13,667.92	5.7J	5.7J	1120-IS03-05	1/6	--	0
Metals Surface Soil (mg/kg)	Aluminum	17,6000J	NE	300	2,100	1120-IS03-05	3/3	0	NA
	Antimony	0.9J	5.42	0.47J	0.75J	1120-IS03-01	2/3	0	0
	Arsenic	1.3J	5.24	0.32J	0.6J	1120-IS03-01	3/3	0	0
	Barium	24	848	2	16	1120-IS02-01	3/3	0	0
	Calcium	105,000	NE	400	2,400	1120-IS02-01	3/3	0	NA
	Chromium	12.6	27.2	0.8J	2.2	1120-IS03-01	3/3	0	0
	Cobalt	0.51J	NE	0.09J	0.17J	1120-IS02-01	3/3	0	NA
	Copper	38.5	704	0.082J	0.98J	1120-IS03-01	3/3	0	0
	Iron	12,200J	151.2	63	1,300	1120-IS03-01	3/3	0	2
	Lead	38.5J	270.06	1.2	4.1	1120-IS02-01	3/3	0	0
	Magnesium	1610	NE	11J	58J	1120-IS02-01	3/3	0	NA
	Manganese	49	65.2	1.8	18	1120-IS03-01	3/3	0	0
	Mercury	0.12J	0.014	0.018J	0.032	1120-IS02-01	2/3	0	3
	Nickel	1.8	56.4	0.56J	0.63J	1120-IS02-01	2/3	0	0
	Potassium	263J	NE	16J	51J	1120-IS02-01	3/3	0	NA
	Sodium	307	NE	15J	21J	1120-IS02-01	3/3	0	NA
	Vanadium	26.2	NE	0.58J	3.5	1120-IS03-01	3/3	0	NA
	Zinc	73.9	1,100	1.9J	4.6	1120-IS01-01	2/3	0	0

TABLE 6-8

SUMMARY OF SOIL ANALYTICAL RESULTS
HPIA BUILDING 1120
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria		Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria	
		Base Background	NC Soil to Groundwater Concentrations	Min.	Max.			Base Background	NC Soil to Groundwater Concentrations
Metals Subsurface Soil (mg/kg)	Aluminum	16,800	NE	610	1,900	1120-IS01-05	3/3	0	NA
	Barium	27.1	848	1.6	3.4	1120-IS01-05	3/3	0	0
	Calcium	4,950	NE	13J	38J	1120-IS02-04,1120-IS01-05	3/3	0	NA
	Chromium	23.3	27.2	1.2	13	1120-IS01-05	3/3	0	0
	Cobalt	6.8	NE	0.094J	0.25J	1120-IS01-05	3/3	0	NA
	Copper	6.7	704	0.11J	0.59J	1120-IS01-05	3/3	0	0
	Iron	15,600	151.2	120	360	1120-IS01-05	3/3	0	2
	Lead	12.2J	270.06	1.3	2.9	1120-IS01-05	3/3	0	0
	Magnesium	1,250	NE	25J	50J	1120-IS01-05	3/3	0	NA
	Manganese	67.6	65.2	1.3	3	1120-IS01-05	3/3	0	0
	Nickel	12.3	56.4	0.22J	5.8	1120-IS01-05	3/3	0	0
	Potassium	869J	NE	49J	97J	1120-IS01-05	3/3	0	NA
	Sodium	NE	NE	11J	16J	1120-IS04-05	3/3	NA	NA
	Vanadium	NE	NE	1.1	3.1	1120-IS01-05	3/3	NA	NA

Notes:

Volatile organic compounds concentrations presented in micrograms per kilogram (µg/kg).
Metals concentrations are presented in milligrams per kilogram (mg/kg).

NC Soil to Groundwater Concentrations = Soil-to-groundwater numbers are based on the current North Carolina Water Quality Standards (North Carolina Administrative Code, Title 15A, Subchapter 2L) or Interim Maximum Allowable Concentrations (IMAC's). If there is no 2L or IMAC, the soil screening number is based on the recommended 2L, or if not available the MCLG. The MCLG is also based on a 10^{-6} risk. A total organic carbon value of 4,300 mg/kg was used for the volatile organic compounds. The default concentrations were used for the metals.

Base Background = Base Background Study for Metals in soil at Camp Lejeune (Baker, September 2002).

J = Value is estimated

NA = Not Applicable

NE = Not Established

TABLE 6-9

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
HPIA BUILDING 1120
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria			Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria		
		NCWQS	MCL	Base Background	Min.	Max.			NCWQS	MCL	Base Background
Volatile Organic Compounds	Bromodichloromethane	0.6 (I)	80 (P) *	--	0.78J	2.4J	1120-TW03	3/3	3	0	--
	Chloroform	0.19	80 (P) *	--	3.4J	8.7	1120-TW02	3/3	3	0	--
	Dibromochloromethane	0.41 (I)	80 (P) *	--	0.84J	0.84J	1120-TW03	1/3	1	0	--
	Trichloroethene	2.8	5	--	0.65J	0.65J	1120-TW03	1/3	0	0	--
Metals	Aluminum	NE	--	41,800 J	640	8,000	1120-TW03	3/3	NA	--	0
	Barium	2,000	--	213J	57	8,000	1120-TW01	3/3	0	--	0
	Beryllium	NE	--	3.2J	0.11J	0.38J	1120-TW01	3/3	NA	--	0
	Calcium	NE	--	384,000J	9,900	29,000	1120-TW01	3/3	NA	--	0
	Chromium	50	--	80.8J	2.5J	8.4J	1120-TW03	2/3	0	--	0
	Cobalt	NE	--	42.7J	1.6J	1.7J	1120-TW03	2/3	NA	--	0
	Copper	1,000	--	47.4J	1.1J	1.8J	1120-TW03	2/3	0	--	0
	Iron	300	--	55,200J	170	2,100	1120-TW03	3/3	1	--	0
	Lead	15	--	61.7J	2.7J	2.7J	1120-TW03	1/3	0	--	0
	Magnesium	NE	--	18,500J	2,500	7,500	1120-TW01	3/3	NA	--	0
	Manganese	50	--	1,060J	11	40	1120-TW01	3/3	0	--	0
	Nickel	100	--	76.5J	3.2J	3.4J	1120-TW01	2/3	0	--	0
	Potassium	NE	--	8,980J	1,700	2,100	1120-TW01	3/3	NA	--	0
	Sodium	NE	--	95,300	4,700	12,000	1120-TW01	3/3	NA	--	0
	Vanadium	NE	--	107J	2J	11	1120-TW03	3/3	NA	--	0
	Zinc	2,100	--	333J	2.7J	8J	1120-TW03	3/3	0	--	0

Notes:

Concentrations presented in micrograms per liter (µg/L).

MCL = Federal Maximum Contaminant Level. Maximum permissible level of a contaminant in water which is delivered to users of public water systems (U.S. Environmental Protection Agency - Drinking Water Regulations and Health Advisories).

NCWQS = North Carolina Water Quality Standards (North Carolina Administrative Code, Title 15A, Subchapter 2L).
(I) = Interim standard or IMAC (Interim Maximum Allowable Concentration)
(P) = Proposed level
* = Total for all THM's combined cannot exceed 80 ug/L (proposed level). The current regulatory level for total THM's is 100 ug/L)

Base Background = deep groundwater data from Base Background Study for Metals in Groundwater at Camp Lejeune (Baker, September 2002).

J = Value is estimated

NA = Not Applicable

NE = Not Established

TABLE 6-10

SUMMARY OF SOIL ANALYTICAL RESULTS
HPIA BUILDING 1409
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria		Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria	
		Base Background	NC Soil to Groundwater Concentrations	Min.	Max.			Base Background	NC Soil to Groundwater Concentrations
Volatile Organic Compounds (ug/kg)	Acetone	--	2,836.54	3.4J	3.4J	1409-IS02-01	1/6	--	0
Semivolatile Organic Compounds (ug/kg)	bis(2-ethylhexyl)phthalate	--	28,650.00	810	810	1409-IS03-04	1/6	--	0
Metals Surface Soil (mg/kg)	Aluminum	17,6000J	NE	1500	4700	1409-IS03-01	3/3	0	NA
	Antimony	0.9J	5.42	0.53J	0.53J	1409-IS03-01	1/3	0	0
	Arsenic	1.3J	5.24	0.56J	0.77J	1409-IS03-01	2/3	0	0
	Barium	24	848	2.7	11	1409-IS03-01	3/3	0	0
	Calcium	105,000	NE	590	5000	1409-IS03-01	3/3	0	NA
	Chromium	12.6	27.2	1.5	5.2	1409-IS03-01	3/3	0	0
	Cobalt	0.51J	NE	0.087J	0.33J	1409-IS03-01	3/3	0	NA
	Copper	38.5	704	0.38J	1.3J	1409-IS03-01	3/3	0	0
	Iron	12,200J	151.2	390	2400	1409-IS03-01	3/3	0	3
	Lead	38.5J	270.06	2.8	12	1409-IS02-01	3/3	0	0
	Magnesium	1610	NE	37J	220J	1409-IS03-01	3/3	0	NA
	Manganese	49	65.2	2.2	7.3	1409-IS03-01	3/3	0	0
	Mercury	0.12J	0.014	0.014J	0.047J	1409-IS03-01	2/3	0	2
	Nickel	1.8	56.4	0.42J	0.99J	1409-IS03-01	3/3	0	0
	Potassium	263J	NE	35J	160	1409-IS03-01	3/3	0	NA
	Sodium	307	NE	13J	29J	1409-IS02-01,1409-IS03-01	3/3	0	NA
	Vanadium	26.2	NE	1.2	7.3	1409-IS03-01	3/3	0	NA
	Zinc	73.9	1,100	2.5	3.8	1409-IS03-01	2/3	0	0

TABLE 6-10

SUMMARY OF SOIL ANALYTICAL RESULTS
HPIA BUILDING 1409
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria		Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria	
		Base Background	NC Soil to Groundwater Concentrations	Min.	Max.			Base Background	NC Soil to Groundwater Concentrations
Metals Subsurface Soil (mg/kg)	Aluminum	16,800	NE	2000	3500	1409-IS01-05	3/3	0	NA
	Arsenic	9.3	5.24	0.44J	1.3	1409-IS01-05	3/3	0	0
	Barium	27.1	848	3	4.8	1409-IS01-05	3/3	0	0
	Calcium	4,950	NE	26J	88	1409-IS01-05	3/3	0	NA
	Chromium	23.3	27.2	3	6.1	1409-IS01-05	3/3	0	0
	Cobalt	6.8	NE	0.16J	0.26J	1409-IS03-05	3/3	0	NA
	Copper	6.7	704	0.18J	0.76J	1409-IS01-05	3/3	0	0
	Iron	15,600	151.2	930	2600	1409-IS01-05	3/3	0	3
	Lead	12.2J	270.06	1.8	4.4	1409-IS03-04	3/3	0	0
	Magnesium	1,250	NE	70J	150J	1409-IS03-04	3/3	0	NA
	Manganese	67.6	65.2	1.3	2.9	1409-IS01-05	3/3	0	0
	Nickel	12.3	56.4	0.37J	0.41J	1409-IS01-05	3/3	0	0
	Potassium	869J	NE	81J	230	1409-IS01-05	3/3	0	NA
	Sodium	NE	NE	20J	26J	1409-IS01-05	3/3	NA	NA
	Vanadium	NE	NE	3.4	9.3	1409-IS01-05	3/3	NA	NA
	Zinc	39.7	1,100	1.5J	1.7J	1409-IS01-05	2/3	0	0

Notes:

Volatile organic compounds concentrations presented in micrograms per kilogram (µg/kg).
Metals concentrations presented in milligrams per kilogram (mg/kg).

NC Soil to Groundwater Concentrations = Soil-to-groundwater numbers are based on the current North Carolina Water Quality Standards (North Carolina Administrative Code, Title 15A, Subchapter 2L) or Interim Maximum Allowable Concentrations (IMAC's). If there is no 2L or IMAC, the soil screening number is based on the recommended 2L, or if not available the MCLG. The MCLG is also based on a 10^{-6} risk. A total organic carbon value of 4,300 mg/kg was used for the volatile organic compounds. The default concentrations were used for the metals.

Base Background = Base Background Study for Metals in soil at Camp Lejeune (Baker, September 2002).

J = Value is estimated

NA = Not Applicable

NE = Not Established

TABLE 6-11

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
HPIA BUILDING 1409
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria			Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria		
		NCWQS	MCL	Base Background	Min.	Max.			NCWQS	MCL	Base Background
Volatile Organic Compounds	Bromodichloromethane	0.6 (I)	80 (P) *	--	5.6	5.6	1409-TW01	1/3	1	0	--
	Chloroform	0.19	80 (P) *	--	1.5J	31	1409-TW01	2/3	2	0	--
	Dibromochlromethane	0.41 (I)	80 (P) *	--	1.3J	1.3J	1409-TW01	1/3	1	0	--
Metals	Aluminum	NE	--	41,800J	460	1,800	1409-TW02	2/3	NA	--	0
	Barium	2,000	--	213J	15	68	1409-TW02	3/3	0	--	0
	Beryllium	NE	--	3.2J	0.12J	68	1409-TW02	1/3	NA	--	0
	Calcium	NE	--	384,000J	14,000	40,000	1409-TW03	3/3	NA	--	0
	Chromium	50	--	80.8J	1.1J	2.3J	1409-TW02	2/3	0	--	0
	Copper	1,000	--	47.4J	1J	2.3J	1409-TW03	2/3	0	--	0
	Iron	300	--	55,200J	73	9,700	1409-TW03	3/3	2	--	0
	Magnesium	NE	--	18,500J	1,300	2,800	1409-TW02	3/3	NA	--	0
	Manganese	50	--	1,060J	24	120	1409-TW03	3/3	1	--	0
	Nickel	100	--	76.5J	3.1J	3.1J	1409-TW03	1/3	0	--	0
	Potassium	NE	--	8,980J	1,100	2,300	1409-TW02	3/3	NA	--	0
	Sodium	NE	--	95,300	6,700	8,800	1409-TW03	3/3	NA	--	0
	Vanadium	NE	--	107J	1.5J	3.6J	1409-TW02	2/3	NA	--	0
	Zinc	2,100	--	333J	2.4J	19J	1409-TW03	3/3	0	--	0

Notes:

Concentrations presented in micrograms per liter (µg/L).

MCL = Federal Maximum Contaminant Level. Maximum permissible level of a contaminant in water which is delivered to users of public water systems (U.S. Environmental Protection Agency - Drinking Water Regulations and Health Advisories).

NCWQS = North Carolina Water Quality Standards (North Carolina Administrative Code, Title 15A, Subchapter 2L).
(I) = Interim standard or IMAC (Interim Maximum Allowable Concentration)
(P) = Proposed level
* = Total for all THM's combined cannot exceed 80 ug/L (proposed level). The current regulatory level for total THM's is 100 ug/L)

Base Background = deep groundwater data from Base Background Study for Metals in Groundwater at Camp Lejeune (Baker, September 2002).

J = Value is estimated

NA = Not Applicable

NE = Not Established

TABLE 6-12

SUMMARY OF SOIL ANALYTICAL RESULTS
HPIA BUILDING 1512
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria		Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria	
		Base Background	NC Soil to Groundwater Concentrations	Min.	Max.			Base Background	NC Soil to Groundwater Concentrations
Volatile Organic Compounds (ug/kg)	Acetone	--	2,836.54	10J	10J	1512-IS03-02	1/6	--	0
Semivolatile Organic Compounds (ug/kg)	Benzo(a)anthracene	--	1,500	45J	45J	1512-IS02-05	1/6	--	0
	Benzo(a)pyrene	--	390	74J	74J	1512-IS02-05	1/6	--	0
	Benzo(b)fluoranthene	--	4,970	70J	70J	1512-IS02-05	1/6	--	0
	Benzo(g,h,i)perylene	--	28,896,800	74J	74J	1512-IS02-05	1/6	--	0
	Benzo(k)fluoranthene	--	49,700	66J	66J	1512-IS02-05	1/6	--	0
	Chrysene	--	163,970	68J	68J	1512-IS02-05	1/6	--	0
	Fluoranthene	--	1,183,450	120J	120J	1512-IS02-05	1/6	--	0
	Phenanthrene	--	253,680	44J	44J	1512-IS02-05	1/6	--	0
	Pyrene	--	1,228,920	83J	83J	1512-IS02-05	1/6	--	0
	bis(2-ethylhexyl)phthalate	--	28,650	260J	440	1512-IS02-05	2/6	--	0
Metals Subsurface Soil (mg/kg)	Aluminum	16,800	NE	540J	4,200J	1512-IS03-05	6/6	0	NA
	Arsenic	9.3	5.24	0.7J	1.9	1512-IS02-04	2/6	0	0
	Barium	27.1	848	3	64	1512-IS01-05	6/6	1	0
	Beryllium	0.91	3.38	0.013J	0.053J	1512-IS03-05	6/6	0	0
	Cadmium	NE	2.72	0.15J	0.15J	1512-IS01-05	1/6	NA	0
	Calcium	4,950	NE	67	17,000	1512-IS01-05	6/6	1	NA
	Chromium	23.3	27.2	0.66J	6.1	1512-IS02-04	6/6	0	0
	Cobalt	6.8	NE	0.095J	0.11J	1512-IS03-05	2/6	0	NA
	Copper	6.7	704	0.1J	2.9	1512-IS01-05	6/6	0	0
	Iron	15,600	151.2	110J	2,700J	1512-IS02-04	6/6	0	5
	Lead	12.2J	270.06	0.99	29	1512-IS01-05	6/6	1	0
	Magnesium	1,250	NE	21J	290	1512-IS01-05	6/6	0	NA
	Manganese	67.6	65.2	1.4	12	1512-IS01-05	6/6	0	0
	Mercury	0.16J	0.014	0.018J	0.02	1512-IS01-05	2/6	0	2
	Nickel	12.3	56.4	0.3J	0.56J	1512-IS03-05	5/6	0	0
	Potassium	869J	NE	21J	220	1512-IS03-05	6/6	0	NA

TABLE 6-12

SUMMARY OF SOIL ANALYTICAL RESULTS
HPIA BUILDING 1512
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria		Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria	
		Base Background	NC Soil to Groundwater Concentrations	Min.	Max.			Base Background	NC Soil to Groundwater Concentrations
Metals (cont.)	Selenium	1.3	12.2	0.35J	0.43J	1512-IS01-03	2/6	0	0
	Vanadium	NE	NE	0.88J	8.4	1512-IS02-04	6/6	NA	NA
	Zinc	39.7	1,100	0.16J	25	1512-IS01-05	6/6	0	0

Notes:

Volatile organic compounds concentrations presented in micrograms per kilogram (µg/kg).
Metals concentrations presented in milligrams per kilogram (mg/kg).

NC Soil to Groundwater Concentrations = Soil-to-groundwater numbers are based on the current North Carolina Water Quality Standards (North Carolina Administrative Code, Title 15A, Subchapter 2L) or Interim Maximum Allowable Concentrations (IMAC's). If there is no 2L or IMAC, the soil screening number is based on the recommended 2L, or if not available the MCLG. The MCLG is also based on a 10^{-6} risk. A total organic carbon value of 4,300 mg/kg was used for the volatile organic compounds. The default concentrations were used for the metals.

Base Background = Base Background Study for Metals in soil at Camp Lejeune (Baker, September 2002).

J = Value is estimated

NA = Not Applicable

NE = Not Established

TABLE 6-13

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
HPIA BUILDING 1512
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria			Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria		
		NCWQS	MCL	Base Background	Min.	Max.			NCWQS	MCL	Base Background
Volatile Organic Compounds	Bromodichloromethane	0.6 (I)	80 (P) *	--	0.61J	3.3J	1512-TW02	2/3	2	0	--
	Chloroform	0.19	80 (P) *	--	1.2J	15	1512-TW02	3/3	3	0	--
	Cis/trans-1,2-dichloroethene	70	70	--	0.88J	0.88J	1512-TW03	1/3	0	0	--
	Dibromochlromethane	0.41 (I)	80 (P) *	--	0.83J	0.83J	1512-TW02	1/3	1	0	--
	Toluene	1,000	1,000	--	2.2J	2.2J	1512-TW03	1/3	0	0	--
	Trichloroethene	2.8	5	--	0.76J	2.2J	1512-TW03	2/3	0	0	--
Metals	Aluminum	NE	--	41,800J	1,400	79,000	1512-TW03	3/3	NA	--	0
	Arsenic	5	--	28.7J	11	11	1512-TW03	1/3	1	--	0
	Barium	2,000	--	213J	18	220	1512-TW03	3/3	0	--	0
	Beryllium	NE	--	3.2J	0.13J	0.96J	1512-TW03	2/3	NA	--	0
	Calcium	NE	--	384,000J	5,100	32,000	1512-TW02	3/3	NA	--	0
	Chromium	50	--	80.8J	1.5J	64	1512-TW03	3/3	1	--	0
	Cobalt	NE	--	42.7J	7.4J	7.4J	1512-TW03	1/3	NA	--	0
	Copper	1,000	--	47.4J	1.5J	5.2J	1512-TW03	2/3	0	--	0
	Iron	300	--	55,200J	400	16,000	1512-TW03	3/3	3	--	0
	Lead	15	--	61.7J	18	18	1512-TW03	1/3	1	--	0
	Magnesium	NE	--	18,500J	1,500	3,200	1512-TW03	3/3	NA	--	0
	Manganese	50	--	1,060J	9.4J	46	1512-TW03	3/3	0	--	0
	Nickel	100	--	76.5J	1.9J	34J	1512-TW03	2/3	0	--	0
	Potassium	NE	--	8,980J	1,300	5,400	1512-TW03	3/3	NA	--	0
	Selenium	50	--	3.8J	6.2J	11	1512-TW03	2/3	0	--	2
	Sodium	NE	--	95,300	5,000	5,600	1512-TW03	3/3	NA	--	0
	Vanadium	NE	--	107J	6.8J	66	1512-TW03	3/3	NA	--	0
	Zinc	2,100	--	333J	1.7J	28	1512-TW03	3/3	0	--	0

Notes:

Concentrations presented in micrograms per liter (µg/L).

MCL = Federal Maximum Contaminant Level. Maximum permissible level of a contaminant in water which is delivered to users of public water systems (U.S. Environmental Protection Agency - Drinking Water Regulations and Health Advisories).

NCWQS = North Carolina Water Quality Standards (North Carolina Administrative Code, Title 15A, Subchapter 2L).
(I) = Interim standard or IMAC (Interim Maximum Allowable Concentration)
(P) = Proposed level
* = Total for all THM's combined cannot exceed 80 ug/L (proposed level). The current regulatory level for total THM's is 100 ug/L)

Base Background = deep groundwater data from Base Background Study for Metals in Groundwater at Camp Lejeune (Baker, September 2002).

J = Value is estimated

NA = Not Applicable

NE = Not Established

TABLE 6-14

SUMMARY OF SOIL ANALYTICAL RESULTS
BUILDING SAS113
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria		Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria	
		Base Background	NC Soil Screening Level	Min.	Max.			Base Background	NC Soil to Groundwater Concentrations
Volatile Organic Compounds (ug/kg)	Acetone	--	2,836.54	15	70	IRP1-SS-IS03-1-3	3/4	--	0
	2- Butanone	--	17,100	3J	14	IRP1-SS-IS03-1-3	2/4	--	0
Semivolatile Organic Compounds (ug/kg)	Di-n-octyl phthalate	--	10,000,000	150J	150J	IRP1-SS-IS04-1-3	1/4	--	0
Pesticide/ Polychlorinated Biphenyls (ug/kg)	4,4'-DDD	--	129	2.5J	3.4J	IRP1-SS-IS04-1-3	2/4	--	0
	4,4'-DDE	--	NE	0.89J	1.8J	IRP1-SS-IS04-1-3	3/4	--	NA
	beta-BHC	--	NE	0.68J	0.68J	IRP1-SS-IS01-1-2	1/4	--	NA
	gamma-Chlordane	--	NE	0.45J	0.45J	IRP1-SS-IS03-1-3	1/4	--	NA
Metals Subsurface Soil (mg/kg)	Aluminum	17,600J	NE	2,000	2,260	IRP1-SS-IS02-1-2	4/4	0	NA
	Barium	24	848	5.2J	7.4J	IRP1-SS-IS02-1-2	4/4	0	0
	Calcium	105,000	NE	690J	72,000	IRP1-SS-IS03-1-3	4/4	0	NA
	Chromium	12.6	27.2	2.1J	5.2	IRP1-SS-IS03-1-3	4/4	0	0
	Copper	38.5	704	0.65J	1.4J	IRP1-SS-IS02-1-2	4/4	0	0
	Iron	12,200J	151.2	981	2,360	IRP1-SS-IS03-1-3	4/4	0	4
	Lead	38.5J	270.06	2.8	7.2	IRP1-SS-IS03-1-3	4/4	0	0
	Magnesium	1610	NE	49.5J	1090J	IRP1-SS-IS03-1-3	4/4	0	NA
	Manganese	49	65.2	3.9J	14.4	IRP1-SS-IS03-1-3	4/4	0	0
	Nickel	1.8	56.4	0.49J	0.99J	IRP1-SS-IS03-1-3	4/4	0	0
	Potassium	263J	NE	88.9J	88.9J	IRP1-SS-IS03-1-3	1/4	0	NA
	Sodium	307	NE	161J	161J	IRP1-SS-IS03-1-3	1/4	0	NA
	Vanadium	26.2	NE	2J	4.6J	IRP1-SS-IS03-1-3	4/4	0	NA
	Zinc	73.9	1,100	9.4	9.4	IRP1-SS-IS03-1-3	1/4	0	0

Notes:

Volatile organic compounds concentrations presented in micrograms per kilogram (µg/kg).
Metals concentrations presented in milligrams per kilogram (mg/kg).

NC Soil Screening Level = North Carolina Hazardous Waste Section Soil Screening Level protective of groundwater as calculated and compiled in Guidelines for Establishing Remediation Goals at RCRA Hazardous Waste Sites (NCDENR, May 2005).
Base Background = Base Background Study for Metals in soil at Camp Lejeune (Baker, September 2002).
J = Value is estimated
NA = Not Applicable
NE = Not Established

TABLE 6-15

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
BUILDING SAS113
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria			Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria		
		NCWQS	MCL	Base Background	Min.	Max.			NCWQS	MCL	Base Background
Volatile Organic Compounds	Carbon disulfide	700	NE	--	1J	1J	IRP1-GW-IS03-6-10	1/4	0	NA	--
Semivolatile Organic Compounds	Caprolactam	3500	NE	--	3J	3J	IRP1-GW-IS01-6-10	2/4	0	NA	--
Pesticide/ Polychlorinated Biphenyls	beta-BHC	0.019 (*)	NE	--	0.028	0.028	IRP1-GW-IS01-6-10	1/4	1	NA	--
Metals	Aluminum	NE	--	3,650	3,000	45,000	IRP1-GW-IS03-6-10	4/4	NA	--	3
	Arsenic	5	--	19	5.3J	18.9	IRP1-GW-IS03-6-10	3/4	3	--	0
	Barium	2,000	--	143J	68.1J	181J	IRP1-GW-IS03-6-10	4/4	0	--	1
	Beryllium	NE	--	0	0.48J	1.1J	IRP1-GW-IS03-6-10	2/4	NA	--	2
	Calcium	NE	--	176,000J	4280J	7,210	IRP1-GW-IS03-6-10	4/4	NA	--	0
	Chromium	50	--	8.4	17.1	67.4	IRP1-GW-IS03-6-10	4/4	1	--	4
	Cobalt	NE	--	5.6J	1.6J	11.1J	IRP1-GW-IS03-6-10	4/4	NA	--	2
	Copper	1,000	--	5.1J	3.4J	11.9J	IRP1-GW-IS03-6-10	4/4	0	--	1
	Iron	300	--	32,700J	10500	33,100	IRP1-GW-IS03-6-10	4/4	4	--	1
	Lead	15	--	4	5.1	40.5	IRP1-GW-IS03-6-10	4/4	1	--	4
	Magnesium	NE	--	11,500	709J	2400J	IRP1-GW-IS03-6-10	4/4	NA	--	0
	Manganese	50	--	359	41.7	130	IRP1-GW-IS03-6-10	4/4	3	--	0
	Nickel	100	--	16.5J	12.8J	40.5	IRP1-GW-IS04-6-10	4/4	0	--	3
	Potassium	NE	--	4,410	1070J	3590J	IRP1-GW-IS03-6-10	4/4	NA	--	0
	Sodium	NE	--	23,000	6,330	14,100	IRP1-GW-IS03-6-10	4/4	NA	--	0
	Vanadium	NE	--	11.5J	8.4J	71.3	IRP1-GW-IS03-6-10	4/4	NA	--	3
	Zinc	2,100	--	129J	56.8	834	IRP1-GW-IS03-6-10	4/4	0	--	3

Notes:

Concentrations presented in micrograms per liter (µg/L).

MCL = Federal Maximum Contaminant Level. Maximum permissible level of a contaminant in water which is delivered to users of public water systems (U.S. Environmental Protection Agency - Drinking Water Regulations and Health Advisories).

NCWQS = North Carolina Water Quality Standards (North Carolina Administrative Code, Title 15A, Subchapter 2L).
(*) = NCWQS for BHC

Base Background = shallow groundwater data from Base Background Study for Metals in Groundwater at Camp Lejeune (Baker, September 2002).

J = Value is estimated

NA = Not Applicable

NE = Not Established

TABLE 6-16

SUMMARY OF SOIL ANALYTICAL RESULTS
BUILDING AS116
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria		Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria	
		Base Background	NC Soil Screening Level	Min.	Max.			Base Background	NC Soil to Groundwater Concentrations
Volatile Organic Compounds (ug/kg)	Acetone	--	2,836.54	21	73	IRP2-SS-IS02-1-2	2/4	--	0
	Methylene Chloride	--	20	3J	3J	IRP2-SS-IS04-1-3	1/4	--	0
Semivolatile Organic Compounds (ug/kg)	bis(2-ethylhexyl)phthalate	--	5,560	470	840	IRP2-SS-IS02-1-2	2/4	--	0
	Di-n-octyl phthalate	--	10,000,000	130J	130J	IRP2-SS-IS02-1-2	1/4	--	0
Pesticide/ Polychlorinated Biphenyls (ug/kg)	4,4'-DDD	--	129	0.8J	6.2	IRP2-SS-IS02-1-2	3/4	--	0
	4,4'-DDE	--	NE	1.2J	4.9	IRP2-SS-IS02-1-2	4/4	--	NA
	beta-BHC	--	NE	0.6J	3J	IRP2-SS-IS02-1-2	4/4	--	NA
	Endosulfan II	--	NE	1.1J	1.1J	IRP2-SS-IS04-1-3	1/4	--	NA
	Endrin	--	440	1J	1J	IRP2-SS-IS04-1-3	1/4	--	0
	Endrin ketone	--	NE	2.7J	2.7J	IRP2-SS-IS02-1-2	1/4	--	NA
	gamma-Chlordane	--	NE	0.74J	0.74J	IRP2-SS-IS02-1-2	1/4	--	NA
	Heptachlor epoxide	--	6.34	0.55J	0.98J	IRP2-SS-IS02-1-2	2/4	--	0
Metals (mg/kg)	Aluminum	17,600J	NE	1,670	4,040	IRP2-SS-IS04-1-3	4/4	0	NA
	Barium	24	848	4.6J	9.1J	IRP2-SS-IS04-1-3	4/4	0	0
	Beryllium	0.53J	3.38	0.075J	0.075J	IRP2-SS-IS04-1-3	1/4	0	0
	Calcium	105,000	NE	343J	2750J	IRP2-SS-IS02-1-2	4/4	0	NA
	Chromium	12.6	27.2	1.6J	4	IRP2-SS-IS04-1-3	4/4	0	0
	Copper	38.5	704	0.43J	0.97J	IRP2-SS-IS02-1-2	4/4	0	0
	Iron	12,200J	151.2	834	1310	IRP2-SS-IS02-1-2	4/4	0	4
	Lead	38.5J	270.06	2.5	5.3	IRP2-SS-IS03-1-3	4/4	0	0
	Magnesium	1,610	NE	39.4J	128J	IRP2-SS-IS04-1-3	4/4	0	NA
	Manganese	49	65.2	2.9J	4.3J	IRP2-SS-IS02-1-2	4/4	0	0
	Nickel	1.8	56.4	0.36J	1.2J	IRP2-SS-IS01-2-3	4/4	0	0
	Sodium	307	NE	62.2J	62.2J	IRP2-SS-IS02-1-2	1/4	0	NA
	Vanadium	26.2	NE	1.8J	4.3J	IRP2-SS-IS04-1-3	4/4	0	NA

Notes:

Volatile organic compounds concentrations presented in micrograms per kilogram (µg/kg).
Metals concentrations presented in milligrams per kilogram (mg/kg).

NC Soil Screening Level = North Carolina Hazardous Waste Section Soil Screening Level protective of groundwater as calculated and compiled in Guidelines for Establishing Remediation Goals at RCRA Hazardous Waste Sites (NCDENR, May 2005).
Base Background = Base Background Study for Metals in soil at Camp Lejeune (Baker, September 2002).
J = Value is estimated
NA = Not Applicable
NE = Not Established

TABLE 6-17

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
BUILDING AS116
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria			Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria		
		NCWQS	MCL	Base Background	Min.	Max.			NCWQS	MCL	Base Background
Volatile Organic Compounds	Carbon disulfide	700	NE	--	1J	1J	IRP2-GW-IS02-6-10	1/4	0	NA	--
	Methyl-tert-butyl ether	200	NE	--	16	16	IRP2-GW-IS02-6-10	1/4	0	NA	--
	Toluene	1000	1000	--	0.8J	0.8J	IRP2-GW-IS03-6-10	1/4	0	0	--
	Xylene (total)	530	10000		7J	7J	IRP2-GW-IS03-6-10	1/4	0	0	
Semivolatile Organic Compounds	bis(2-ethylhexyl)phthalate	2.5	6	--	11	11	IRP2-GW-IS02-6-10	1/4	1	1	--
	Caprolactam	3500	NE	--	4J	11	IRP2-GW-IS02-6-10	2/4	0	NA	--
	Pentachlorophenol	0.29	1	--	7J	7J	IRP2-GW-IS02-6-10	1/4	1	1	--
Pesticide/ Polychlorinated Biphenyls	alpha-Chlordane	0.1 (*)	2(*)	--	0.01J	0.01J	IRP2-GW-IS03-6-10	1/4	0	0	--
Metals	Aluminum	NE	--	3,650	19,300	242,000J	IRP2-GW-IS02-6-10	4/4	NA	--	4
	Arsenic	5	--	19	16.2	35.2	IRP2-GW-IS02-6-10	4/4	4	--	1
	Barium	2,000	--	143J	82.6J	488	IRP2-GW-IS02-6-10	4/4	0	--	1
	Beryllium	NE	--	0	0.47J	3.6J	IRP2-GW-IS02-6-10	4/4	NA	--	4
	Cadmium	1.75	--	0	1.1J	1.8J	IRP2-GW-IS02-6-10	2/4	1	--	2
	Calcium	NE	--	176,000J	2700J	22,500	IRP2-GW-IS01-7-11	4/4	NA	--	0
	Chromium	50	--	8.4	42.4	277	IRP2-GW-IS02-6-10	4/4	1	--	4
	Cobalt	NE	--	5.6J	2.4J	17.4J	IRP2-GW-IS03-6-10	4/4	NA	--	3
	Copper	1,000	--	5.1J	7.9J	60.6	IRP2-GW-IS02-6-10	4/4	0	--	4
	Iron	300	--	32,700J	23600	109,000	IRP2-GW-IS01-7-11	4/4	4	--	2
	Lead	15	--	4	28	165	IRP2-GW-IS02-6-10	4/4	4	--	4
	Magnesium	NE	--	11,500	939J	8,240	IRP2-GW-IS02-6-10	4/4	NA	--	0
	Manganese	50	--	359	78	176	IRP2-GW-IS02-6-10	4/4	0	--	0
	Mercury	1.1	--	0	0.35	0.35	IRP2-GW-IS02-6-10	1/4	0	--	1
	Nickel	100	--	16.5J	22.3J	59.8	IRP2-GW-IS02-6-10	4/4	0	--	4
	Potassium	NE	--	4,410	1560J	9,590	IRP2-GW-IS02-6-10	4/4	NA	--	1
	Sodium	NE	--	23,000	5,300	14,500	IRP2-GW-IS01-7-11	4/4	NA	--	0
	Vanadium	NE	--	11.5J	37J	287	IRP2-GW-IS02-6-10	4/4	NA	--	4
	Zinc	2,100	--	129J	99	207	IRP2-GW-IS02-6-10	4/4	0	--	3

Notes:

Concentrations presented in micrograms per liter (µg/L).

MCL = Federal Maximum Contaminant Level. Maximum permissible level of a contaminant in water which is delivered to users of public water systems (U.S. Environmental Protection Agency - Drinking Water Regulations and Health Advisories).
NCWQS = North Carolina Water Quality Standards (North Carolina Administrative Code, Title 15A, Subchapter 2L).
(*) = NCWQS or MCL for chlordane
Base Background = shallow groundwater data from Base Background Study for Metals in Groundwater at Camp Lejeune (Baker, September 2002).
J = Value is estimated
NA = Not Applicable
NE = Not Established

TABLE 6-18

SUMMARY OF SOIL ANALYTICAL RESULTS
BUILDING AS119
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria		Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria	
		Base Background	NC Soil Screening Level	Min.	Max.			Base Background	NC Soil to Groundwater Concentrations
Volatile Organic Compounds (ug/kg)	4-methyl-2-pentanone	--	8,125	9	9	IRP3-SS-IS03-0-3	1/4	--	0
	Acetone	--	2,836.54	21	21	IRP3-SS-IS04-1-3	1/4	--	0
	Methylene chloride	--	20	2	3	IRP3-SS-IS04-1-3	2/4	--	0
Semivolatile Organic Compounds (ug/kg)	Anthracene	--	995,000	150J	150J	IRP3-SS-IS02-2-3	1/4	--	0
	Benzo(a)anthracene	--	343	1000	1000	IRP3-SS-IS02-2-3	1/4	--	1
	Benzo(a)pyrene	--	92.8	780	780	IRP3-SS-IS02-2-3	1/4	--	0
	Benzo(b)fluoranthene	--	1,180	770	770	IRP3-SS-IS02-2-3	1/4	--	0
	Benzo(g,h,i)perylene	--	6,720,000	170J	170J	IRP3-SS-IS02-2-3	1/4	--	0
	Benzo(k)fluoranthene	--	11,800	810	810	IRP3-SS-IS02-2-3	1/4	--	0
	bis(2-ethylhexyl)phthalate	--	5,560	430	430	IRP3-SS-IS03-0-3	1/4	--	0
	Caprolactam	--	NE	97J	97J	IRP3-SS-IS01-1-2	1/4	--	NA
	Chrysene	--	38,200	1100	1100	IRP3-SS-IS02-2-3	1/4	--	0
	dibenzo(a,h)anthracene	--	172	220J	220J	IRP3-SS-IS02-2-3	1/4	--	1
	Fluoranthene	--	276,000	1800	1800	IRP3-SS-IS02-2-3	1/4	--	0
	indeno(1,2,3-cd)pyrene	--	3,320	440	440	IRP3-SS-IS02-2-3	1/4	--	0
	Phenanthrene	--	59,600	870	870	IRP3-SS-IS02-2-3	1/4	--	0
	Pyrene	--	286,000	2000	2000	IRP3-SS-IS02-2-3	1/4	--	0
Pesticide/ Polychlorinated Biphenyls (ug/kg)	4,4'-DDD	--	129	3.6J	140	IRP3-SS-IS02-2-3	3/4	--	1
	4,4'-DDE	--		0.86J	56	IRP3-SS-IS02-2-3	4/4	--	NA
	4,4'-DDT	--	1360	1.1J	1.9J	IRP3-SS-IS02-2-3	2/4	--	0
	beta-BHC	--		0.97J	3.3J	IRP3-SS-IS02-2-3;IRP3-SS-IS03-0-3	4/4	--	NA
	delta-BHC	--		1J	1J	IRP3-SS-IS03-0-3	1/4	--	NA
	Dieldrin	--	1.13	2.6J	2.6J	IRP3-SS-IS01-1-2	1/4	--	0
	Endrin aldehyde	--		1.2J	1.2J	IRP3-SS-IS02-2-3	1/4	--	NA
	gamma-BHC (lindane)	--	6.2	0.4J	0.4J	IRP3-SS-IS03-0-3	1/4	--	0
	gamma-Chlordane	--		0.49J	0.49J	IRP3-SS-IS04-1-3	1/4	--	NA
Metals (mg/kg)	Aluminum	17,600J	NE	1,710	3,690	IRP3-SS-IS03-0-3	4/4	0	NA
	Arsenic	1.3J	5.24	0.87J	0.87J	IRP3-SS-IS03-0-3	1/4	0	0
	Barium	24	848	4.8J	9.6J	IRP3-SS-IS02-2-3	4/4	0	0
	Cadmium	0.11J	0.95	0.088J	0.088J	IRP3-SS-IS03-0-3	1/4	0	0
	Calcium	105,000	NE	419J	12,300J	IRP3-SS-IS04-1-3	4/4	0	NA
	Chromium	12.6	27.2	3	6	IRP3-SS-IS03-0-3	4/4	0	0
	Copper	38.5	704	0.52J	1.8J	IRP3-SS-IS02-2-3	4/4	0	0
	Iron	12,200J	151.2	992	3260	IRP3-SS-IS03-0-3	4/4	0	4

TABLE 6-18

SUMMARY OF SOIL ANALYTICAL RESULTS
BUILDING AS119
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria		Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria	
		Base Background	NC Soil Screening Level	Min.	Max.			Base Background	NC Soil to Groundwater Concentrations
	Lead	38.5J	270.06	2.7	13.7	IRP3-SS-IS02-2-3	4/4	0	0
Metals (cont.)	Magnesium	1,610	NE	97.2J	264J	IRP3-SS-IS04-1-3	4/4	0	NA
	Manganese	49	65.2	4.2J	10.4J	IRP3-SS-IS04-1-3	4/4	0	0
	Nickel	1.8	56.4	0.37J	0.8J	IRP3-SS-IS01-1-2	4/4	0	0
	Potassium	263J	NE	79.3J	177J	IRP3-SS-IS03-0-3	2/4	0	NA
	Sodium	307	NE	69.1J	69.1J	IRP3-SS-IS03-0-3	1/4	0	NA
	Vanadium	26.2	NE	3.5J	9.1J	IRP3-SS-IS03-0-3	4/4	0	NA
	Zinc	73.9	1,100	5	6	IRP3-SS-IS01-1-2;IRP3-SS-IS03-0-3	3/4	0	0

Notes:

Volatile organic c =
Metals concentrations presented in milligrams per kilogram (mg/kg).
NC Soil Screening Level = North Carolina Hazardous Waste Section Soil Screening Level protective of groundwater as calculated and compiled in Guidelines for Establishing Remediation Goals at RCRA Hazardous Waste Sites (NCDENR, May 2005).
Base Background = Base Background Study for Metals in soil at Camp Lejeune (Baker, September 2002).
J = Value is estimated
NA = Not Applicable
NE = Not Established

TABLE 6-19

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
BUILDING AS119
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria			Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria		
		NCWQS	MCL	Base Background	Min.	Max.			NCWQS	MCL	Base Background
Volatile Organic Compounds	Chloroform	70	80 (P)	--	2J	2J	IRP3-GW-IS03-6-10	1/4	0	0	--
	Methylene chloride	4.6	5	--	2J	2J	IRP3-GW-IS01-6-10	1/4	0	0	--
	Toluene	1000	1000	--	1J	1J	IRP3-GW-IS03-6-10	1/4	0	0	--
Semivolatile Organic Compounds	bis(2-ethylhexyl)phthalate	2.5	6	--	11	11	IRP3-GW-IS01-6-10	1/4	1	1	--
	Caprolactam	3500	NE	--	2J	3J	IRP3-GW-IS01-6-10	2/4	0	NA	--
				--		3J					
Pesticide/ Polychlorinated Biphenyls	beta-BHC	0.019 (*)	NE	--	0.019J	0.019J	IRP3-GW-IS02-6-10	1/4	0	NA	--
	delta-BHC	0.019 (*)	NE	--	0.014J	0.014J	IRP3-GW-IS03-6-10	1/4	0	NA	--
Metals	Aluminum	NE	--	3,650	558	102,000J	IRP3-GW-IS01-6-10	4/4	NA	--	2
	Arsenic	5	--	19	3J	11.2	IRP3-GW-IS01-6-10	3/4	2	--	0
	Barium	2,000	--	143J	86.2J	350	IRP3-GW-IS01-6-10	4/4	0	--	3
	Beryllium	NE	--	0	1.5J	1.5J	IRP3-GW-IS01-6-10	1/4	NA	--	1
	Cadmium	1.75	--	0	0.85J	0.85J	IRP3-GW-IS01-6-10	1/4	0	--	1
	Calcium	NE	--	176,000J	20,900	88,200	IRP3-GW-IS04-6-10	4/4	NA	--	0
	Chromium	50	--	8.4	6.6J	112	IRP3-GW-IS01-6-10	3/4	1	--	2
	Cobalt	NE	--	5.6J	1J	3.3J	IRP3-GW-IS01-6-10	3/4	NA	--	0
	Copper	1,000	--	5.1J	2.5J	17.2J	IRP3-GW-IS01-6-10	3/4	0	--	1
	Iron	300	--	32,700J	8720	45,500	IRP3-GW-IS01-6-10	4/4	4	--	2
	Lead	15	--	4	3.9	65.1	IRP3-GW-IS01-6-10	3/4	1	--	2
	Magnesium	NE	--	11,500	2710J	11,100	IRP3-GW-IS02-6-10	4/4	NA	--	0
	Manganese	50	--	359	83	268	IRP3-GW-IS02-6-10	4/4	4	--	0
	Mercury	1.1	--	0	0.26	0.33	IRP3-GW-IS03-6-10	2/4	0	--	2
	Nickel	100	--	16.5J	6.6J	51.1	IRP3-GW-IS02-6-10	4/4	0	--	3
	Potassium	NE	--	4,410	4220J	11,600	IRP3-GW-IS01-6-10	4/4	NA	--	3
	Sodium	NE	--	23,000	4830J	27,700	IRP3-GW-IS03-6-10	4/4	NA	--	1
	Vanadium	NE	--	11.5J	2.2J	143	IRP3-GW-IS01-6-10	4/4	NA	--	2
	Zinc	2,100	--	129J	55	297	IRP3-GW-IS02-6-10	4/4	0	--	3

Notes:

Concentrations presented in micrograms per liter (µg/L).

MCL = Federal Maximum Contaminant Level. Maximum permissible level of a contaminant in water which is delivered to users of public water systems (U.S. Environmental Protection Agency - Drinking Water Regulations and Health Advisories).

NCWQS = North Carolina Water Quality Standards (North Carolina Administrative Code, Title 15A, Subchapter 2L).
(P) = Proposed level
(*) = NCWQS for BHC

Base Background = shallow groundwater data from Base Background Study for Metals in Groundwater at Camp Lejeune (Baker, September 2002).

J = Value is estimated

NA = Not Applicable

NE = Not Established

TABLE 6-20

SUMMARY OF SOIL ANALYTICAL RESULTS
BUILDING M119
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria		Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria	
		Base Background	NC Soil Screening Level	Min.	Max.			Base Background	NC Soil to Groundwater Concentrations
Volatile Organic Compounds (ug/kg)	Methylene Chloride	--	20	3J	3J	IRP4-SS-IS04-0-3	1/4	--	0
Semivolatile Organic Compounds (ug/kg)	bis(2-ethylhexyl)phthalate	--	5,560	140J	140J	IRP4-SS-IS01-0-3	1/4	--	0
	Di-n-octyl phthalate	--	10,000,000	610J	610J	IRP4-SS-IS01-0-3	1/4	--	0
Pesticide/ Polychlorinated Biphenyls (ug/kg)	4,4'-DDD	--	129	1.4J	1.4J	IRP4-SS-IS04-0-3	1/4	--	0
	4,4'-DDE	--		120J	120J	IRP4-SS-IS04-0-3	1/4	--	NA
	4,4'-DDT	--	1360	52J	52J	IRP4-SS-IS04-0-3	1/4	--	0
	alpha-Chlordane	--		2.6J	2.6J	IRP4-SS-IS04-0-3	1/4	--	NA
	beta-BHC	--		0.61J	0.8J	IRP4-SS-IS03-1-3	2/4	--	NA
	Endrin	--	440	1.4J	1.4J	IRP4-SS-IS04-0-3	1/4	--	0
	gamma-Chlordane	--		2.1J	2.1J	IRP4-SS-IS04-0-3	1/4	--	NA
Metals (mg/kg)	Aluminum	17,600J	NE	2,350	4,350	IRP4-SS-IS01-0-3	4/4	0	NA
	Arsenic	1.3J	5.24	0.55J	0.67J	IRP4-SS-IS01-0-3	2/4	0	0
	Barium	24	848	4.7J	19.7J	IRP4-SS-IS04-0-3	4/4	0	0
	Calcium	105,000	NE	758J	2,470J	IRP4-SS-IS04-0-3	4/4	0	NA
	Chromium	12.6	27.2	1.5J	3.2	IRP4-SS-IS01-0-3	4/4	0	0
	Cobalt	0.51J	NE	0.19J	0.19J	IRP4-SS-IS01-0-3	1/4	0	NA
	Copper	38.5	704	0.64J	2J	IRP4-SS-IS04-0-3	4/4	0	0
	Iron	12,200J	151.2	977	2260	IRP4-SS-IS01-0-3	4/4	0	4
	Lead	38.5J	270.06	2	14.8	IRP4-SS-IS04-0-3	4/4	0	0
	Magnesium	1,610	NE	62.2J	122J	IRP4-SS-IS01-0-3	4/4	0	NA
	Manganese	49	65.2	4.1J	8.9J	IRP4-SS-IS04-0-3	4/4	0	0
	Nickel	1.8	56.4	0.61J	1J	IRP4-SS-IS01-0-3	4/4	0	0
	Potassium	263J	NE	78.8J	78.8J	IRP4-SS-IS01-0-3	1/4	0	NA
	Vanadium	26.2	NE	2.4J	5.6J	IRP4-SS-IS01-0-3	4/4	0	NA
	Zinc	73.9	1,100	18.9	18.9	IRP4-SS-IS04-0-3	1/4	0	0

Notes:

Volatile organic compounds concentrations presented in micrograms per kilogram (µg/kg).
Metals concentrations presented in milligrams per kilogram (mg/kg).

NC Soil Screening Level = North Carolina Hazardous Waste Section Soil Screening Level protective of groundwater as calculated and compiled in Guidelines for Establishing Remediation Goals at RCRA Hazardous Waste Sites (NCDENR, May 2005).

Base Background = Base Background Study for Metals in soil at Camp Lejeune (Baker, September 2002).

J = Value is estimated

NA = Not Applicable

NE = Not Established

TABLE 6-21

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
BUILDING M119
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria			Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria		
		NCWQS	MCL	Base Background	Min.	Max.			NCWQS	MCL	Base Background
Volatile Organic Compounds	Ethylbenzene	29	700	--	1J	1J	IRP4-GW-IS03-12-16	1/4	0	0	--
	Toluene	1000	1000	--	1J	1J	IRP4-GW-IS03-12-16	1/4	0	0	--
	Xylene (total)	530	10000	--	15	15	IRP4-GW-IS03-12-16	1/4	0	0	--
Pesticide/ Polychlorinated Biphenyls	beta-BHC	0.019 (*)	NE	--	0.013J	0.013J	IRP4-GW-IS02-12-16	1/4	0	NA	--
	delta-BHC	0.019 (*)	NE	--	0.01J	0.01J	IRP4-GW-IS02-12-16	1/4	0	NA	--
						0.01J					
Metals	Aluminum	NE	--	3,650	935J	8750J	IRP4-GW-IS01-12-16	4/4	NA	--	2
	Barium	2,000	--	143J	51.4J	166J	IRP4-GW-IS04-14-18	4/4	0	--	1
	Beryllium	NE	--	0	0.44J	0.44J	IRP4-GW-IS04-14-18	1/4	NA	--	1
	Calcium	NE	--	176,000J	1750J	12,800	IRP4-GW-IS04-14-18	4/4	NA	--	0
	Chromium	50	--	8.4	1.3J	26.2	IRP4-GW-IS01-12-16	3/4	0	--	1
	Cobalt	NE	--	5.6J	0.7J	2.2J	IRP4-GW-IS04-14-18	4/4	NA	--	0
	Copper	1,000	--	5.1J	2.5J	4.7J	IRP4-GW-IS01-12-16	2/4	0	--	0
	Iron	300	--	32,700J	1610	8,720	IRP4-GW-IS01-12-16	4/4	4	--	0
	Lead	15	--	4	1.4J	8.6	IRP4-GW-IS01-12-16	3/4	0	--	1
	Magnesium	NE	--	11,500	1950J	10,700	IRP4-GW-IS04-14-18	4/4	NA	--	0
	Manganese	50	--	359	19.8	74.8	IRP4-GW-IS04-14-18	4/4	1	--	0
	Nickel	100	--	16.5J	10.1J	22.9J	IRP4-GW-IS03-12-16	4/4	0	--	2
	Potassium	NE	--	4,410	1000J	1830J	IRP4-GW-IS01-12-16	4/4	NA	--	0
	Sodium	NE	--	23,000	8,320	23,600	IRP4-GW-IS02-12-16	4/4	NA	--	1
	Vanadium	NE	--	11.5J	0.91J	12.4J	IRP4-GW-IS01-12-16	3/4	NA	--	1
	Zinc	2,100	--	129J	103	322	IRP4-GW-IS01-12-16	4/4	0	--	3

Notes:

Concentrations presented in micrograms per liter (µg/L).

MCL = Federal Maximum Contaminant Level. Maximum permissible level of a contaminant in water which is delivered to users of public water systems (U.S. Environmental Protection Agency - Drinking Water Regulations and Health Advisories).

NCWQS = North Carolina Water Quality Standards (North Carolina Administrative Code, Title 15A, Subchapter 2L).
(*) = NCWQS for BHC

Base Background = shallow groundwater data from Base Background Study for Metals in Groundwater at Camp Lejeune (Baker, September 2002).

J = Value is estimated

NA = Not Applicable

NE = Not Established

TABLE 6-22

SUMMARY OF SOIL ANALYTICAL RESULTS
BUILDING M315
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria		Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria	
		Base Background	NC Soil Screening Level	Min.	Max.			Base Background	NC Soil to Groundwater Concentrations
Volatile Organic Compounds (ug/kg)	Methylene Chloride	--	20	2J	4J	IRP5-SS-IS04-0-3	2/5	--	0
Semivolatile Organic Compounds (ug/kg)	bis(2-ethylhexyl)phthalate	--	5,560	83J	150J	IRP5-SS-IS01-0-3	2/5	--	0
Pesticide/ Polychlorinated Biphenyls (ug/kg)	4,4'-DDE	--		0.86J	68	IRP5-SS-IS01-0-3	5/5	--	NA
	4,4'-DDT	--	1,360	2J	41	IRP5-SS-IS01-0-3	3/5	--	0
	alpha-Chlordane	--		0.56J	14J	IRP5-SS-IS01-0-3	3/5	--	NA
	beta-BHC	--		0.64J	1.1J	IRP5-SS-IS02-0-4	2/5	--	NA
	Endrin ketone	--		0.96J	0.96J	IRP5-SS-IS01-0-3	1/5	--	NA
	gamma-Chlordane	--		0.57J	8.2	IRP5-SS-IS01-0-3	3/5	--	NA
	Heptachlor epoxide	--	6.34	0.65J	1.2J	IRP5-SS-IS01-0-3	2/5	--	0
Metals (mg/kg)	Aluminum	17,600J	NE	1,710	3,590	IRP5-SS-IS02-0-4	5/5	0	NA
	Arsenic	1.3J	5.24	0.95J	0.95J	IRP5-SS-IS03-DUP-0-3	1/5	0	0
	Barium	24	848	6.3J	10.6J	IRP5-SS-IS03-0-3	5/5	0	0
	Calcium	105,000	NE	429J	995J	IRP5-SS-IS04-0-3	5/5	0	NA
	Chromium	12.6	27.2	1.4J	4	IRP5-SS-IS02-0-4	5/5	0	0
	Cobalt	0.51J	NE	0.19J	0.2J	IRP5-SS-IS02-0-4	2/5	0	NA
	Copper	38.5	704	0.74J	3.1J	IRP5-SS-IS02-0-4	5/5	0	0
	Iron	12,200J	151.2	667	1830	IRP5-SS-IS03-DUP-0-3	5/5	0	5
	Lead	38.5J	270.06	3.2	29	IRP5-SS-IS01-0-3	5/5	0	0
	Magnesium	1,610	NE	50.8J	94.5J	IRP5-SS-IS02-0-4	5/5	0	NA
	Manganese	49	65.2	3.1J	8.6J	IRP5-SS-IS01-0-3	5/5	0	0
	Nickel	1.8	56.4	0.6J	1.2J	IRP5-SS-IS01-0-3	5/5	0	0
	Potassium	263J	NE	60.1J	110J	IRP5-SS-IS02-0-4	2/5	0	NA
	Vanadium	26.2	NE	2J	5.4J	IRP5-SS-IS02-0-4	5/5	0	NA
	Zinc	73.9	1,100	5.2	23.2	IRP5-SS-IS01-0-3	3/5	0	0

Notes:

Volatile organic compounds concentrations presented in micrograms per kilogram (µg/kg).
Metals concentrations presented in milligrams per kilogram (mg/kg).

NC Soil Screening Level = North Carolina Hazardous Waste Section Soil Screening Level protective of groundwater as calculated and compiled in Guidelines for Establishing Remediation Goals at RCRA Hazardous Waste Sites (NCDENR, May 2005).
Base Background = Base Background Study for Metals in soil at Camp Lejeune (Baker, September 2002).
J = Value is estimated
NA = Not Applicable
NE = Not Established

TABLE 6-23

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
BUILDING M315
PRELIMINARY ASSESSMENT SITES, CTO - 190
MCB, CAMP LEJEUNE, NORTH CAROLINA

Fraction	Detected Compounds	Comparison Criteria			Concentration Range of Positive Detections		Location of Maximum Detection	Detection Frequency	Detections Above Comparison Criteria		
		NCWQS	MCL	Base Background	Min.	Max.			NCWQS	MCL	Base Background
Semivolatile Organic Compounds	bis(2-ethylhexyl)phthalate	2.5	6	--	4J	4J	IRP5-GW-IS01-16-20	1/4	1	0	--
Pesticide/ Polychlorinated Biphenyls	beta-BHC	0.019 (*)	NE	--	0.014J	0.014J	IRP5-GW-IS01-16-20	1/4	0	NA	--
Metals	Aluminum	NE	--	3,650	583J	26,600J	IRP5-GW-IS02-16-20	4/4	NA	--	1
	Arsenic	5	--	19	4.9J	7.3J	IRP5-GW-IS04-15-19	2/4	1	--	0
	Barium	2,000	--	143J	61.2J	82.1J	IRP5-GW-IS02-16-20	4/4	0	--	0
	Beryllium	NE	--	0	0.36J	0.91J	IRP5-GW-IS02-16-20	2/4	NA	--	2
	Cadmium	1.75	--	0	0.56J	0.56J	IRP5-GW-IS04-15-19	1/4	0	--	1
	Calcium	NE	--	176,000J	898J	2010J	IRP5-GW-IS03-16-20	4/4	NA	--	0
	Chromium	50	--	8.4	4.9J	47.3	IRP5-GW-IS02-16-20	3/4	0	--	2
	Cobalt	NE	--	5.6J	0.92J	2.1J	IRP5-GW-IS04-15-19	4/4	NA	--	0
	Copper	1,000	--	5.1J	4.2J	16.9J	IRP5-GW-IS02-16-20	2/4	0	--	1
	Iron	300	--	32,700J	1500	9,820	IRP5-GW-IS02-16-20	4/4	4	--	0
	Lead	15	--	4	3.3	16.7	IRP5-GW-IS02-16-20	2/4	1	--	1
	Magnesium	NE	--	11,500	1070J	2460J	IRP5-GW-IS04-15-19	4/4	NA	--	0
	Manganese	50	--	359	17.3	46.9	IRP5-GW-IS02-16-20	4/4	0	--	0
	Nickel	100	--	16.5J	16.9J	30.1J	IRP5-GW-IS01-16-20	4/4	0	--	4
	Potassium	NE	--	4,410	841J	2670J	IRP5-GW-IS02-16-20	4/4	NA	--	0
	Sodium	NE	--	23,000	5,740	6,990	IRP5-GW-IS01-16-20	4/4	NA	--	0
	Vanadium	NE	--	11.5J	2.5J	26.7J	IRP5-GW-IS02-16-20	3/4	NA	--	1
	Zinc	2,100	--	129J	84.5	238	IRP5-GW-IS04-15-19	4/4	0	--	1

Notes:

Concentrations presented in micrograms per liter (µg/L).

MCL = Federal Maximum Contaminant Level. Maximum permissible level of a contaminant in water which is delivered to users of public water systems (U.S. Environmental Protection Agency - Drinking Water Regulations and Health Advisories).

NCWQS = North Carolina Water Quality Standards (North Carolina Administrative Code, Title 15A, Subchapter 2L).
(*) = NCWQS for BHC

Base Background = shallow groundwater data from Base Background Study for Metals in Groundwater at Camp Lejeune (Baker, September 2002).

J = Value is estimated

NA = Not Applicable

NE = Not Established

FIGURES

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IR78-IS01-1409
IR78-IS03-1409
IR78-IS02-1409

SAMPLE ID	IR78-1409-IS03-04
SAMPLE DATE	06-28-2002
SAMPLE DEPTH (FEET)	8.5
SEMIVOLATILES (ug/kg)	
bis(2-Ethylhexyl)phthalate	810

SAMPLE ID	IR78-1409-IS02-01
SAMPLE DATE	06-28-2002
SAMPLE DEPTH (FEET)	2
VOLATILES (ug/kg)	
Acetone	3.4 J

IR78-IS02-1120
IR78-IS03-1120
IR78-IS01-1120

SAMPLE ID	IR78-1120-IS02-01
SAMPLE DATE	06-28-2002
SAMPLE DEPTH (FEET)	1-3
VOLATILES (ug/kg)	
Tetrachloroethene	54 J

SAMPLE ID	IR78-1120-IS03-05
SAMPLE DATE	06-28-2002
SAMPLE DEPTH (FEET)	10
VOLATILES (ug/kg)	
Cis/Trans-1,2-Dichloroethene	2 J
Tetrachloroethene	5.8
Toluene	30
Trichloroethene	5.3 J
Xylenes, Total	5.7 J

IR78-IS03-1512
IR78-IS02-1512
IR78-IS01-1512

SAMPLE ID	IR78-1512-IS03-02
SAMPLE DATE	06-27-2002
SAMPLE DEPTH	4
VOLATILES (ug/kg)	
Acetone	10 J

SAMPLE ID	IR78-1512-IS02-05
SAMPLE DATE	06-27-2002
SAMPLE DEPTH (FEET)	9.5
SEMIVOLATILES (ug/kg)	
Benzo(a)anthracene	45 J
Benzo(a)pyrene	74 J
Benzo(b)fluoranthene	70 J
Benzo(g,h,i)perylene	74 J
Benzo(k)fluoranthene	66 J
Chrysene	68 J
Fluoranthene	120 J
Phenanthrene	44 J
Pyrene	83 J
bis(2-Ethylhexyl)phthalate	440

SAMPLE ID	IR78-1512-IS01-05
SAMPLE DATE	06-27-2002
SAMPLE DEPTH (FEET)	10
VOLATILES (ug/kg)	
SEMIVOLATILES (ug/kg)	
bis(2-Ethylhexyl)phthalate	260 J

NORTH CAROLINA SOIL TO GROUNDWATER CONCENTRATIONS

Volatiles Organic Compounds	NC Soil to Groundwater Concentrations
Acetone	2,800
Total-1,2-dichloroethene	300
Tetrachloroethene	20
Toluene	16,500
Trichloroethene	36
Xylenes, Total	13,700

Semivolatiles Organic Compounds	NC Soil to Groundwater Concentrations
Benzo(a)anthracene	1,500
Benzo(a)pyrene	390
Benzo(b)fluoranthene	4,970
Benzo(g,h,i)perylene	28,896,800
Benzo(k)fluoranthene	49,700
Chrysene	163,970
Fluoranthene	1,183,450
Phenanthrene	253,680
Pyrene	1,228,920
bis(2-ethylhexyl)phthalate	28,650

NOTE:
1. CONCENTRATIONS PRESENTED IN MICROGRAMS PER KILOGRAM (ug/kg).
2. EXCEEDING NC SOIL TO GROUNDWATER CONCENTRATIONS IN BLUE.
3. A TOTAL ORGANIC CARBON VALUE OF 4,300 mg/kg WAS USED TO CALCULATE THE NC CONCENTRATIONS

200 0 100 200
1 inch = 200 ft.

Baker

LEGEND

⊕ - GEOPROBE SAMPLE LOCATION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 6-1
POSITIVE DETECTIONS OF VOCs AND SVOCs IN SOIL BUILDINGS 1120, 1409 AND 1512-HPIA PRELIMINARY ASSESSMENT SITES, CTO - 190

MARINE CORPS BASE, CAMP LEJEUNE NORTH CAROLINA

K\26007\190Phase\DraftPA\CADFigures\ 2190904PL

CAMP LEJEUNE BASE BACKGROUND CONCENTRATIONS FOR METALS IN SURFACE SOIL AND SUBSURFACE SOIL AND NORTH CAROLINA SOIL TO GROUNDWATER CONCENTRATIONS

Metals Surface Soil	Base Background Surface Soil	NC Soil to Groundwater Concentrations
Aluminum	17,6000J	NE
Antimony	0.9J	5.42
Arsenic	1.3J	5.24
Barium	24	848
Calcium	105,000	NE
Chromium	12.6	27.2
Cobalt	0.51J	NE
Copper	38.5	704
Iron	12,200J	151.2
Lead	38.5J	270.06
Magnesium	1610	NE
Manganese	49	65.2
Mercury	0.12J	0.014
Nickel	1.8	56.4
Potassium	263J	NE
Sodium	307	NE
Vanadium	26.2	NE
Zinc	73.9	1,100

Metals Subsurface Soil	Base Background Subsurface Soil	NC Soil to Groundwater Concentrations
Aluminum	16,800	NE
Barium	27.1	848
Calcium	4,950	NE
Chromium	23.3	27.2
Cobalt	6.8	NE
Copper	6.7	704
Iron	15,600	151.2
Lead	12.2J	270.06
Magnesium	1,250	NE
Manganese	67.6	65.2
Nickel	12.3	56.4
Potassium	869J	NE
Sodium	NE	NE
Vanadium	NE	NE

SAMPLE ID	IR78-1120-IS03-01
SAMPLE DATE	06-28-2002
SAMPLE DEPTH (FEET)	1-2
METALS (mg/kg)	
Aluminum	2100
Antimony	0.75 J
Arsenic	0.6 J
Barium	9
Calcium	400
Chromium	2.2
Cobalt	0.1 J
Copper	0.98 J
Iron	1300
Lead	3
Magnesium	28 J
Manganese	18
Mercury	0.078 J
Nickel	0.56 J
Potassium	29 J
Sodium	17 J
Vanadium	3.5
Zinc	1.9 J

SAMPLE ID	IR78-1120-IS03-05
SAMPLE DATE	06-28-2002
SAMPLE DEPTH (FEET)	10
METALS (mg/kg)	
Aluminum	780
Barium	1.6
Calcium	13 J
Chromium	1.6
Cobalt	0.1 J
Copper	0.11 J
Iron	210
Lead	1.6
Magnesium	31 J
Manganese	1.3
Nickel	0.27 J
Potassium	63 J
Sodium	16 J
Vanadium	1.7

SAMPLE ID	IR78-1120-IS01-01
SAMPLE DATE	06-28-2002
SAMPLE DEPTH (FEET)	1-2
METALS (mg/kg)	
Aluminum	300
Antimony	0.47 J
Arsenic	0.32 J
Barium	2
Calcium	450
Chromium	0.8 J
Cobalt	0.09 J
Copper	0.082 J
Iron	63
Lead	1.2
Magnesium	11 J
Manganese	2.2
Potassium	16 J
Sodium	15 J
Vanadium	0.58 J
Zinc	4.6

SAMPLE ID	IR78-1120-IS01-05
SAMPLE DATE	06-28-2002
SAMPLE DEPTH (FEET)	10.5
METALS (mg/kg)	
Aluminum	1900
Barium	3.4
Calcium	38 J
Chromium	13
Cobalt	0.25 J
Copper	0.59 J
Iron	360
Lead	2.9
Magnesium	50 J
Manganese	3
Nickel	5.8
Potassium	97 J
Sodium	11 J
Vanadium	3.1

SAMPLE ID	IR78-1120-IS02-01
SAMPLE DATE	06-28-2002
SAMPLE DEPTH (FEET)	1-3
METALS (mg/kg)	
Aluminum	1800
Arsenic	0.51 J
Barium	16
Calcium	2400
Chromium	1.7
Cobalt	0.17 J
Copper	0.97 J
Iron	550
Lead	4.1
Magnesium	58 J
Manganese	1.8
Mercury	0.032
Nickel	0.63 J
Potassium	51 J
Sodium	21 J
Vanadium	2

SAMPLE ID	IR78-1120-IS02-04
SAMPLE DATE	06-28-2002
SAMPLE DEPTH (FEET)	7.5
METALS (mg/kg)	
Aluminum	610
Barium	1.8
Calcium	38 J
Chromium	1.2
Cobalt	0.094 J
Copper	0.11 J
Iron	120
Lead	1.3
Magnesium	25 J
Manganese	1.4
Nickel	0.22 J
Potassium	49 J
Sodium	12 J
Vanadium	1.1

IR78-IS01-1409
IR78-IS03-1409
IR78-IS02-1409
IR78-IS03-1512
IR78-IS02-1512
IR78-IS01-1512
IR78-IS02-1120
IR78-IS03-1120
IR78-IS01-1120

200 0 100 200
1 inch = 200 ft.

Baker

NOTE:
1. CONCENTRATIONS PRESENTED IN MILLIGRAMS PER KILOGRAM (mg/kg).
2. EXCEEDING BASE BACKGROUND SURFACE AND SUBSURFACE SOIL IN IN BLUE.
3. EXCEEDING NC SOIL TO GROUNDWATER CONCENTRATIONS IN GREEN.
4. EXCEEDING BOTH BASE BACKGROUND SOIL AND NC SOIL TO GROUNDWATER CONCENTRATIONS IN RED.
5. NE = NOT ESTABLISHED

⊕ – GEOPROBE SAMPLE LOCATION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 6-2
POSITIVE DETECTIONS OF METALS IN SOIL
BUILDING 1120-HPIA
PRELIMINARY ASSESSMENT SITES, CTO – 190

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

SAMPLE ID	IR78-1409-IS01-01
SAMPLE DATE	06-28-2002
SAMPLE DEPTH (FEET)	1.5
METALS (mg/kg)	
Aluminum	1500
Barium	2.7
Calcium	590
Chromium	1.5
Cobalt	0.087 J
Copper	0.38 J
Iron	980
Lead	2.8
Magnesium	37 J
Manganese	2.2
Nickel	0.42 J
Potassium	35 J
Sodium	13 J
Vanadium	1.2

SAMPLE ID	IR78-1409-IS01-05
SAMPLE DATE	06-28-2002
SAMPLE DEPTH (FEET)	10
METALS (mg/kg)	
Aluminum	3500
Arsenic	1.3
Barium	4.8
Calcium	88
Chromium	6.1
Cobalt	0.24 J
Copper	0.76 J
Iron	2500
Lead	4
Magnesium	140 J
Manganese	2.9
Nickel	0.41 J
Potassium	230
Sodium	26 J
Vanadium	9.3
Zinc	1.7 J

SAMPLE ID	IR78-1409-IS02-01
SAMPLE DATE	06-28-2002
SAMPLE DEPTH (FEET)	2
METALS (mg/kg)	
Aluminum	2900
Arsenic	0.56 J
Barium	7.8
Calcium	650
Chromium	3.5
Cobalt	0.19 J
Copper	0.83 J
Iron	1500
Lead	12
Magnesium	87 J
Manganese	4.6
Mercury	0.014 J
Nickel	0.64 J
Potassium	100
Sodium	29 J
Vanadium	4.7
Zinc	2.5

SAMPLE ID	IR78-1409-IS02-04
SAMPLE DATE	06-28-2002
SAMPLE DEPTH (FEET)	8.5
METALS (mg/kg)	
Aluminum	2000
Arsenic	0.44 J
Barium	3
Calcium	26 J
Chromium	3
Cobalt	0.16 J
Copper	0.18 J
Iron	930
Lead	1.8
Magnesium	70 J
Manganese	1.3
Nickel	0.37 J
Potassium	81 J
Sodium	20 J
Vanadium	3.4

SAMPLE ID	IR78-1409-IS03-01
SAMPLE DATE	06-28-2002
SAMPLE DEPTH (FEET)	1-3
METALS (mg/kg)	
Aluminum	4700
Antimony	0.53 J
Arsenic	0.77 J
Barium	11
Calcium	5000
Chromium	5.2
Cobalt	0.33 J
Copper	1.3 J
Iron	2400
Lead	5.9
Magnesium	220 J
Manganese	7.3
Mercury	0.047
Nickel	0.99 J
Potassium	160
Sodium	29 J
Vanadium	7.3
Zinc	3.8

SAMPLE ID	IR78-1409-IS03-04
SAMPLE DATE	06-28-2002
SAMPLE DEPTH (FEET)	8.5
METALS (mg/kg)	
Aluminum	3000
Arsenic	0.88 J
Barium	4.5
Calcium	29 J
Chromium	4.4
Cobalt	0.26 J
Copper	0.73 J
Iron	1700
Lead	4.4
Magnesium	150 J
Manganese	3.1
Nickel	0.38 J
Potassium	170
Sodium	20 J
Vanadium	6.6
Zinc	1.5 J

CAMP LEJEUNE BASE BACKGROUND CONCENTRATIONS FOR METALS IN SURFACE SOIL AND SUBSURFACE SOIL AND NORTH CAROLINA SOIL TO GROUNDWATER CONCENTRATIONS

Metals Surface Soil	Base Background Surface Soil	NC Soil to Groundwater Concentrations
Aluminum	17,6000J	NE
Antimony	0.9J	5.42
Arsenic	1.3J	5.24
Barium	24	848
Calcium	105,000	NE
Chromium	12.6	27.2
Cobalt	0.51J	NE
Copper	38.5	704
Iron	12,200J	151.2
Lead	38.5J	270.06
Magnesium	1610	NE
Manganese	49	65.2
Mercury	0.12J	0.014
Nickel	1.8	56.4
Potassium	263J	NE
Sodium	307	NE
Vanadium	26.2	NE
Zinc	73.9	1,100

Metals Subsurface soil	Base Background Subsurface Soil	NC Soil to Groundwater Concentrations
Aluminum	16,800	NE
Arsenic	9.3	5.24
Barium	27.1	848
Calcium	4,950	NE
Chromium	23.3	27.2
Cobalt	6.8	NE
Copper	6.7	704
Iron	15,600	151.2
Lead	12.2J	270.06
Magnesium	1,250	NE
Manganese	67.6	65.2
Mercury	0.16J	0.014
Nickel	12.3	56.4
Potassium	869J	NE
Sodium	NE	NE
Vanadium	NE	NE
Zinc	39.7	1,100

IR78-IS01-1409
IR78-IS03-1409
IR78-IS02-1409
IR78-IS03-1512
IR78-IS02-1512
IR78-IS01-1512
IR78-IS02-1120
IR78-IS03-1120
IR78-IS01-1120

200 0 100 200
1 inch = 200 ft.

Baker

NOTE:
1. CONCENTRATIONS PRESENTED IN MILLIGRAMS PER KILOGRAM (mg/kg).
2. EXCEEDING BASE BACKGROUND SURFACE AND SUBSURFACE SOIL IN IN *BLUE*.
3. EXCEEDING NC SOIL TO GROUNDWATER CONCENTRATIONS IN GREEN.
4. EXCEEDING BOTH BASE BACKGROUND SOIL AND NC SOIL TO GROUNDWATER CONCENTRATIONS IN RED.
5. NE = NOT ESTABLISHED

⊕ – GEOPROBE SAMPLE LOCATION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

FIGURE 6-3
POSITIVE DETECTIONS OF METALS IN SOIL
BUILDING 1409-HPIA
PRELIMINARY ASSESSMENT SITES, CTO – 190

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

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SAMPLE ID	IR78-1512-IS03-02
SAMPLE DATE	06-27-2002
SAMPLE DEPTH (FEET)	4
METALS (mg/kg)	
Aluminum	1500 J
Barium	5.6
Beryllium	0.024 J
Calcium	290
Chromium	2.4
Copper	0.51 J
Iron	840 J
Lead	2.9
Magnesium	42 J
Manganese	2.9
Mercury	0.018 J
Nickel	0.3 J
Potassium	50 J
Vanadium	2.4
Zinc	1.4 J

SAMPLE ID	IR78-1512-IS03-05
SAMPLE DATE	06-27-2002
SAMPLE DEPTH (FEET)	10
METALS (mg/kg)	
Aluminum	4200 J
Barium	5.6
Beryllium	0.053 J
Calcium	100
Chromium	5.7
Cobalt	0.11 J
Copper	0.72 J
Iron	1000 J
Lead	3.2
Magnesium	170
Manganese	3.7
Nickel	0.56 J
Potassium	220
Vanadium	7.1
Zinc	1.6 J

SAMPLE ID	IR78-1512-IS02-04
SAMPLE DATE	06-27-2002
SAMPLE DEPTH (FEET)	8
METALS (mg/kg)	
Aluminum	3900 J
Arsenic	1.9
Barium	5.9
Beryllium	0.049 J
Calcium	460
Chromium	6.1
Cobalt	0.095 J
Copper	0.66 J
Iron	2100 J
Lead	3
Magnesium	150
Manganese	2.4
Nickel	0.52 J
Potassium	200
Vanadium	8.4
Zinc	1.3 J

SAMPLE ID	IR78-1512-IS02-05
SAMPLE DATE	06-27-2002
SAMPLE DEPTH (FEET)	9.5
METALS (mg/kg)	
Aluminum	3000 J
Arsenic	0.7 J
Barium	6.6
Beryllium	0.04 J
Calcium	1000
Chromium	6
Copper	0.84 J
Iron	1700 J
Lead	3.4
Magnesium	120
Manganese	4.7
Nickel	0.52 J
Potassium	140
Vanadium	6.9
Zinc	2.2

SAMPLE ID	IR78-1512-IS01-03
SAMPLE DATE	06-27-2002
SAMPLE DEPTH (FEET)	7
METALS (mg/kg)	
Aluminum	540 J
Barium	3
Beryllium	0.013 J
Calcium	67
Chromium	0.66 J
Copper	0.1 J
Iron	110 J
Lead	0.99
Magnesium	21 J
Manganese	1.4
Potassium	21 J
Selenium	0.43 J
Vanadium	0.88 J
Zinc	0.16 J

SAMPLE ID	IR78-1512-IS01-05
SAMPLE DATE	06-27-2002
SAMPLE DEPTH (FEET)	10
METALS (mg/kg)	
Aluminum	590 J
Barium	64
Beryllium	0.028 J
Cadmium	0.15 J
Calcium	17000
Chromium	3.7
Copper	2.9
Iron	580 J
Lead	29
Magnesium	290
Manganese	12
Mercury	0.02
Nickel	0.52 J
Potassium	34 J
Selenium	0.35 J
Vanadium	1.9
Zinc	25

IR78-IS01-1409
IR78-IS03-1409
IR78-IS02-1409
IR78-IS02-1120
IR78-IS03-1120
IR78-IS01-1120
IR78-IS03-1512
IR78-IS02-1512
IR78-IS01-1512

CAMP LEJEUNE BASE BACKGROUND CONCENTRATIONS FOR METALS IN SUBSURFACE SOIL AND NORTH CAROLINA SOIL TO GROUNDWATER CONCENTRATIONS

Metals Subsurface Soil	Base Background Subsurface Soil	NC Soil to Groundwater Concentrations
Aluminum	16,800	NE
Arsenic	9.3	5.24
Barium	27.1	848
Beryllium	0.91	3.38
Cadmium	NE	2.72
Calcium	4,950	NE
Chromium	23.3	27.2
Cobalt	6.8	NE
Copper	6.7	704
Iron	15,600	151.2
Lead	12.2J	270.06
Magnesium	1,250	NE
Manganese	67.6	65.2
Mercury	0.16J	0.014
Nickel	12.3	56.4
Potassium	869J	NE
Selenium	1.3	12.2
Vanadium	NE	NE
Zinc	39.7	1,100

NOTE:
1. CONCENTRATIONS PRESENTED IN MILLIGRAMS PER KILOGRAM (mg/kg).
2. EXCEEDING BASE BACKGROUND SURFACE AND SUBSURFACE SOIL IN IN *BLUE*.
3. EXCEEDING NC SOIL TO GROUNDWATER CONCENTRATIONS IN GREEN.
4. EXCEEDING BOTH BASE BACKGROUND SOIL AND NC SOIL TO GROUNDWATER CONCENTRATIONS IN RED.
5. NE = NOT ESTABLISHED

⊕ – GEOPROBE SAMPLE LOCATION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

200 0 100 200
1 inch = 200 ft.

Baker

FIGURE 6-4
POSITIVE DETECTIONS OF METALS IN SOIL
BUILDING 1512-HPIA
PRELIMINARY ASSESSMENT SITES, CTO – 190

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

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SAMPLE ID	IR78-1409-TW01-02B
SAMPLE DATE	07-01-2002
VOLATILES (ug/L)	
Bromodichloromethane	5.6
Chloroform	31
Dibromochloromethane	1.3 J

SAMPLE ID	IR78-1409-TW02-02B
SAMPLE DATE	07-01-2002
VOLATILES (ug/L)	
Chloroform	1.5 J

SAMPLE ID	IR78-1120-TW02-02B
SAMPLE DATE	07-01-2002
VOLATILES (ug/L)	
Bromodichloromethane	2 J
Chloroform	8.7

SAMPLE ID	IR78-1120-TW03-02B
SAMPLE DATE	07-01-2002
VOLATILES (ug/L)	
Bromodichloromethane	2.4 J
Chloroform	7
Dibromochloromethane	0.84 J
Trichloroethene	0.65 J

SAMPLE ID	IR78-1120-TW01-02B
SAMPLE DATE	07-01-2002
VOLATILES (ug/L)	
Bromodichloromethane	0.78 J
Chloroform	3.4 J

SAMPLE ID	IR78-1512-TW03-02B
SAMPLE DATE	07-01-2002
VOLATILES (ug/L)	
Chloroform	1.2 J
Cis/Trans-1,2-Dichloroethene	0.88 J
Toluene	2.2 J
Trichloroethene	3.5 J

SAMPLE ID	IR78-1512-TW02-02B
SAMPLE DATE	07-01-2002
VOLATILES (ug/L)	
Bromodichloromethane	3.3 J
Chloroform	15
Dibromochloromethane	0.83 J
Trichloroethene	0.76 J

SAMPLE ID	IR78-1512-TW01-02B
SAMPLE DATE	07-01-2002
VOLATILES (ug/L)	
Bromodichloromethane	0.61 J
Chloroform	2.7 J

NORTH CAROLINA WATER QUALITY STANDARDS (NCWQS 2L) AND UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (USEPA) REGION IV MAXIMUM CONTAMINANT LEVELS (MCLS)

Volatile Organic Compounds	NCWQS 2L	USEPA REGION IV MCL
Bromodichloromethane	0.6 (I)	80 (P)
Chloroform	0.19	80 (P)
Total 1,2-Dichloroethene	70	70
Dibromochloromethane	0.41 (I)	80 (P)
Toluene	1,000	1,000
Trichloroethene	2.8	5

NOTE:
1. CONCENTRATIONS PRESENTED IN MICROGRAMS PER LITER (ug/L).
2. EXCEEDING NCWQS 2L IN BLUE.
3. EXCEEDING USEPA REGION IV MCL IN GREEN.
4. EXCEEDING BOTH NCWQS 2L AND USEPA REGION IV MCL IN RED.
5. NE = NOT ESTABLISHED
6. (I) = INTERIM STANDARD
7. (P) = PROPOSED LEVEL

LEGEND

⊕ – GEOPROBE SAMPLE LOCATION AND TEMPORARY MONITORING WELL LOCATION

SOURCE: MCB CAMP LEJEUNE MARCH 2000

200 0 100 200
1 inch = 200 ft.

Baker

FIGURE 6-5
POSITIVE DETECTIONS OF VOCs IN GROUNDWATER BUILDINGS 1120, 1409 AND 1512-HPIA PRELIMINARY ASSESSMENT SITES, CTO – 190

MARINE CORPS BASE, CAMP LEJEUNE NORTH CAROLINA

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SAMPLE ID	IR78-1409-TW01-02B
SAMPLE DATE	07-01-2002
METALS (ug/L)	
Barium	15
Calcium	14000
Iron	73
Magnesium	1300
Manganese	24
Potassium	1100
Sodium	7700
Vanadium	1.5 J
Zinc	4.6 J

SAMPLE ID	IR78-1409-TW03-02B
SAMPLE DATE	07-01-2002
METALS (ug/L)	
Aluminum	460
Barium	34
Calcium	40000
Chromium	1.1 J
Copper	2.3 J
Iron	*9700*
Magnesium	1800
Manganese	*120*
Nickel	3.1 J
Potassium	1400
Sodium	8800
Zinc	19 J

SAMPLE ID	IR78-1409-TW02-02B
SAMPLE DATE	07-01-2002
METALS (ug/L)	
Aluminum	1800
Barium	68
Beryllium	0.12 J
Calcium	34000
Chromium	2.3 J
Copper	1 J
Iron	*790*
Magnesium	2800
Manganese	25
Potassium	2300
Sodium	6700
Vanadium	3.6 J
Zinc	2.4 J

SAMPLE ID	IR78-1512-TW03-02B
SAMPLE DATE	07-01-2002
METALS (ug/L)	
Aluminum	79000
Arsenic	*11*
Barium	220
Beryllium	0.96 J
Calcium	9300
Chromium	*64*
Cobalt	7.4 J
Copper	5.2 J
Iron	*16000*
Lead	*18*
Magnesium	3200
Manganese	46
Nickel	34 J
Potassium	5400
Selenium	*11*
Sodium	5600
Vanadium	66
Zinc	28

SAMPLE ID	IR78-1512-TW02-02B
SAMPLE DATE	07-01-2002
METALS (ug/L)	
Aluminum	1400
Barium	18
Calcium	32000
Chromium	1.5 J
Iron	*400*
Magnesium	2100
Manganese	11
Potassium	1300
Sodium	5400
Vanadium	7 J
Zinc	1.7 J

SAMPLE ID	IR78-1512-TW01-02B
SAMPLE DATE	07-01-2002
METALS (ug/L)	
Aluminum	3100
Barium	43
Beryllium	0.13 J
Calcium	5100
Chromium	5 J
Copper	1.5 J
Iron	*860*
Magnesium	1500
Manganese	9.4 J
Nickel	1.9 J
Potassium	1700
Selenium	*5.2 J*
Sodium	5000
Vanadium	6.8 J
Zinc	4.4 J

SAMPLE ID	IR78-1120-TW02-02B
SAMPLE DATE	07-01-2002
METALS (ug/L)	
Aluminum	640
Barium	57
Beryllium	0.11 J
Calcium	11000
Iron	170
Magnesium	2500
Manganese	11
Potassium	1700
Sodium	5600
Vanadium	2 J
Zinc	2.7 J

SAMPLE ID	IR78-1120-TW03-02B
SAMPLE DATE	07-01-2002
METALS (ug/L)	
Aluminum	8000
Barium	65
Beryllium	0.3 J
Calcium	9900
Chromium	8.4 J
Cobalt	1.7 J
Copper	1.8 J
Iron	*2100*
Lead	2.7 J
Magnesium	3500
Manganese	24
Nickel	3.2 J
Potassium	1800
Sodium	4700
Vanadium	11
Zinc	8 J

SAMPLE ID	IR78-1120-TW01-02B
SAMPLE DATE	07-01-2002
METALS (ug/L)	
Aluminum	2500
Barium	86
Beryllium	0.38 J
Calcium	29000
Chromium	2.5 J
Cobalt	1.6 J
Copper	1.1 J
Iron	280
Magnesium	7500
Manganese	40
Nickel	3.4 J
Potassium	2100
Sodium	12000
Vanadium	2.6 J
Zinc	3.3 J

CAMP LEJEUNE BASE BACKGROUND METALS IN GROUNDWATER AND NORTH CAROLINA WATER QUALITY STANDARDS (NCWQS 2L)

METALS	NCWQS 2L	CAMP LEJEUNE BASE BACKGROUND
Aluminum	NE	41800 J
Arsenic	10	28.7 J
Barium	2000	213 J
Beryllium	NE	3.2 J
Calcium	NE	384000 J
Chromium	50	80.8 J
Cobalt	NE	42.7 J
Copper	1000	47.4 J
Iron	300	55200 J
Lead	15	61.7 J
Magnesium	NE	18500 J
Manganese	50	1060 J
Nickel	100	76.5 J
Potassium	NE	8980 J
Selenium	50	3.8 J
Sodium	NE	95300
Vanadium	NE	107 J
Zinc	2100	333 J

NOTE:
1. CONCENTRATIONS PRESENTED IN MICROGRAMS PER LITER (ug/L).
2. EXCEEDING NCWQS 2L IN *BLUE*.
3. EXCEEDING CAMP LEJEUNE BASE BACKGROUND IN GREEN.
4. EXCEEDING BOTH NCWQS 2L AND CAMP LEJEUNE BASE BACKGROUND IN **RED**.
5. NE = NOT ESTABLISHED
6. (I) = INTERIM STANDARD
7. (P) = PROPOSED LEVEL

LEGEND

⊕ – GEOPROBE SAMPLE LOCATION AND TEMPORARY MONITORING WELL LOCATION

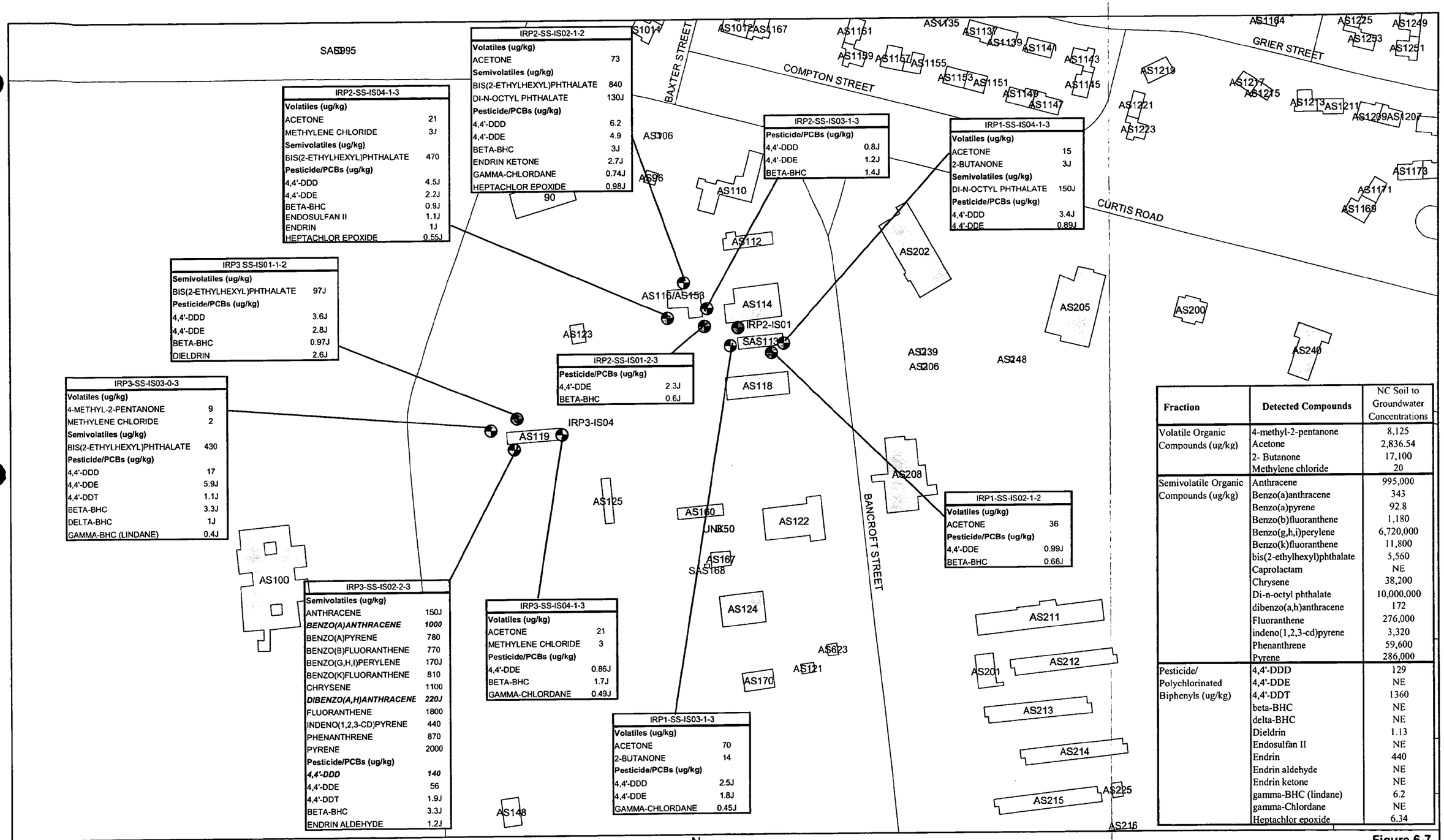
SOURCE: MCB CAMP LEJEUNE MARCH 2000

200 0 100 200
1 inch = 200 ft.

Baker

FIGURE 6-6
POSITIVE DETECTIONS OF METALS IN GROUNDWATER BUILDINGS 1120, 1409 AND 1512-HPIA PRELIMINARY ASSESSMENT SITES, CTO - 190

MARINE CORPS BASE, CAMP LEJEUNE NORTH CAROLINA



Fraction	Detected Compounds	NC Soil to Groundwater Concentrations
Volatile Organic Compounds (ug/kg)	4-methyl-2-pentanone	8,125
	Acetone	2,836.54
	2- Butanone	17,100
	Methylene chloride	20
Semivolatile Organic Compounds (ug/kg)	Anthracene	995,000
	Benzo(a)anthracene	343
	Benzo(a)pyrene	92.8
	Benzo(b)fluoranthene	1,180
	Benzo(g,h,i)perylene	6,720,000
	Benzo(k)fluoranthene	11,800
	bis(2-ethylhexyl)phthalate	5,560
	Caprolactam	NE
	Chrysene	38,200
	Di-n-octyl phthalate	10,000,000
	dibenzo(a,h)anthracene	172
	Fluoranthene	276,000
	indeno(1,2,3-cd)pyrene	3,320
	Phenanthrene	59,600
	Pyrene	286,000
Pesticide/ Polychlorinated Biphenyls (ug/kg)	4,4'-DDD	129
	4,4'-DDE	NE
	4,4'-DDT	1360
	beta-BHC	NE
	delta-BHC	NE
	Dieldrin	1.13
	Endosulfan II	NE
	Endrin	440
	Endrin aldehyde	NE
	Endrin ketone	NE
	gamma-BHC (lindane)	6.2
	gamma-Chlordane	NE
	Heptachlor epoxide	6.34

Legend

Geoprobe Sample Location

J - Estimated
Exceeding NC Soil to Groundwater Concentrations in Italics

Figure 6-7
Positive Detections of VOCs, SVOCs, and Pesticides in Soil
Buildings SAS113, AS116, and AS119
Preliminary Assessment Sites, CTO-190
MCB Camp Leieune. North Carolina

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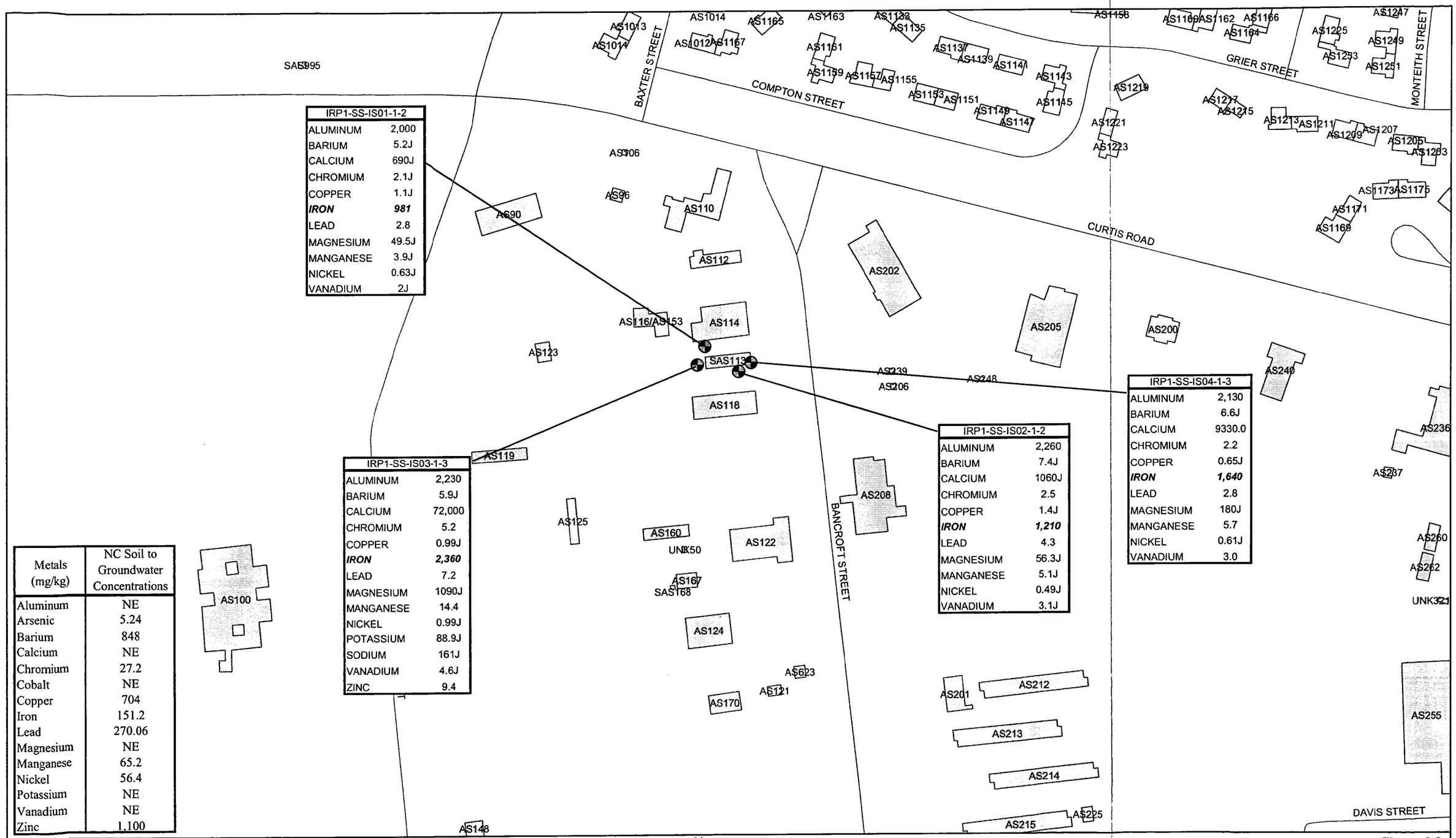
File Path: X:\USNavFaceNGCom\315007CampLejeune\Projects\PA_Sites\Figure 6-7 - Detections of VOCs SVOCs and Pesticides in Soil.mxd, Date: 01/24/2006



Legend

Geoprobe Sample Location

J - Estimated

Exceeding NC Soil to Groundwater Concentrations in Italics

Figure 6-8
Positive Detections of Metals in Soil
Building SAS113
Preliminary Assessment Sites, CTO-190
MCB Camp Lejeune. North Carolina

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File Path: X:\USNavFaceNGCom\315007CampLejeune\Projects\PA_Sites\Figure 6-8 - Detections of Metals in Soil - SAS113.mxd, Date: 01/24/2006

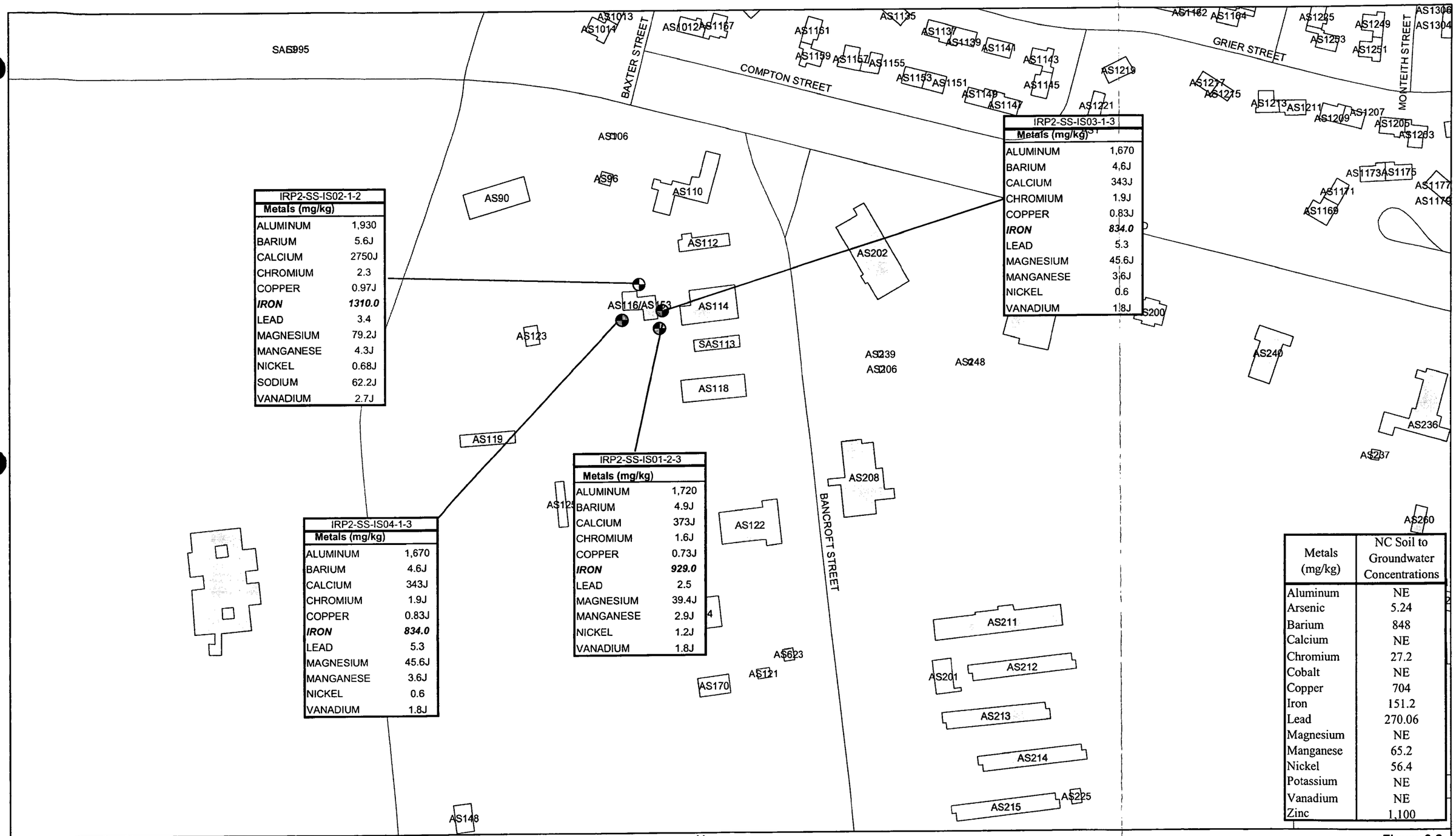

Figure 6-9
Positive Detections of Metals in Soil
Building AS116
Preliminary Assessment Sites, CTO-190
MCB Camp Leieune. North Carolina

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File Path: X:\USNavFaceNGCom\315007CampLejeune\Projects\PA_Sites\Figure 6-9 - Detections of Metals in Soil - AS116.mxd, Date: 01/24/2006

IRP3-SS-IS03-0-3	
ALUMINUM	3,690
ARSENIC	0.87J
BARIUM	8.8J
CADMIUM	0.088J
CALCIUM	8410J
CHROMIUM	6
COPPER	1.6J
IRON	***3260.0***
LEAD	10.1
MAGNESIUM	230J
MANGANESE	8.8J
NICKEL	0.79J
POTASSIUM	177J
SODIUM	69.1J
VANADIUM	9.1J
ZINC	6

IRP3-SS-IS01-1-2	
ALUMINUM	3,010
BARIUM	6.7J
CALCIUM	419J
CHROMIUM	3
COPPER	0.91J
IRON	***1930***
LEAD	4.6
MAGNESIUM	97.2J
MANGANESE	4.2J
NICKEL	0.8J
VANADIUM	5.4J
ZINC	6

IRP3-SS-IS04-1-3	
ALUMINUM	2,530
BARIUM	4.8J
CALCIUM	12300J
CHROMIUM	3
COPPER	0.52J
IRON	***992***
LEAD	2.7
MAGNESIUM	264J
MANGANESE	10.4J
NICKEL	0.37J
POTASSIUM	79.3J
VANADIUM	3.8J

IRP3-SS-IS02-2-3	
Metals (mg/kg)	
ALUMINUM	1,710
BARIUM	9.6J
CALCIUM	6550J
CHROMIUM	3
COPPER	1.8J
IRON	***1430***
LEAD	13.7
MAGNESIUM	147J
MANGANESE	9.1J
NICKEL	0.52J
VANADIUM	3.5J
ZINC	5

Metals (mg/kg)	NC Soil to Groundwater Concentrations
Aluminum	NE
Arsenic	5.24
Barium	848
Calcium	NE
Chromium	27.2
Cobalt	NE
Copper	704
Iron	151.2
Lead	270.06
Magnesium	NE
Manganese	65.2
Nickel	56.4
Potassium	NE
Vanadium	NE
Zinc	1,100

COMPTON STREET
GRIER STREET
CURTIS ROAD
CRAWFORD STREET
WHITE STREET
BANCROFT STREET
DAVIS STREET

AS1011 AS1107 AS1161 AS1159 AS1157 AS1155 AS1153 AS1151 AS1149 AS1147 AS1139 AS1141 AS1143 AS1145 AS1219 AS1221 AS1223 AS1253 AS1249 AS1251 AS1304 AS1302 AS1217 AS1215 AS1213 AS1211 AS1209 AS1207 AS1205 AS1203 AS1201 AS1173 AS1175 AS1171 AS1169 AS1177 AS1179
AS106 AS96 AS90 AS110 AS112 AS116/AS153 AS114 AS123 SAS113 AS118 AS119
AS239 AS206 AS248 AS205 AS200 AS240 AS236 AS237
AS125 AS160 UNK50 AS122 AS167 SAS168 AS124 AS623 AS121 AS170 AS148
AS208 AS211 AS212 AS201 AS213 AS214 AS215 AS225 AS216
AS100
AS260 AS262 UNK321 AS232 AS255

Legend

Geoprobe Sample Location

J - Estimated

Exceeding NC Soil to Groundwater Concentrations in Italics

N

0 100 200 300 400 Feet

Figure 6-10
Positive Detections of Metals in Soil
Building AS119
Preliminary Assessment Sites, CTO-190
MCB Camp Leieune. North Carolina

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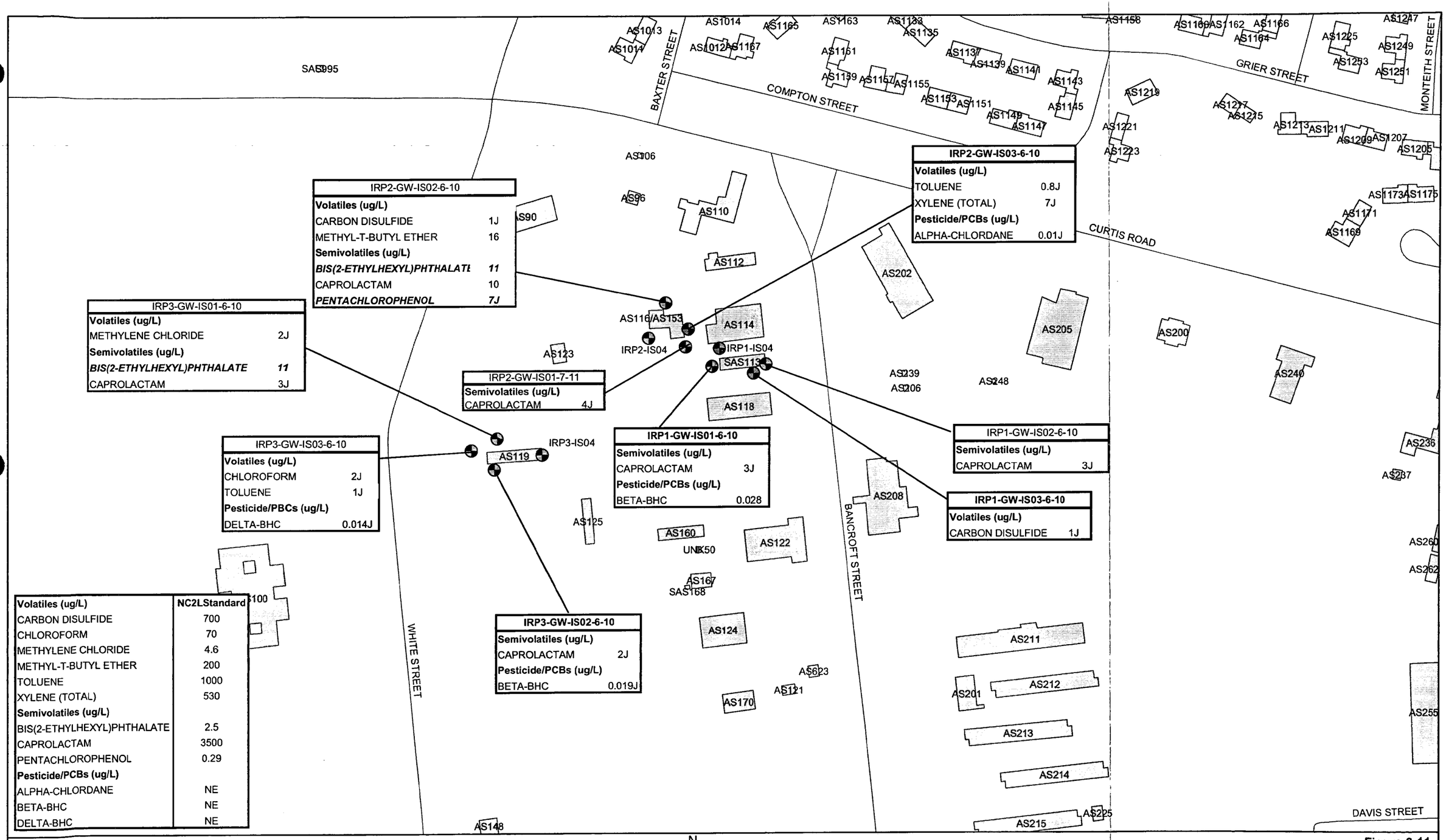
File Path: X:\USNavFaceNGCom\315007CampLejeune\Projects\PA_Sites\Figure 6-10 - Detections of Metals in Soil - AS119.mxd, Date: 01/24/2006



Legend

Geoprobe Sample Location J - Estimated
Exceeding NCWQS in Italics

Figure 6-11
Positive Detections of VOCs SVOCs and Pesticides in Groundwater
Buildings SAS113, AS116, and AS119
Preliminary Assessment Sites, CTO-190
MCB Camp Leieune. North Carolina

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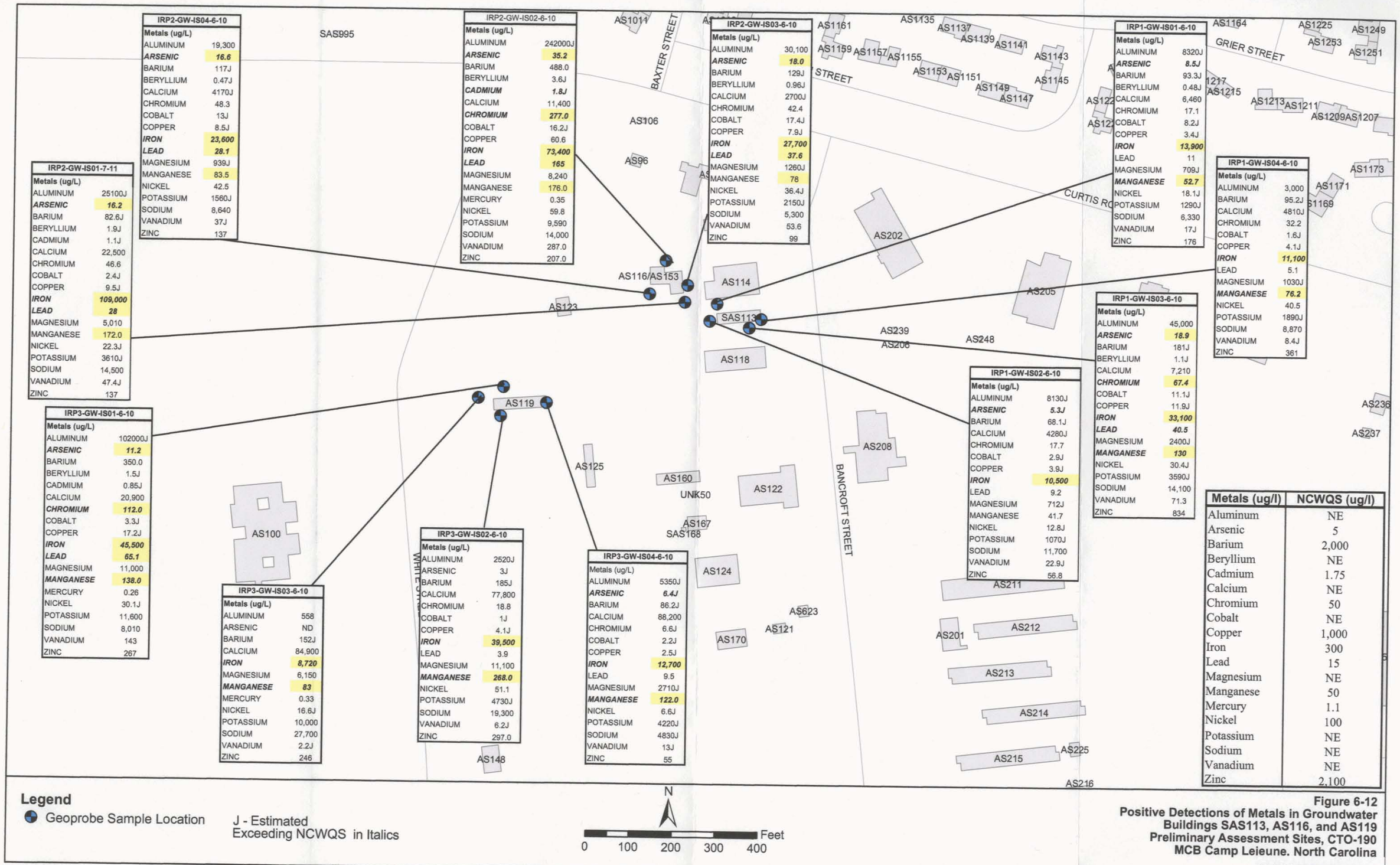
File Path: X:\USNavFaceNGCom\315007CampLejeune\Projects\PA_Sites\Figure 6-11 - Detections of VOCs SVOCs and Pesticides in GW.mxd, Date: 01/24/2006



Metals (ug/l)	NCWQS (ug/l)
Aluminum	NE
Arsenic	5
Barium	2,000
Beryllium	NE
Cadmium	1.75
Calcium	NE
Chromium	50
Cobalt	NE
Copper	1,000
Iron	300
Lead	15
Magnesium	NE
Manganese	50
Mercury	1.1
Nickel	100
Potassium	NE
Sodium	NE
Vanadium	NE
Zinc	2,100

Legend

Geoprobe Sample Location

J - Estimated
Exceeding NCWQS in Italics

Figure 6-12
Positive Detections of Metals in Groundwater
Buildings SAS113, AS116, and AS119
Preliminary Assessment Sites, CTO-190
MCB Camp Lejeune. North Carolina

File Path: X:\USNavFaceNGCom\315007CampLejeune\Projects\PA_Sites\Figure 6-12 - Detections of Metals in GW.mxd, Date: 01/24/2006

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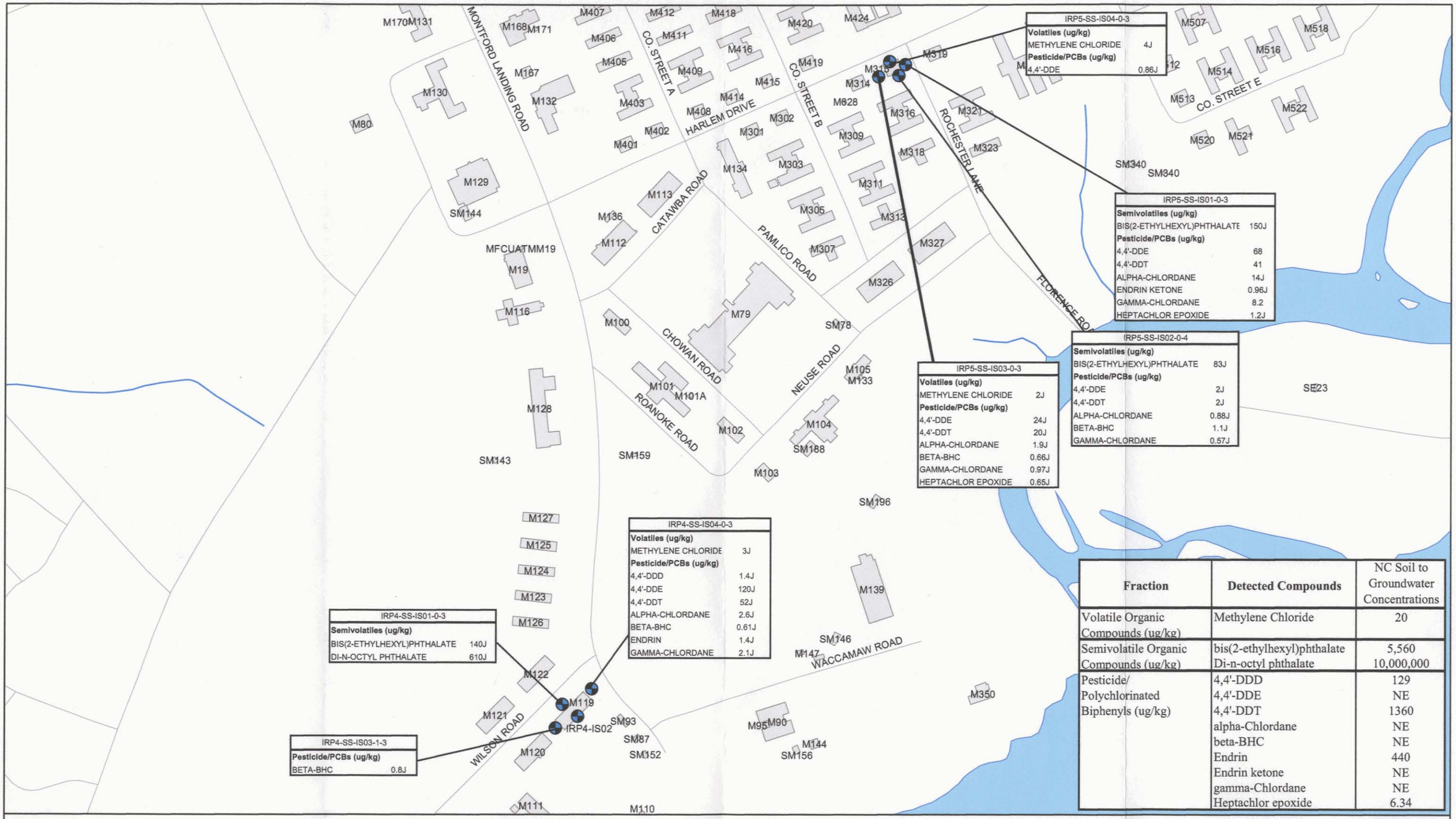

Fraction	Detected Compounds	NC Soil to Groundwater Concentrations
Volatile Organic Compounds (ug/kg)	Methylene Chloride	20
Semivolatile Organic Compounds (ug/kg)	bis(2-ethylhexyl)phthalate	5,560
	Di-n-octyl phthalate	10,000,000
Pesticide/ Polychlorinated Biphenyls (ug/kg)	4,4'-DDD	129
	4,4'-DDE	NE
	4,4'-DDT	1360
	alpha-Chlordane	NE
	beta-BHC	NE
	Endrin	440
	Endrin ketone	NE
	gamma-Chlordane	NE
	Heptachlor epoxide	6.34

Legend

Geoprobe Sample Location

J - Estimated
Exceeding NC Soil to Groundwater Concentrations in Italics

N

0 300 600 Feet

Figure 6-13
Positive Detections of VOCs, SVOCs, and Pesticides in Soil
Buildings M119 and M315
Preliminary Assessment Sites, CTO-190
MCB Camp Leieune. North Carolina

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File Path: X:\USNavFaceNGCom\315007CampLejeune\Projects\PA_Sites\Figure 6-13 - Detections of VOCs SVOCs and Pesticides in Soil.mxd, Date: 01/24/2006

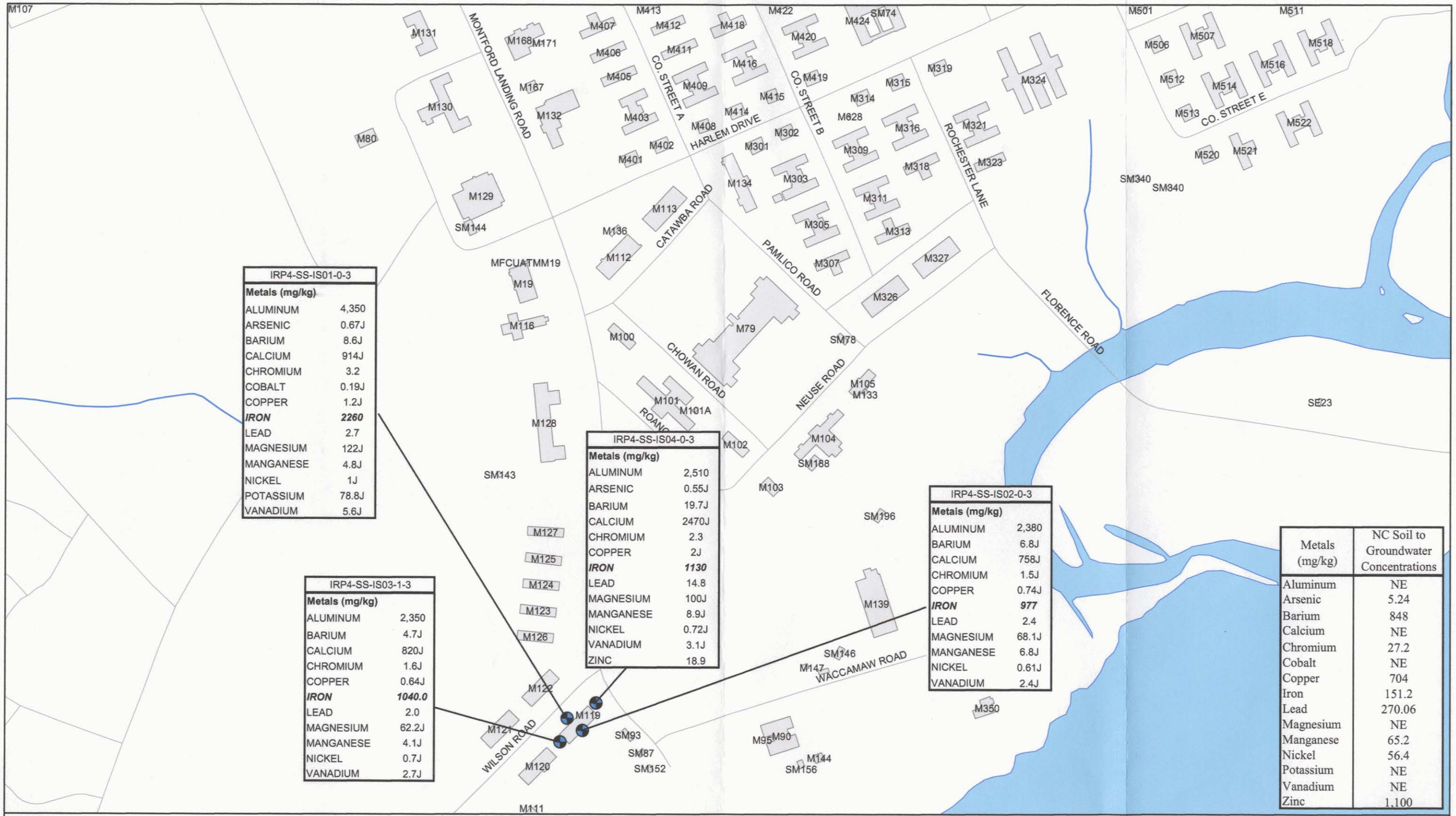

Figure 6-14
Positive Detections of Metals in Soil
Building M119
Preliminary Assessment Sites, CTO-190
MCB Camp Leieune. North Carolina

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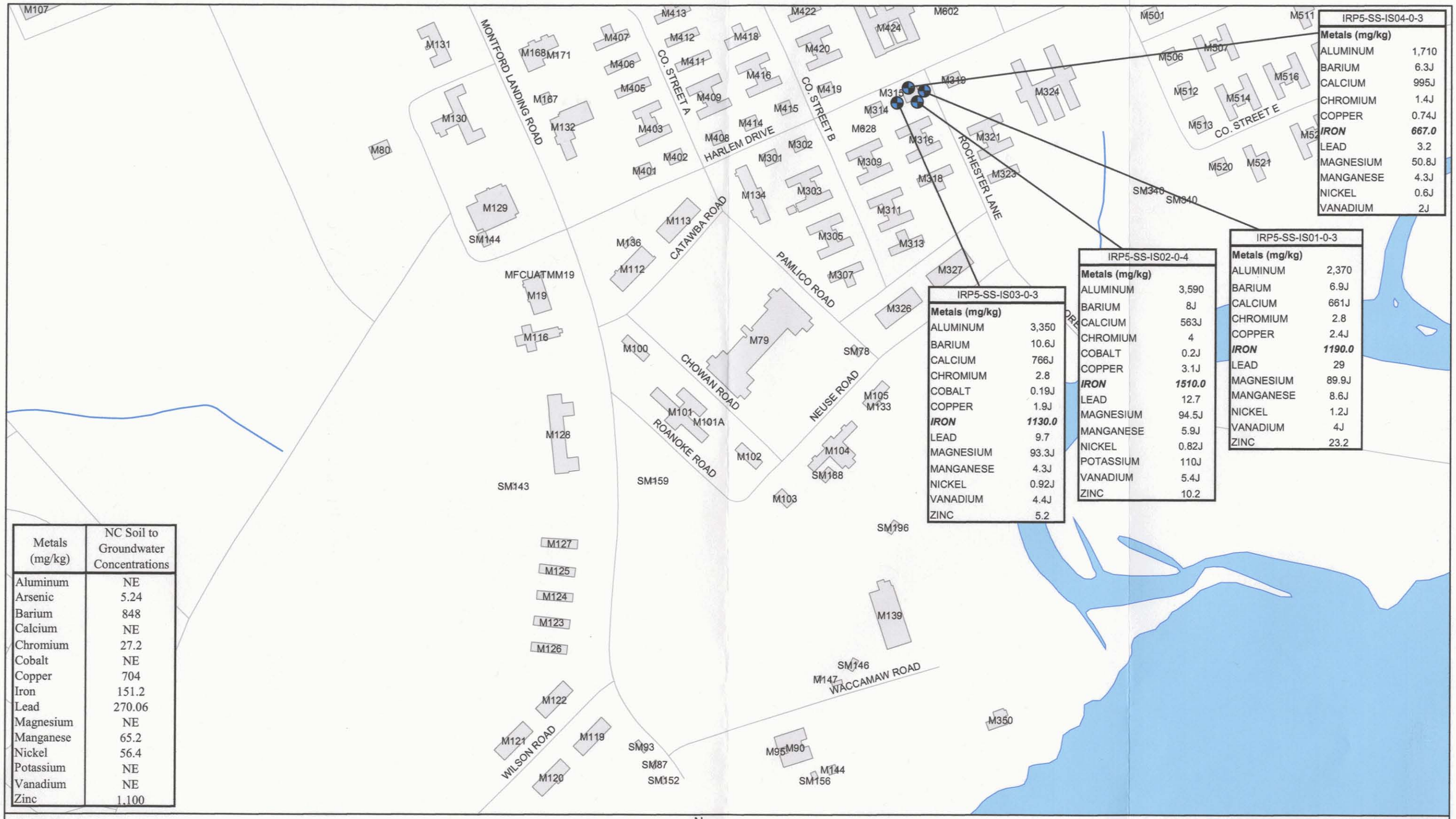
File Path: X:\USNavFaceNGCom\315007CampLejeune\Projects\PA_Sites\Figure 6-14 - Detections of Metals in Soil - M119.mxd, Date: 01/24/2006



Metals (mg/kg)	NC Soil to Groundwater Concentrations
Aluminum	NE
Arsenic	5.24
Barium	848
Calcium	NE
Chromium	27.2
Cobalt	NE
Copper	704
Iron	151.2
Lead	270.06
Magnesium	NE
Manganese	65.2
Nickel	56.4
Potassium	NE
Vanadium	NE
Zinc	1,100

IRP5-SS-IS04-0-3	
Metals (mg/kg)	
ALUMINUM	1,710
BARIUM	6.3J
CALCIUM	995J
CHROMIUM	1.4J
COPPER	0.74J
IRON	***667.0***
LEAD	3.2
MAGNESIUM	50.8J
MANGANESE	4.3J
NICKEL	0.6J
VANADIUM	2J

IRP5-SS-IS01-0-3	
Metals (mg/kg)	
ALUMINUM	2,370
BARIUM	6.9J
CALCIUM	661J
CHROMIUM	2.8
COPPER	2.4J
IRON	***1190.0***
LEAD	29
MAGNESIUM	89.9J
MANGANESE	8.6J
NICKEL	1.2J
VANADIUM	4J
ZINC	23.2

IRP5-SS-IS02-0-4	
Metals (mg/kg)	
ALUMINUM	3,590
BARIUM	8J
CALCIUM	563J
CHROMIUM	4
COBALT	0.2J
COPPER	3.1J
IRON	***1510.0***
LEAD	12.7
MAGNESIUM	94.5J
MANGANESE	5.9J
NICKEL	0.82J
POTASSIUM	110J
VANADIUM	5.4J
ZINC	10.2

IRP5-SS-IS03-0-3	
Metals (mg/kg)	
ALUMINUM	3,350
BARIUM	10.6J
CALCIUM	766J
CHROMIUM	2.8
COBALT	0.19J
COPPER	1.9J
IRON	***1130.0***
LEAD	9.7
MAGNESIUM	93.3J
MANGANESE	4.3J
NICKEL	0.92J
VANADIUM	4.4J
ZINC	5.2

Legend

Geoprobe Sample Location

J - Estimated

Exceeding NC Soil to Groundwater Concentrations in Italics

N

0 300 600 Feet

Figure 6-15
Positive Detections of Metals in Soil
Building M315
Preliminary Assessment Sites, CTO-190
MCB Camp Leieune. North Carolina

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File Path: X:\USNavFaceNGCom\315007CampLejeune\Projects\PA_Sites\Figure 6-15 - Detections of Metals in Soil - M315.mxd, Date: 01/24/2006

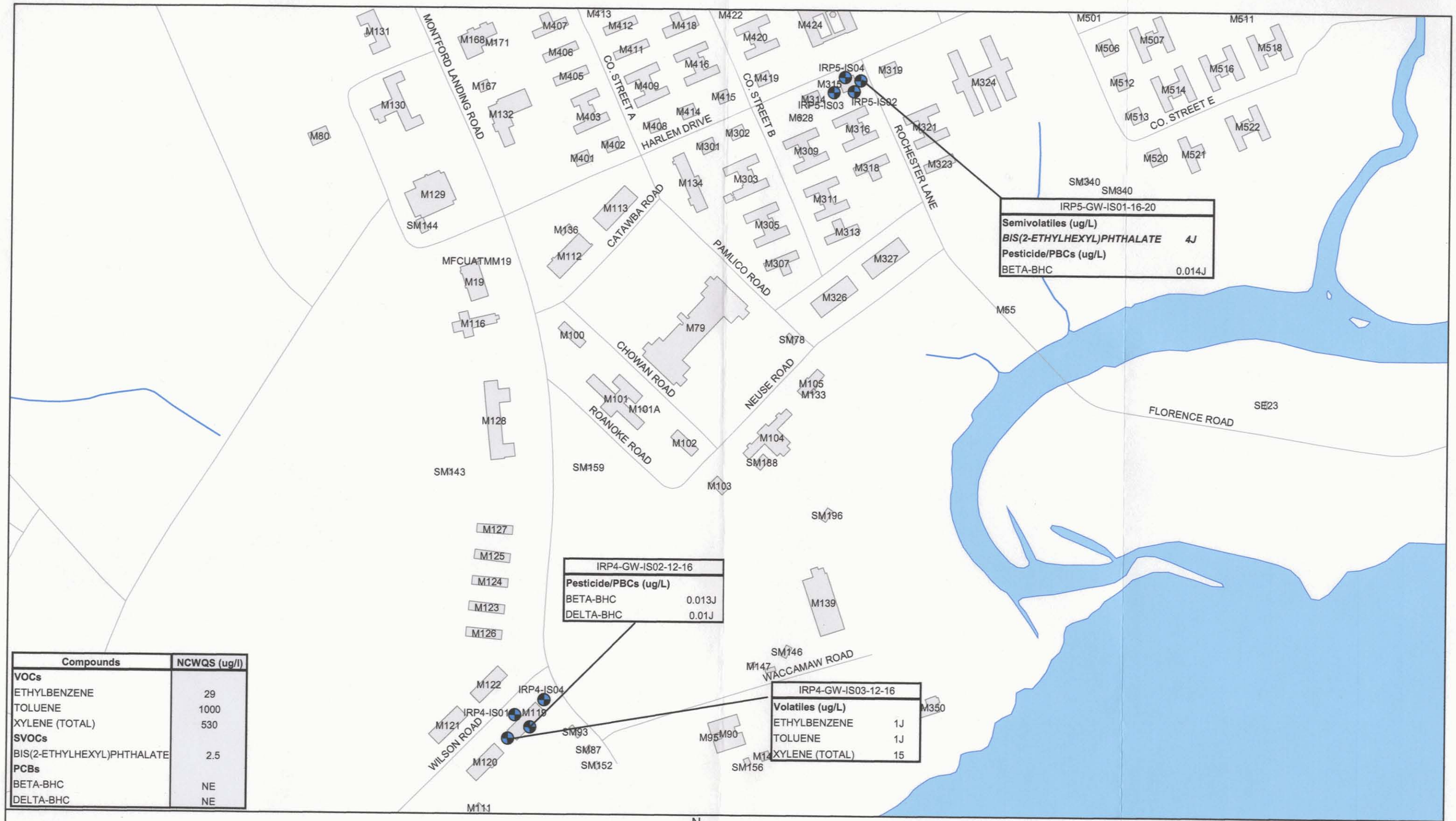

Figure 6-16
Positive Detections of VOCs, SVOCs, and Pesticides in Groundwater
Buildings M119 and M315
Preliminary Assessment Sites, CTO-190
MCB Camp Lejeune. North Carolina

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File Path: X:\USNavFaceNGCom\315007CampLejeune\Projects\PA_Sites\Figure 6-16 - Detections of VOCs SVOCs and Pesticides in GW.mxd, Date: 01/24/2006

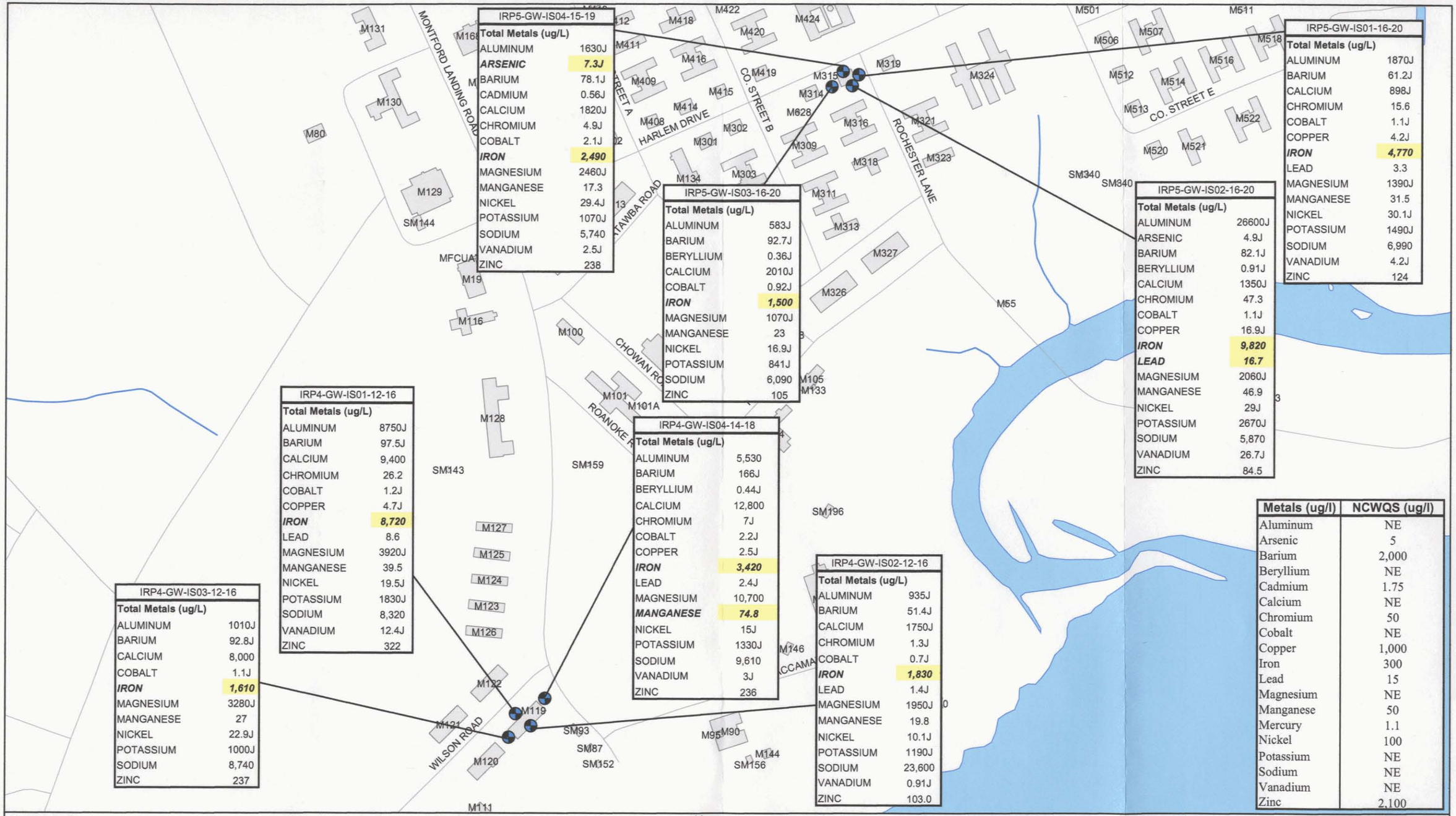

Figure 6-17
Positive Detections of Metals in Groundwater
Buildings M119 and M315
Preliminary Assessment Sites, CTO-190
MCB Camp Lejeune. North Carolina

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File Path: X:\USNavFaceNGCom\315007CampLejeune\Projects\PA_Sites\Figure 6-17 - Detections of Metals in GW.mxd, Date: 01/24/2006

SECTION 7.0

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